



FArming Tools for external nutrient Inputs and water MAnagement

D 4.2.3 Policy Analysis Report

WP4.2 – Policy analysis and indicator framework

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with contributions from Regional Teams



European
Commission

Horizon 2020
European Union funding
for Research & Innovation

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 633945.

Document Information

Grant Agreement Number	633945	Acronym	FATIMA
Full Title of Project	Farming Tools for external nutrient inputs and water Management		
Horizon 2020 Call	SFS-02a-2014: External nutrient inputs (Research and innovation Action)		
Start Date	1 March 2015	Duration	36 months
Project website	www.fatima-h2020.eu		
Document URL	(insert URL if document is <u>publicly</u> available online)		
REA Project Officer	Arantza Uriarte		
Project Coordinator	Anna Osann		
Deliverable	D4.2.3. Policy Analysis Report		
Work Package	WP4.2 – Policy analysis and indicator framework		
Date of Delivery	Contractual	M34	Actual 28 Feb 2018
Nature	R - Report	Dissemination Level	PU
Lead Beneficiary	07_2ECO		
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Internal Reviewer 1	Pasquale Nino		
Internal Reviewer 2	Anna Osann		
Objective of document	To present the results of the policy analysis in FATIMA pilot areas.		
Readership/Distribution	All FATIMA Regional Teams; All WP leaders and other FATIMA team members; European Commission / REA; Public		
Keywords	Policy analysis, sustainable crop production, incentives, policy mix		

Document History

Version	Issue Date	Stage	Changes	Contributor
Draft v01	16/01/2018	Draft		Rui Santos Paula Antunes
Draft v02	28/01/2018	Final	Review comments integrated	

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Executive summary

This report presents the main results that were attained in the policy analysis work that was developed in FATIMA pilot areas, with the goal of assessing the performance of the relevant instruments in the different contexts and deriving policy recommendations to create an enabling environment for the uptake of FATIMA tools and services, thus contributing to a more efficient and sustainable agriculture.

Policy analysis has focused on three policy instruments that are at the core of FATIMA:

- Implementation of the Nitrate Directive regulations (or equivalent in non-EU pilot area) and related policy instruments;
- Implementation of the Water Framework Directive (or other water management regulations), mainly concerning the efficient use of water and the application of water pricing schemes;
- Incentives provided by the Common Agricultural Policy (CAP) agri-environmental payments, or similar incentive schemes.

In the absence of existing documentation and reports dealing with the evaluation of policies (or ideally as a complement to existing published material) it was necessary to obtain information and knowledge from local stakeholders (e.g. experts from public authorities, farmers, farmers' representatives, business representatives, etc.) to support this assessment. Stakeholder consultations were undertaken in the context of a Regional Meeting or in the form of small meeting/focus group with selected participants or individual interviews with selected stakeholders/experts.

In general, the policy-effectiveness of Nitrate regulations remains to be demonstrated, in spite of an overall reduction in the use of fertilizers that has been recorded in most areas. The application of FATIMA tools could contribute significantly to reduce the income losses for farmers associated with N applications restrictions. Monitoring and enforcement of the implementation of nitrate regulations could be substantially improved in all pilot areas. FATIMA tools and services can have a very important role in this.

There is still a long way to go in the design of effective water pricing mechanisms and in the creation of conditions to ensure their application. FATIMA tools can be used to optimize water use, improve estimations of water consumption and to detect illegal abstractions, but the enabling regulatory framework has yet to be established, in spite of the existing umbrella provided by the WFD.



1 Background and purpose

The goal of FATIMA is to establish innovative and new tools and service capacities that help optimizing the external input management (nutrients, water and energy) and productivity of farming systems, with the vision of bridging sustainable crop production with fair economic competitiveness. FATIMA aims to demonstrate how improved, highly efficient technology (e.g. EO, sensors, VRT N management) may contribute to promote agricultural sustainability. However, it is also acknowledged that technology alone may not be sufficient to ensure sustainable crop production, even if combined with increased awareness and adoption of improved management practices by farmers and other stakeholders. Public policies play a crucial role in shaping farmers and other actors' decisions that influence the sustainability of rural communities and therefore they are a central element in the development of a pathway towards sustainable crop production (Figure 1).

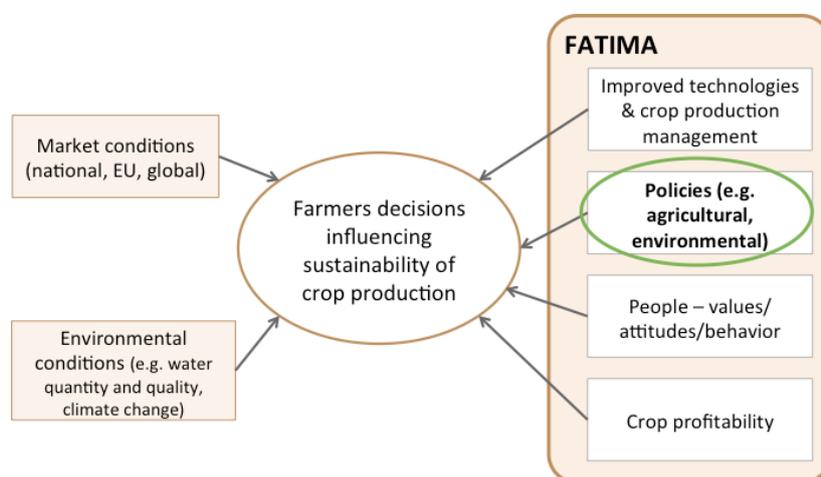


Figure 1 – Policy analysis in the context of FATIMA

This report presents the main results that were attained in the policy analysis work that was developed in FATIMA pilot areas, with the goal of assessing the performance of the relevant instruments in the different contexts and deriving policy recommendations to create an enabling environment for the uptake of FATIMA tools and services, thus contributing to a more efficient and sustainable agriculture.

In the following sections, we first briefly present the framework that was developed to support the analysis (section 2). We then describe the main aspects of the policy instruments that are at the core of FATIMA: the Common Agricultural Policy (CAP), the Nitrate Directive (NV) and the Water Framework Directive (WFD) (section 3). Chapter 4 summarizes the main findings that were obtained in FATIMA pilot areas. Finally, section 5 discusses the expected contributions of FATIMA towards the stated policy objectives and the main policy recommendations derived from our study.

2 Framework and indicators for policy analysis

Deliverable *D4.2.1 – Framework for Policy Analysis* establishes the background and main definitions and describes in detail the framework that was developed to support policy analysis in FATIMA pilot areas (Figure 2). The framework aims to support the assessment of the performance of policy instruments for ensuring the sustainability of agricultural systems in pilot areas.

The policy analysis framework includes a set of procedures to develop this task, including the criteria/indicators to support the assessment of policy instruments and associated institutional and governance arrangements. This framework includes 5 procedural steps operating in a sequential and iterative mode. It also integrates specific criteria to assess the performance of policies regarding the different dimensions of sustainability: environmental (policy effectiveness), economic (cost-effectiveness), social (social impacts), and governance (enforcement capacity and monitoring requirements). The framework includes guidelines to help pilot areas in identifying the issue(s) that should be the main priority(ies) for policy and the development of concrete proposals for the improvement of the current policies in order to foster an enabling environment to attain FATIMA’s vision and goals.

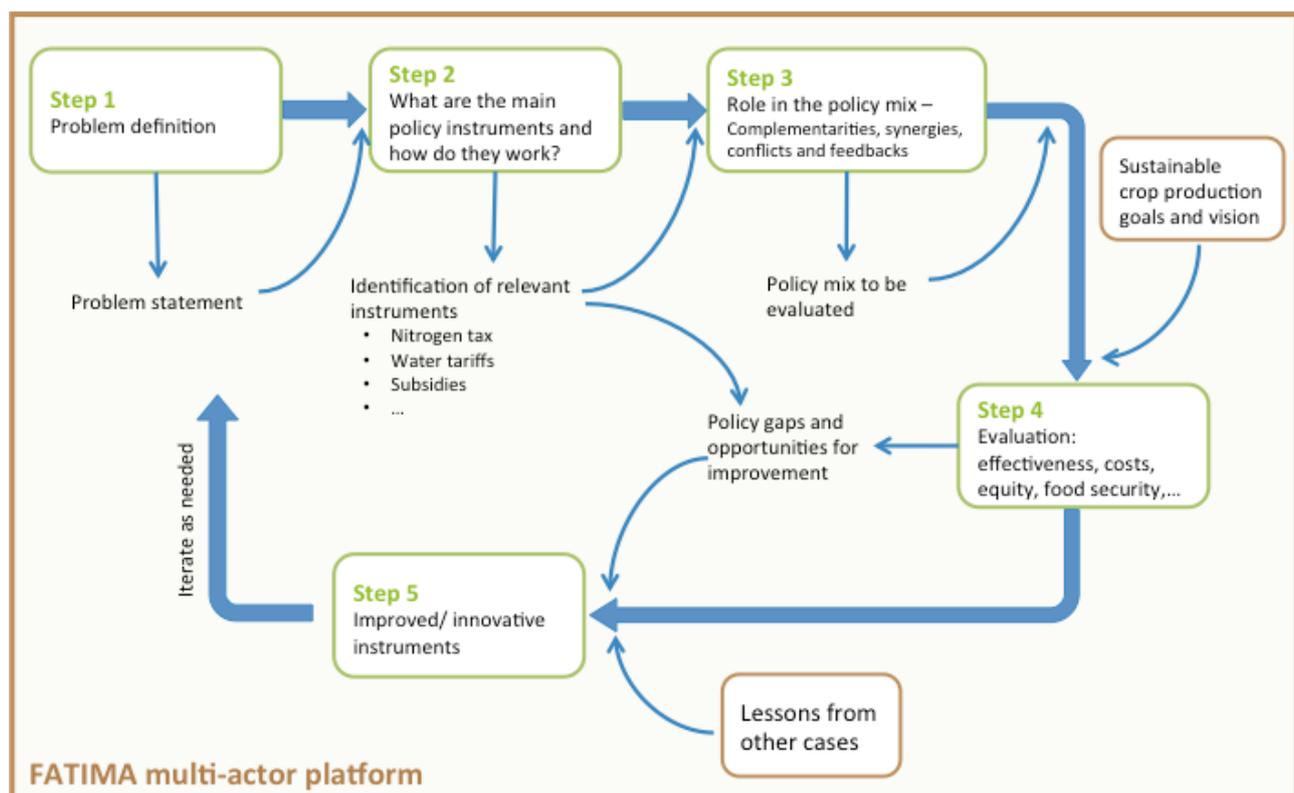


Figure 2 – Steps and outcomes of the FATIMA policy analysis framework

In steps 1 and 2, all pilot areas responded to a set of scoping questions that allowed us to understand that they all share common concerns relevant in the scope of FATIMA that are related with:

- Implementation of the **Nitrate Directive regulations** (or equivalent in non-EU pilot area) and related policy instruments;

- Implementation of the **Water Framework Directive** (or other water management regulations), mainly concerning the efficient use of water and the application of **water pricing schemes**;
- Incentives provided by the **Common Agricultural Policy (CAP) agri-environmental payments**, or similar incentive schemes.

Taking this into account, the following steps of policy analysis (steps 4 and 5 – evaluation and policy recommendations) were focused in these three policy instruments in all pilot areas. In the absence of existing documentation and reports dealing with the evaluation of policies (or ideally as a complement to existing published material) it was necessary to obtain information and knowledge from local stakeholders (e.g. experts from public authorities, farmers, farmers' representatives, business representatives, etc.) to support this assessment. A template was provided to guide Regional Managers in performing these stakeholder consultations.

The consultations were undertaken in the context of a Regional Meeting or in the form of small meeting/focus group with selected participants – people with knowledge and experience in the application of the selected policy instruments, either as representatives from public authorities or as affected parties (e.g. farmers or farmers advisory services). In some cases (e.g. Greece), individual interviews with selected stakeholders/experts were performed as a complement to the information gathered in these meetings. The relevant stakeholders to consult for this task had been identified and mapped previously, as described in the Stakeholder Analysis Reports (Deliverable D1.1.3).



3 Policy context – EU Regulations

3.1 Common Agricultural Policy (CAP)

3.1.1 Rationale and objectives

For the last 50 years the Common Agricultural Policy (CAP) has been EU's most important common policy. This explains why traditionally it has taken a large part of the EU budget, although the percentage has steadily declined over recent years. Over the past five decades, the CAP has encouraged the agricultural sector to become rapidly modernised and to increase the intensification of agricultural production, although adopting also some measures that reflect environmental concerns.

The CAP establishes a link between the expectations of EU citizens for agriculture, and the needs of EU farmers facing economic and environmental challenges. It translates an investment of the EU in a strategic sector in terms of food, environment and economic growth in rural areas.

CAP is in place since 1962, and over time has undergone different reforms in order to face the challenges of the sector. These reforms have increased market orientation for agriculture while providing income support and safety net mechanisms for producers, improved the integration of environmental requirements and reinforced support for rural development across the EU. The current challenges facing the sector, many of which are driven by factors that are external to agriculture, have been identified as:

- Economic: food security and globalisation; a declining rate of productivity growth; price volatility; pressures on production costs due to high input prices; and deteriorating position of farmers in the food supply chain.
- Environmental: resource efficiency; soil and water quality; and threats to habitats and biodiversity.
- Territorial: where rural areas are faced with demographic, economic and social developments including depopulation and relocation of businesses.

The recent CAP reform for the 2014-2020 period aimed to respond to these three main challenges facing the sector, moving from product to producer support and now to a more land-based approach. The policy objectives are to have (1) a viable food production, (2) a sustainable management of natural resources and climate action and (3) a balanced territorial development (Figure 3). The reform may be broadly summarised as guaranteeing food security and improving environmental performance in rural areas which are faced with large-scale competition for land, reflecting rapid changes in the socio-economic situation. An important feature of the new CAP is the recognition that farmers should be rewarded for the services they provide to the public even though they might not have a market value (e.g. biodiversity conservation). This reform intended to strengthen the competitiveness of the sector, promote sustainable farming, innovation and greater effectiveness and support jobs and growth in rural areas.



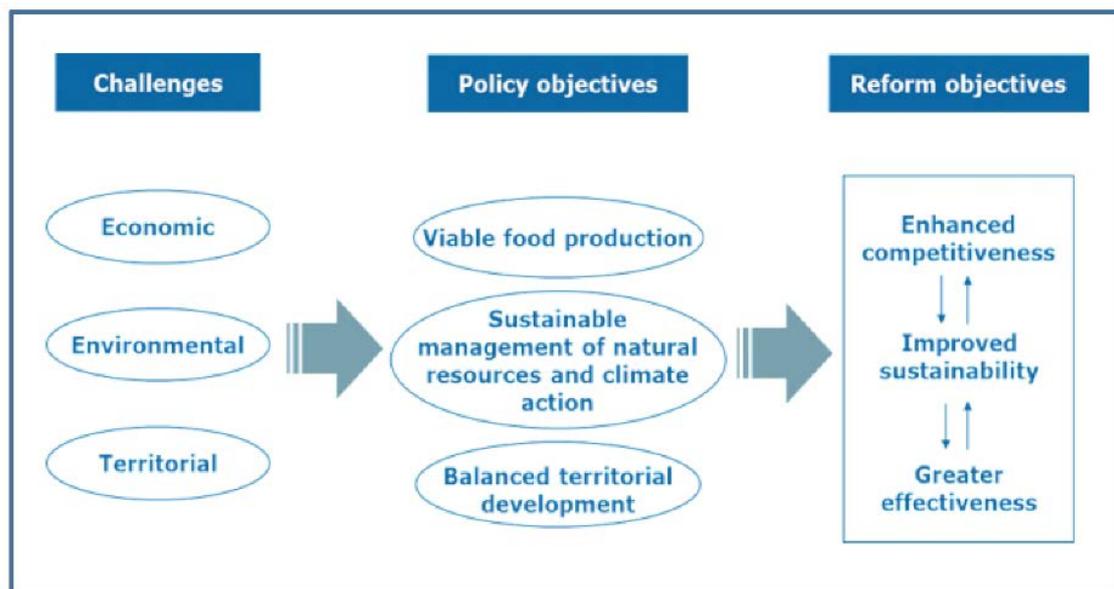


Figure 3 - The objectives of the new CAP 2014-2020

Source: Agricultural Policy Perspectives Brief, No 5, European Commission, December 2013

3.1.2 Main dispositions

The CAP is a common policy for all the Member States of the European Union. It is managed and funded at European level. Then each Member State is responsible for composing and running their rural development programmes. Those are composed of the same list of measures; however, Member States have the flexibility to address the issues of most concern within their respective territory reflecting their specific economic, natural and structural conditions.

In its early years, the CAP encouraged farmers to use modern machinery and new techniques, including chemical fertilisers and plant protection products, resulting in food surpluses. Nowadays, the emphasis has changed and CAP helps farmers to: (1) farm in a manner that reduces emissions of greenhouse gases; (2) use eco-friendly farming techniques; (3) meet public health, environmental and animal welfare standards; (4) produce and market the food specialities of their region; (5) make more productive use of forests and woodland; (6) develop new uses for farm products in sectors like cosmetics, medicine and handicrafts.

The new CAP provides farmers with financial assistance, however, in order to receive their full entitlement of income support payments, farmers have to adopt environmentally-sustainable farming methods. The CAP introduces a new policy instrument the Green Direct Payment, this accounts for 30% of the national direct payment envelope and rewards farmers for respecting three obligatory agricultural practices:

- (1) maintenance of permanent grassland areas (grass is good at absorbing carbon dioxide, which helps in the fight against climate change);
- (2) crop diversification (grow a minimum number of crops) and;
- (3) protection of ecological focus areas (must farm 5 % of their arable area in a manner that promotes biodiversity).

As the green direct payment is compulsory it has the advantage of introducing practices that are beneficial for the environment and climate on most of the used agricultural area.

Farmers may also receive additional support if they adopt stricter agri-environmental farming practices. At least 30% of the budget of each Rural Development Programme must be reserved for voluntary measures that are beneficial for the environment and climate change. These include agri-environmental climate measures, organic farming, Areas of Natural Constraints (ANC), Natura 2000 areas, forestry measures and investments which are beneficial for the environment or climate.

Four consecutive EU Regulations form the core of CAP legislation: Rural Development (Regulation 1305/2013); "Horizontal" issues such as funding and controls (Regulation 1306/2013); Direct payments for farmers (Regulation 1307/2013); and Market measures (Regulation 1308/2013).

3.1.3 Funding

The CAP can be described as having three dimensions: market support, income support and rural development. The first two dimensions - market and income support - are solely funded by the EU budget, whilst the rural development dimension is based on multiannual programming and is co-financed by Member States.

The CAP is financed by two funds: the European Agricultural Guarantee Fund (EAGF) - primarily finances direct payments to farmers and measures regulating or supporting agricultural markets; and the European Agricultural Fund for Rural Development (EAFRD) - finances the EU contribution to rural development programmes. These agricultural funding mechanisms are addressed in the Regulation on the Financing, Management and Monitoring of the CAP (Regulation (EU) No 1306/2013), of 17 December 2013. This Regulation lays down the rules on: (a) the financing of expenditure under the CAP, including expenditure on rural development; (b) the farm advisory system; (c) the management and control systems to be put in place by the Member States; (d) the cross-compliance system; (e) clearance of accounts.

The EAGF and EAFRD are implemented in shared management between the Member States and the EU. This means that the Commission does not make payments directly to the beneficiaries of aid, being this task delegated to the Member States. Funds for rural development are disbursed through programmes run by national governments: the government appoints the Managing Authority whose task is to inform potential beneficiaries of the support that is available, the rules that apply and the level of the EU contribution.

The EAGF and the EAFRD come under the general budget of the EU. A total amount of EUR 408 billion for 2014-2020 is available, of which EUR 313 billion is foreseen for direct payments to farmers and measures regulating or supporting agricultural markets (funded by EAGF) and EUR 95 billion for rural development programmes (funded by EAFRD). The minimum EAFRD contribution rate shall be 20%. Nevertheless, at least 30% of funding for each rural development programme must be dedicated to measures relevant for the environment and climate change.



3.1.4 Link to FATIMA

The successive reforms of the CAP intend to make farming methods more environmentally friendly and efficient (more sustainable) by encouraging better use of natural resources, which is fully aligned with FATIMA objectives. This modernisation of agriculture is a result of the continuous allocation of funding into research and new technology. Greening the CAP is intended to slow down the decline in farmland biodiversity, most notably in intensive farming areas. The new CAP, as FATIMA technologies and solutions, supports all different types of farm and farming practices (big or small, family-run, conventional or organic).

Furthermore, the new CAP also places a strong focus on bridging the gap between science and practice via the Farm Advisory System, as well as training and innovation programmes. These instruments are aimed at helping the farm sector to adapt to new trends and technologies, thus becoming more resource efficient, cost effective and capable of adapting to emerging challenges, which is directly linked to FATIMA.

3.2 Nitrate Directive

3.2.1 Rationale and objectives

The agricultural use of nitrates is the main non-point pollution source affecting the waters in EU. It is therefore necessary, in order to protect human health, living resources, aquatic ecosystems and to safeguard other legitimate uses of water, to reduce water pollution caused or induced by nitrates from agricultural sources and to prevent further such pollution.

The Nitrates Directive (Directive 91/676/EEC of 12 December 1991) was created in response to the need of a common action to control the problem arising from intensive agricultural production. While nitrogen is a vital nutrient that helps plants and crops to grow, high concentrations are harmful to people and nature. The agricultural use of nitrates in organic and chemical fertilisers has been a major source of water pollution in Europe. The Directive aims to protect water quality across Europe by preventing nitrates from agricultural sources polluting ground and surface waters and by promoting the use of good farming practices. As water sources are not restricted within national boundaries, an EU wide approach was crucial to tackling the problem of pollution.

3.2.2 Main dispositions

The Nitrates Directive obliges Member States to designate Nitrate Vulnerable Zones (NVZ) of all known areas in Member States whose waters – including groundwater – are or are likely to be affected by nitrate pollution. Vulnerable zones are defined as those waters which contain a nitrates concentration of more than 50 mg/l or are susceptible to contain such nitrates concentration if measures are not taken.

Under the Nitrates Directive, all Member States have to:

- (1) Designate as **Nitrate Vulnerable Zones** all those draining into waters which are or could be affected by high nitrate levels and eutrophication. The designation is reviewed and possibly revised at least every 4 years to take account of any changes that occur;



- (2) Draw up a **Code of Good Agricultural Practice** which farmers apply on a voluntary basis. It sets out various good practices, such as measures limiting the periods when nitrogen fertilizers can be applied on land; measures limiting the conditions for fertilizer application to prevent nitrate losses from leaching and run-off; requirement for a minimum storage capacity for livestock manure; and crop rotations, soil winter cover, and catch crops to prevent nitrate leaching and run-off during wet seasons.
- (3) Establish mandatory **Action Programmes (AP)** for these areas, taking into account available scientific and technical data and overall environmental conditions. AP must include measures already included in Codes of Good Agricultural Practice, which become mandatory in NVZs; and other measures, such as limitation of fertilizer application (mineral and organic), taking into account crop needs, all nitrogen inputs and soil nitrogen supply, maximum amount of livestock manure to be applied (corresponding to 170 kg nitrogen /hectare/year).
- (4) Carry out a comprehensive monitoring programme and submit every 4 years, a report on the implementation of the Directive. The report includes information on nitrate-vulnerable zones, results of water monitoring, and a summary of the relevant aspects of codes of good agricultural practices and action programmes;
- (5) Provide training and information for farmers, where appropriate.

The Nitrate Directive has been in place since 19 December 1991. The successive amendments and corrigenda to the Directive have been incorporated into the original text (Regulation (EC) No 1882/2003 and Regulation (EC) No 1137/2008). It is applied at European level and has been transposed to national law by Member States. Member States must establish and present to the European Commission reports every 4 years on the implementation of this Directive and the Commission should report regularly on the implementation of this Directive by the Member States.

3.2.3 Link to FATIMA

This Directive is directly related with FATIMA objectives. The Nitrate Directive aims to prevent and protect ground and surface waters against pollution caused by nitrate leaching from agricultural sources. The Directive has imposed a maximum nitrate concentration level of 50 mg/l in water, and by establishing this limit it implies that farmers need to change farming practices and adopt new technologies in order to reduce the nitrate input. FATIMA technologies and solutions aim to contribute to this objective.

The measures for action of the Nitrates Directive are also listed in the Water Framework Directive (Directive 2000/60/EC, Annex VI) and the Groundwater Directive (Directive 2006/118/EC, Annex IV, part B).

3.3 Water Framework Directive (WFD)

3.3.1 Rationale and objectives

The Water Framework Directive (WFD) represents the cornerstone of EU water protection policy, which requires that all EU waters should achieve good status by 2015. It seeks to provide a framework for the protection of inland surface waters, transitional waters, coastal waters and groundwater. In doing so the WFD aims to help improve freshwater quality and quantity, protect the environment and ecosystems and



reduce water pollution. One of the major challenges to achieve these objectives is represented by the pollutants released into the aquatic environment from a variety of sources including agriculture, industry and incineration. The Water Framework Directive (WFD) (Directive 2000/60/EC, of 23 October of 2000) aims to protect and improve the quality of water in Europe.

The WFD relates to the quality of fresh and coastal waters in EU, aiming to attain good ecological and chemical status of Europe's fresh and coastal waters. Specifically, this includes: protecting all forms of water (inland, surface, transitional, coastal and ground); restoring the ecosystems in and around these water bodies; reducing pollution in water bodies, and; guaranteeing sustainable water use by individuals and businesses.

3.3.2 Main dispositions

The WFD requires all Member States to protect and improve water quality in all waters in order to achieve good ecological status. The legislation places clear responsibilities on national authorities. They have to:

- identify the individual river basins on their territory - that is, the surrounding land areas that drain into particular river systems;
- designate authorities to manage these basins in line with the EU rules;
- analyse the features of each river basin, including the impact of human activity and an economic assessment of water use;
- monitor the status of the water in each basin;
- register protected areas, such as those used for drinking water, which require special attention;
- develop and implement "river-basin management plans" (RBMP) to prevent deterioration of surface water, protect and enhance groundwater and preserve protected areas. RBMP include a programme of measures to be implemented in the plan horizon, that shall correspond to a cost-effective approach to achieve established objectives;
- ensure the cost of water services is recovered so that the resources are used efficiently and polluters pay;
- provide public information and consultation on their river-basin management plans.

The successful implementation of the Water Framework Directive depends strongly on agricultural land use, which is mainly influenced by the Common Agricultural Policy (CAP). The WFD is linked to a number of other EU directives some of the most relevant are: directives relating to the protection of biodiversity - Birds and Habitats Directives; directives related to specific uses of waters - Drinking Water, Bathing Waters and Urban Waste Water Directives; directives on topics such as Floods and the Marine Strategy Framework (supplemented by the Priority Substances Directive and the Groundwater Directive); Nitrates Directive - forms an integral part of the WFD, and; the Sustainable Use of Pesticides and the Sewage Sludge Directives also provide for the control of materials applied to land.



3.3.3 Link to FATIMA

Due to the fact that FATIMA approach aims to obtain a better sustainability of agriculture through the adoption of new farming strategies and tools, mainly focused on input reduction (fertilizers and water), it is important to show how an improved fertilization approach can reduce the impact on water quality, thus enhancing the contribute of “sustainable agriculture” to the environmental protection objective, in the specific, on water quality status.

Agriculture is responsible for 44 % of total water abstraction in Europe (EEA, 2008), being irrigation the most significant use of water. The WFD contributes to preserving, protecting and improving the environmental quality and also the prudent and rational utilization of natural resources, introducing the concept of the “full cost recovery” for water services. Full cost recovery not only encompasses the cost of water supply, maintenance and new infrastructure but also environmental and resource costs. As such it reflects the “water user pays” principle. The WFD recognises that water pricing is critical to achieve sustainable water use, requiring that pricing provide adequate incentives to use water resources efficiently.



4 Policy analysis in pilot areas

4.1 Austria

Three instruments were analysed in Austria: (1) CAP agri-environmental payments – preventive groundwater protection; (2) nitrate regulations – action programme nitrate; (3) CAP subsidy on investments. The policy measures (1) and (3) are applied at national level and are parts of the Austrian Regional Development Program 2014-2020 (Österreichisches Programm für ländliche Entwicklung 2014-2020, LE 14-20). Nitrate regulations are applied at the EU level. The targeted actors of these instruments are farmers and farming communities.

A policy workshop was organized to discuss the different topics addressed. A total of 22 stakeholders participated in the workshop, amongst them farmers, advisors, scientists and participants from companies. The session was organized following the world-café template with 3 rotating tables, of 30 minutes discussion, followed by a plenary for conclusions.



Figure 4a – Policy workshop in Austria



Figure 4b – Policy workshop in Austria

4.1.1 Agri-environmental payments: Preventive groundwater protection

The policy measure Preventive groundwater protection is part of the Austria Regional Development Program 2014-2020 (Österreichisches Programm für ländliche Entwicklung 2014-2020, LE 14-20) and supports farmers for losses of income caused by efforts regarding measures preventing a nitrate enrichment of ground (= drinking) water (e.g. fertilisation restrictions, soil analyses, yield losses).

Policy effectiveness

In the Austrian province Styria the agri-environmental measure “Preventive groundwater protection” was accepted very well with a high share of participants. However, **the goals of this measure, i.e. a reduction of the NO₃ groundwater concentrations, could not be reached after several years.** Thus, **legal measures were taken with stricter restrictions regarding nitrogen (N) management**, but without financial support.

Also in the province “Lower Austria” many farmers participated in the measure “Preventive groundwater protection”, but the goals, a distinct reduction of nitrate in the groundwater, could not be reached in most regions until now. The reasons are sometimes beyond the influence of agricultural management, for example low annual precipitation, low groundwater regeneration (between < 10 and >50 years, depending on the groundwater body). Thus, **measures taken in the last years, e.g. reduction of N fertilizer use, limitations in fertilizer application times, less intensive tillage, permanent crop cover, have not shown the required effect, i.e. a decrease of groundwater contamination with nitrate or plant protection products/substances.**

The programme supports agri-environmental measures, namely losses of income caused by them. A reduction of N amendments and, in general, more sustainable management practices, for instance better

crop rotations, cover/catch crops, slurry application close to the ground, less tillage have been/will be carried out.

However, in many Austrian regions the nitrate concentration of the groundwater, which must have the same quality as drinking water, did not rise any more due to the above-mentioned measures. As stated above, in some regions a deterioration of the groundwater quality regarding nitrate occurred despite a high acceptance of the agri-environmental measure “Preventive groundwater protection” and corresponding payments to the farmers.

One of the pointed reasons for this failure is that measures are not strict enough, for example: a second crop after an early harvested crop is not obligatory, not even a high share of catch/cover crops. N fertilization limits, especially for vegetables are still high, there is no need to take into account the N mineralisation from the soil during the vegetation period and the N mineralisation from crop residues.

Often agri-environmental measures are not implemented by farmers, because a more intensive management (with less environment protection) is economically better.

Problematic fields, i.e. coarse textured, sandy soils with a shallow rooting depth, should be taken out of production or managed in a more sustainable way, for instance low input short rotation coppice.

From farmers point of view, sometimes nitrogen is missing to achieve high yields and product qualities (e.g. quality wheat and vegetables).

Cost-effectiveness

Due to lower N fertilization amounts, a reduction in crop yields and/or qualities and, thus, incomes may occur, the payments should compensate for these losses.

Commodity prices are generally low for conventionally produced cereals, also intensive production of vegetables is sometimes not economically feasible, because the achievable prices are so low. On the other hand, the prices for organically produced agricultural products are satisfactory. However, participants fear that this may lead to an increase of organic farming due to economic reasons and not caused by farmers' conviction of the comprehensive sustainability of this management practice. From this it may follow that only the guidelines are fulfilled but nothing more done to improve sustainable crop production.

Social impacts

In general, the measure should reduce income losses of farmers and, thus, it can be seen positively. Again, it was stated that the prices that farmers get for their products (e.g. cereals, potatoes, partly vegetables) are very low and the trade margins too high. Furthermore, awareness among consumers should be created that high-quality food has a higher price.

In general, the economic pressure, displacement competition, is high, regarding which farms will survive. Especially for rented land the thinking in generations, i.e. the necessity for sustainable management, decreases.

Agriculture is often in the crossfire of criticism of the non-agricultural population and agri-environmental measures may contribute to achieve a better view. Examples are a reduction of pesticides application; slurry



application close to the ground, which leads to less odour; less tillage or other measures that reduce adverse impacts through agriculture.

In general, a solution should be found on how the young generation can be motivated to remain a farmer.

Enforcement and monitoring requirements vs capacity

An ex-ante as well as an ex-post evaluation must be carried out for the agri-environmental program. The program is monitored by a company, Agrarmarkt Austria Marketing (AMA). The monitoring cannot be done on each and every farm, but checks are carried out every year, which are feared by the farmers. In particular, the ex-post evaluation includes detailed studies on the effectiveness of the program, e.g. in terms of soil quality, climate relevance and biodiversity. Results of evaluations of the programme are available in: https://www.bmnt.gv.at/land/laendl_entwicklung/le-07-13/evaluierung/le_studien.html (all studies are in German).

Farmers would, of course, deny that there are incentives to bypass regulations, but it is not impossible caused by severe economic pressure.

Information needs

The participation in the agri-environmental measure “Preventive groundwater protection” includes compulsory training lessons (12 hours until December 2018). They are seen positively, but they should be done as early as possible, in order to raise awareness and inform farmers about options to minimise groundwater nitrate contamination. This is, for instance the reduction of N fertilization, taking into account N mineralisation from the soil, the organic amendments, the crop residues (especially sugar beet leaves and residues from vegetables). Furthermore, farmers should be informed about the N mineralisation effects of (intensive) tillage and the protective effects of cover crops and catch crops.

The lectures should also show incentives, what a farmer can win with the implementation of agri-environmental measures regarding the fertility of his/her soils, also for the next generation.

The obligatory analyses of soil samples and the computation of N balances should be used to improve agricultural management – not only the results stored for inspection.

The knowledge on varieties resistant to diseases and about stabilised N fertilizers should be applied.

Public awareness and information for consumers is also important.

It is desirable that the development of know-how at the farm, i.e. "research" farms, are sponsored, so that new technologies can be tried out.

The need for new information tools, in particular detailed field data, biomass and soil maps, etc. at low cost is high.

Other aspects

Food security and stability of food prices: The participants believe that the agri-environmental measure has a limited impact on global food security and food price stability. Local and regional yield or quality losses may occur, e.g. by a reduction of the N fertilization amounts. To avoid this, an option was to grow more crops



which need less N, for instance ethanol cereals, brewing barley, sugar beet. An influence on food supplies caused by the measure “Preventive groundwater protection” is unlikely.

Technological/technical feasibility: Farmers would be grateful to obtain excellent, easy to use and efficient tools to better adapt N fertilization to the site and the crop. The used technologies, e.g. satellite data, should be compatible to enable collaboration/networking. Farmers would appreciate to get low-cost tools enabling a variable N fertilization which take into account the variability of the soil and the crop. Satellite data could also contribute to a better regional targeting of agri-environmental measures considering e.g. “hot spots”.

Potential Role of FATIMA

As stated above, farmers would be grateful to obtain excellent, easy to use and efficient tools to better adapt N fertilization to the site and the crop. The used technologies, e.g. satellite data, should be compatible to enable collaboration/networking. Farmers would appreciate to get low-cost tools enabling a variable N fertilization which takes into account the variability of the soil and the crop. Satellite data could also contribute to a better regionalisation of agri-environmental measures considering e.g. “hot spots”.

The main challenge for implementation is that this technology is not ready to use now. More data must be collected to “translate” satellite data into biomass and crop N supply maps to create N fertilization recommendation maps. This will be done in the FATIMA project.

4.1.2 Nitrate regulations - Action Program (AP) nitrate

The Action Program (AP) Nitrate is based on Council Directive of 12 December 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources (91/676/EEC).

Policy effectiveness

The AP nitrate, inter alia, the reduction of N fertilization amounts, is not sufficiently effective from the point of view of the participants (with regard to the reduction of the nitrate contamination of the groundwater), although it has to be applied nationwide. However, **it has a stabilizing effect and the situation would be worse without AP.**

The upper limits of N fertilization amounts are set too high, and therefore the effectiveness is low. This also applies to the farms` nitrogen balances, which are too imprecise. The N fertilization ban periods are generally maintained, work well. The implementation of the AP nitrate is often not easy for farmers, there are major challenges with regard to investments (for example, storage space for farm fertilizers).

Cost-effectiveness

In principle, the AP nitrate is not designed for economic feasibility. However, the view of economic impact depends on whether it comes from the society or farm's point of view. An improvement on groundwater, i. e. of the drinking water quality, is economically positive for the water supplier and the population, since lower costs for the water treatment are incurred. For farms, however, it can also be economically negative, especially for farms with many rented fields, since yields and / or product qualities are influenced.

The requirements of the industry regarding the necessary protein contents should be questioned.



It was seen as problematic that when the upper limits for the farm fertilizers quantities were reached, it was not allowed to use them at the farm, and a potential additional N-demand then had to be compensated by the purchase of mineral fertilizers.

As a further problem from the point of view of farmers, it is also seen that the achievement or adherence to certain standards is increasingly no longer eligible as they are already prescribed by law. In general, too little attention is paid to the economic recoupling of the AP nitrate on agriculture.

It was seen positively that the function of farm fertilizers as a valuable raw material (source of nutrients and organic matter, increase of soil fertility) was brought back into the foreground via the AP nitrate.

Social impacts

In general, the AP nitrate can contribute to an improvement in the understanding of society for agriculture and the public image of agriculture (e.g. the reduction of the odour load by ground-level manure spreading). In this context, however, more/broader corresponding information should also be disseminated. Farmers evaluate the increased disease pressure affected by greening measures negatively. There is also a certain contradiction between the limitation of the use of plant protection measures and the groundwater contamination by nitrate: through increased use of soil management measures for weed control (e.g. intensive ploughing/tillage), the N mineralization could be boosted and thus the leaching risk could be increased.

Enforcement and monitoring requirements vs capacity

Enforcement is working. The groundwater measuring points are sampled regularly (1 to 4 times a year) and measurements are carried out. That means, there are "incorruptible" measured values. There are no bad experiences with the controls. However, the assessment of the data should take account not only of the measured value itself, but also framework conditions such as the groundwater recharge rate or climate. A low groundwater renewal can be the reason why nitrate concentrations in groundwater do not improve.

Farmers must keep extensive records (N balance sheets). These should be carried out as correctly as possible so that the data can be used as best as possible for fertilization planning. However, this is currently only partially used.

Main enforcement problems are associated with the fact that regulations on distances (for example to the receiving watercourses) are not observed in some production areas. Due to the economic pressure, participants felt that the possibility of farmers having an incentive to bypass regulations, provide wrong information or avoid compliance could not be excluded.

Information needs

Information needed for good implementation is available. However, the need for cost-effective tools, e.g. detailed field data, biomass maps, etc. is high. Farmers would like to receive enough technical information. It would also be important to ensure objective communication on this topic. Usually farmers are seen as polluters of the environment and have low reputation within society. The topic of nitrogen pollution should be increasingly incorporated into the schools' curriculum and treated in the schools. Communication with



consumers is often lacking, it would be important to improve the image of agriculture in the non-agricultural population.

Other aspects

The impact of AP nitrate on food security is currently not an issue in the public debate.

FATIMA results (satellite and sensor data, biomass maps) may contribute to an improvement of N fertilization recommendations.

Social acceptance of AP nitrate is given.

Suggestions for improvement

The soil fertility (quality) should be taken into account for certain measures of AP nitrate and the delimitation of the groundwater bodies refined for the application of certain measures in order to increase the accuracy of the measures. The industry should be involved in the specifications (e.g., rethink actual requirements for raw protein contents for baking qualities). A key focus should be on a combination of measures for the long-term preservation of soil fertility.

Advisory activities on soil and water protection should be increasingly provided by public authorities (and thus free of charge!)

The N-fertilization recommendations should be linked more directly with a possible irrigation on site.

Compensatory measures or support for concrete, meaningful measures should be provided (for example, for greening of high-risk areas).

Recommendations for soil and crop management should be provided up to the level of the varieties.

Soil qualities should be taken into account, e.g. cultivation of intensive crops only with appropriate soil quality.

4.1.3 Agri-environmental measures: Subsidy of investments

The policy measure Preventive groundwater protection is part of the Austria Regional Development Program 2014-2020 (Österreichisches Programm für ländliche Entwicklung 2014-2020, LE 14-20). This instrument has the following goals:

- Improvement of competitiveness
- Increased uptake of innovation
- Increased efficiency in use of natural resources
- Food safety, increased hygiene and quality
- Employment, improved working conditions, animal welfare

The subsidy¹ is granted for:

¹ Only aspects relevant for FATIMA are listed here. For a complete list see <https://noe-bbk.lko.at/?+Investitionsfoerderung+2014+-+2020+&id=2500%2C2284974%2C%2C%2C>



- Investments in technical machinery if bought for communal use;
- Investments in irrigation infrastructure.

There are several criteria that need to be fulfilled to receive the subsidy: profitability and effect of investment on income, energy efficiency, impact on environment, water use, emissions, etc. Organic farms, young farmers and farms in disadvantaged areas receive a premium of 5%-10%.

The Ministry of Agriculture (BMLFUW) is responsible for the implementation of the programme LE 14-20. The Agrarmarkt Austria (AMA) is taking over all tasks concerning financial execution of the programme. It is responsible for approval, controlling and payments. The AMA can assign the responsibility for approval to the regional governments, which is done in the case of the subsidy of investments.

Task	Stakeholder
General national implementation, supervisor	Ministry (BMLFUW)
Payments, control	AMA
Application	Regional governments
Support	Regional and local agricultural chambers

The local and regional agricultural chambers provide support for the application process.

The last programme LE 07-13 triggered investments of 3.5 billion Euro and subsidies of 642 million Euro. Until 2020 1,1 billion Euro are provided; more than 50% of which are financed by the EU.

The policy measure is part of the LE 14-20 and therefore associated with other measures in this programme (e.g. ÖPUL (1)). A study showed that the subsidy is more often used by organic farmers than by conventional farms and to support farmers to change organic farming (Sandbichler et al., 2012).

Policy effectiveness

There are various goals: 1. Improvement of competitiveness, 2. Increased uptake of innovation, 3. Increased efficiency in use of natural resources, 4. Food safety, increased hygiene and quality, 5. Employment, improved working conditions, animal welfare. It is not clearly visible how especially this policy instrument has contributed to the fulfilment of these objectives, as no evaluation has been conducted. However, the instrument is well accepted and often used by farmers.

The main contributions of this instrument are: (1) modern machinery increases competitiveness of Austrian farmers (goal 1), and (2) new machines require less energy and are more efficient in terms of water use (goal 3).

The main failures are: (1) no link to innovative solutions was found – there is no definition on what innovation means (goal 2), and (2) no direct link to food safety, increased hygiene and quality (goal 4).

No statement on goal 5 can be made as there is neither evidence for contributions nor failures.

Cost effectiveness



Farmers are supported with a substantial amount of money to invest in new infrastructure. If infrastructure is bought communally, not only the investment, but also the running costs are cheaper than before.

The subsidy has no negative economic impacts, but there are several criteria (e.g. the product should be bought in Austria) that reduce the economic effect. Every year only a certain amount of money is paid as subsidy (“first come, first served” principle), therefore farmers have no security if they will receive the subsidy.

Less bureaucracy and more funds would contribute to improve the effectiveness of this instrument.

Social impacts

Positive aspects: There are incentives to make investments communally which increase the sense of community in the village. People get closer to each other and learn to compromise. The use of a new infrastructure motivates to work even harder and makes more fun.

Negative impacts: The disadvantage of communal system is a lack of “ownership-feeling” and machines need more repair than in single farms as people do not care about them as if they would belong to them. Farmers feel that society needs to be aware of their problems as this subsidy gives the feeling that farmers receive everything for free without contributing money or work.

Enforcement and monitoring requirements

Enforcement and control of the application of this instrument are working properly. There are strict guidelines on how farmers can apply for the subsidy and the executing institutions follow these guidelines. Authorities have enough capacity to monitor the application of the subsidies. However, more time for the provision of information may be required to avoid non-complying applications.

Since this is a voluntary instrument, there are no major enforcement issues. Farmers must follow a certain procedure to receive the subsidy. Some are not willing to do so and buy their infrastructure in neighbouring countries or negotiate harder with the seller to avoid the process to apply for the subsidy.

Information needs

The information needed for good implementation is available. Individual consultancy at the agricultural chamber/regional government helps to apply successfully. Single cases vary, therefore the general information provided online is in some cases not enough.

Farmers see it as their obligation to inform themselves as they are subsidized. However, there is a need for better monitoring of benefits to assess attainment of goals. There is also a need to develop a transparent way of displaying how much money is still available in each year.

Other aspects

Funding needs: This instrument requires funding needs but the assignment is not transparent, according to the farmers, as the annual budget can deplete and then farmers receive no subsidy. Nevertheless, all payments are transparently displayed online (Transparenzdatenbank).



Legitimacy/social acceptability: There is a general opinion in society that farmers receive money for doing nothing due to the high support from the European Union.

Suggestions for improvement

Possible suggestions for improvement include:

- Reduce bureaucracy in the application process;
- Show benefits of the subsidy -> are the goals reached;
- Consider not only investments in hardware, but also innovative software solutions (e.g. FATIMA tools), alternative cropping systems (e.g. no till) and capacity building;
- Less differences within Europe: farmers in all countries receive different levels of subsidy. Farmers in Austria feel disadvantaged compared to farmers Eastern Europe;
- More incentives for communal investments and development of hardware management (who uses the machine when, eg. mobile app);
- Bring innovation to the farmers: more modern, innovative infrastructure shall be supported.

Potential Role of FATIMA

FATIMA cannot improve the performance of this policy instrument, but the tools developed in the project can be possible infrastructure to be subsidized. Both water and nitrogen recommendations can help to save natural resources and money.

The subsidy of FATIMA tools may be an incentive to use fertilizer and water more efficiently. In the current scheme, the focus is on hardware. The use of FATIMA tools can be a complementary measure to increase efficiency and make farmers aware of innovative solutions to improve their competitiveness, which fits to the general goal of this policy measure.

In the future, the instrument should support not only investments in hardware, but also innovative software solutions (e.g. FATIMA tools), alternative cropping systems (e.g. no till) and capacity building.

4.2 Czech Republic

The policy analysis in Czech Republic focused on the implementation of the Nitrate Directive and the associated Action Plans and, further, to a certain extent, on CAP subsidy on investments related with Precision Farming. The policy measures are applied at the EU level. The APs are controlled by Czech Central Agricultural Office (under the Ministry of Agriculture). The APs are obligatory (if in the NVZs). There are other incentives that might cover the losses (agro-eco programme).

The targeted actors include:

- Farmers (small to large, with different land/livestock/production scope and manner)
- Department of Environmental Subsidies for Rural Development Programme of Czech Ministry of Agriculture (DES-RDP)
- Vltava River Basin Management Authority (Povodí Vltavy)
- Czech Ministry of Environment (responsible for achieving the good water quality status)



A Meeting with 18 representatives of the Ministry of Agriculture was organized to discuss the different topics addressed in FATIMA.



Figure 5 – Meeting with representatives of the Ministry of Agriculture, Czech Republic

4.2.1 Nitrate Regulations

The Nitrate Directive (ND) aims to reduce water pollution by nitrates originating mainly from agricultural land use and management, especially in nitrate vulnerable zones (NVZs). ND defines rules for NVZs designation and establishes the action programme (AP; the package of land management practices) to protect waters against pollution by nitrogen. NVZs are delineated either on a whole state approach (Germany, Austria,...) or within the most affected catchments (CZ, Spain, Portugal...) or rather administrative units (in CZ – cadastral units).

Requirements of ND in the Czech Republic (CR) are established via the government regulation No. 262/2012 (about the designation of nitrate vulnerable zones and action programme) as entered into force on 1st of August 2016 (g.r. 235/2016). In 2016, NVZs were revised (Fig. 6) and the 4th action programme was applied in CR, which is mandatory for farmers situated in NVZs. Selected requirements of **ND** are included in Statutory Management Requirements (SMRs). Their accomplishment in CR is monitored within the *cross compliance* system.

Action Programmes are implemented on the basis of the user of a land block. If the land block is within the NVZs, the APs are obligatory.

Monitoring of surface waters – nitrates (ranges and trends)

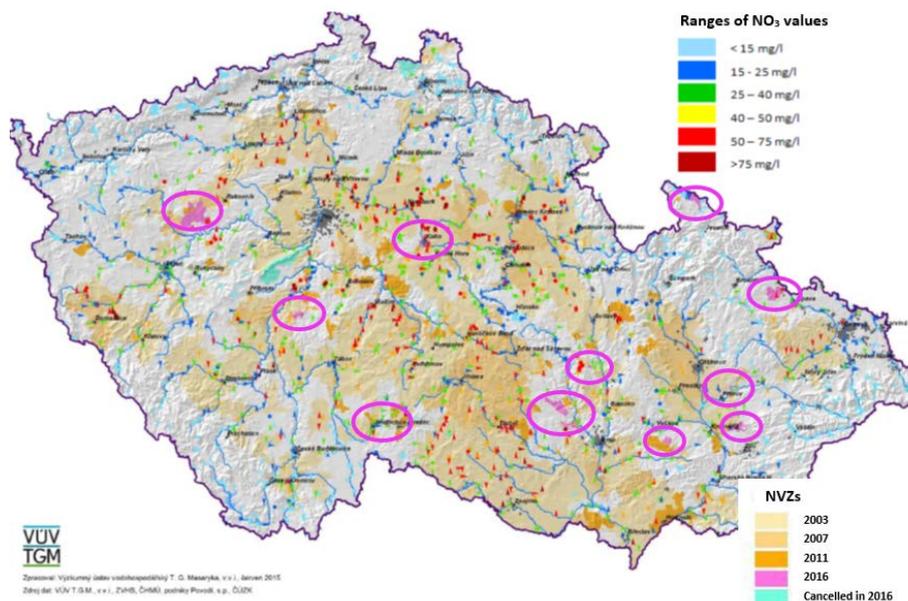


Figure 6 - NVZs in the Czech Rep.; trends in monitored sites in different periods (2003 – 2016)

In general, nitrates in waters is still a problem and challenging issue as well. In the CR, nitrates were found to be a major problem in surface waters, whereas in many other EU countries, the greater burden of NO_3 is being found in groundwater.

The ND report for CR from 2015 shows that despite keeping the rules given by the AP, for surface waters, 42% of monitoring sites experienced a rising trend of NO_3 values; 58% had stagnate or downward trends. For groundwater, the upward trends were found for 30% of the sites; 70% had stagnate or downward trends. Having this in mind, the AP were amended in 2016 in CR more precisely and strictly in the following aspects:

- Periods when fertilizers are banned: application of fertilizer for wheat and rape in the early spring period (for slopes $< 5^\circ$).
- Periods when fertilisers are limited: fertilization according to three yield levels (based on climate and soil conditions) and adjustment of usable nitrogen of the digestate from 70% to 60%*
- Fertilization in summer and autumn: bare soil over winter – no mineral nitrogen fertilizer use for catch crops and the decomposition of straw; a decrease of organic nitrogen doses, when no straw is incorporated and catch crops cultivated (including the expanded obligation to use a nitrification inhibitor in the 1st and 2nd application zone); mineral nitrogen fertilization usage for catch crops and the decomposition of straw in the 3rd application zone.
- Manure storage methods: shortened storing manure in a temporary storage from 12 to 9 months
- Fertilizer use on slopes: a shift of no fertilizer application for grasslands from 10° to 12° .

Policy effectiveness

In the Czech Republic (CR), the implementation of fertilizer and tillage restrictions in the Action Programmes (AP) in nitrate vulnerable zones (NVZ) has only partly contributed to achieve the goals set by ND. In CR, 42%



of surface- and groundwater monitored sites in NVZ demonstrated stable or raising NO₃ trends in the period 2012-2015.

To some extent the AP has contributed to a more effective use/application of fertilizers by the farmers; decreasing the very high N doses, that could apparently not be used by crops (e.g. 250 kg N/ha/year for cereals, etc). The very high doses would most probably have a more detrimental effect on water quality. **However, to decrease N leaching from agricultural soil, the measures in AP appeared to be not sufficient enough, as they do not take into account all the processes that govern N leaching and turnover in soils.**

Moreover, the more fluctuating weather in last several years (drought in 2015, more frequent extreme rainfall events) has had a negative impact on the effective use of applied N in fertilizers. It means, that even the optimal N doses may not be effectively utilized by crops due to unfavourable weather course (N leaching in period of low N crop consumption, or, N accumulation in soils after crop harvest). These facts and processes are difficult to integrate into any (generalized) agricultural policy or programmes. Variable N doses according to crop statuses, along with soil and terrain conditions would most probably better reflect the aforementioned facts.

The implementation of the AP has implied that farming becomes too homogeneous, as farmers are losing the option (and willingness) to differentiate the N doses in a more detailed, sub-field scale. For some areas, it has also led to a useless reduction of fertilizer doses, when water quality could not be threatened.

In CR, the consumption (use) of N fertilizers is raising (both mineral and organic – mainly digestate), which, together with the fluctuating weather and rather low doses of other nutrient fertilization doses (P, K, Ca) and, low doses of organic fertilizers with slowly released N, encourages leaching risks for N.

Cost-effectiveness

The main negative economic/financial impacts of the instrument are, to some extent, related to sometimes lowering of crop yields (in NVZ – maize) and the inducement of low demands of precision agriculture approaches and techniques by the farmers.

However, a more effective application of fertilizers may be seen as a positive impact. The farmer should carefully decide how many, where and when to apply the fertilizers – which leads to a partly increase in efficiency.

The current **AP** in CR (2016-2020) has implemented the differentiation of N doses to different crops according to s.c. **yield levels** (1-lowest yields, 2-average yields, 3-high yields), based on climatic regions, soil types, and average expected yields for different crops; this could help for a more effective use of N applied by crops and mitigate N leaching. FATIMA (or other precision farming approach) could help to verify these zones, or, to delineate them more precisely based on crop yield potential along with detailed geomorphological characteristics (slope and soil conditions).

The same results could partly be achieved with lower negative impacts, with the help of variable rate technology (VRT) approaches (to take into account the unequivocally, time-stable yield fluctuations incurred by soil heterogeneity, and in these areas/spots adjust N doses). Mainly by a more precise and strict setting of agricultural management in different geomorphological zones (sub-field scale), which is, to our experience, and at the moment, too complicated, and rather unfeasible when focusing on whole-country scale.



To a lesser extent, the same results could also be achieved with a possible restructuring of the farms (more grassland, less biogas production), which would have profound socio-economic consequences.

Social impacts

Positive social impacts in quite intensive or traditional farming in areas with a high vulnerability of water quality.

Main negative impacts are related with lower incomes due to reduced planting of productive crops and high administrative burden for farmers. The need to set up large cisterns for slurry or liquid manure (due to application restriction of slurry in autumn) is also a negative aspect.

Enforcement and monitoring requirements

The AP in NVZ are obligatory, so enforcement works, however, the impact on water quality appears as insufficient. The farmers are controlled (if they keep the rules and duties) based on national legislation (the Law on Fertilizers) by the Czech Central Institute for Supervising and Testing in Agriculture (UKZUZ in Czech) in regular inspections, and, by the Czech Environmental Inspectorate (CEI; ČIŽP in Czech), according to Water Law.

Some farmers feel the restrictions are too (and unnecessarily) strict; there is a problem with summer and autumn fertilization restrictions, especially on coarse-textured and shallow soils. The farmers operating on such soils (soils with low water and nutrient capacity; i.e. high N leaching vulnerability), face a problem how to empty the slurry (or digestate) cisterns, since these fertilizers are allowed to be applied only to intercrops and to support straw decomposition.

The fulfilment of some ND demands is being observed in CR also by Cross compliance (PPH 1). Some of the demands in the AP are required to provide subsidies for agro-environmental-climatic measures and ecological (organic) farming. There is a penalty in case of violation, according to the importance, scope and time-scale of the offense (according to some GAEC and ND articles); by negligence violation from 3-5% subsidies decrease, in case of repeated violation up to 15%. In case of deliberate violation, up to 20% subsidies decrease.

The farmers could discover that they would have reached the same yield with lower inputs, mainly by economic purposes (self-enforcement); however, based rather on individual experience of several farmers. Some other farmers as well as some experts think the yields are being influenced by many other factors than only different N doses (other nutrients, soil organic matter, soil water regime, weather conditions).

To date, there are still many uncertainties in Czech conditions regarding the efficiency (crop as well as financial) of the use of variable N application approaches. Moreover, given the quite considerable and often cloud cover in Czech Highland region, at the moment, the employment of solely satellite-based precision farming approaches seems to be rather inefficient.

Information needs

Information needed for good implementation is partially available, but there remain many technical and financial issues open. Spatialised field data (soil and crop), crop yield maps, materials and methods for VRT



application, remote sensing (not only satellite) data and approaches on sub-field block level would be welcome.

Main needed contributions are to broaden (on a country / state level) the advantages of precision farming, to prepare the incentives for farmers, then targeted subsidies, support of training. Further research is definitely needed, both on small spot as well as on field, operational levels.

Other relevant aspects

Technological/technical feasibility, funding needs and generated revenues are other aspects considered relevant by the consulted stakeholders.

Potential role of FATIMA

One of the environmentally targeted goal of FATIMA project has been a link to the ND. In Czech FATIMA pilot Dehtare, a focus has been put on the aforementioned aim too, since the site is located in NVZ and, in Czech largest drinking water reservoir catchment Zelivka. The results, achieved in Dehtare during 2015-2016, are useful for measures, potentially available in the AP with a regard to fertilizer application, based on crop nitrogen needs. A significant shift of soil mineral nitrogen (N_{min}) from upper to lower parts of a slightly sloping (3°) field with tile drainage and heterogeneous soil conditions was proved distinctly. The soil N_{min} differentiated down the slope was particularly well visible in the spring time, i.e. after the winter season, when mobile nitrates were transported via increased water runoff through the soil profile (i.e. via the shallow interflow).

The acquired knowledge of soil N_{min} accumulation at the base of a field slope is useful for optimal fertilizer doses based on crop nitrogen demands. To prevent or reduce accumulation of N in the lowest parts of a field block, soil N_{min} as well as crop yield potential could be considered when determining the N fertilizer doses in these field parts. Further, the involvement of catch and winter crops in crop rotations is vital because of taking up mineral nitrogen after the main growing season. These findings can be incorporated into methodological instructions in NVZs in the 5th Action Programme (2020-2024).

Variable rate technology (VRT) and the identification of different zones within the field block for VRT application are the main contributions from FATIMA. The incorporation of water transport pathways (runoff / leaching / tile drainage) in VRT zones delineation; rather beyond FATIMA scope, is also necessary for Czech Highland region (not only).

The main challenges for implementation are related with:

- On larger areas, the adjustment of N application doses to the actual crop status before every application (remote sensing, drones, etc);
- Technologically – to cope with the cloud cover in the Czech Highland region; the uncertainties in calibration of the yield potentials (given by many factors, different for in-season and long-term scale); support for on-the-go systems (crop sensors on the vehicles);
- Lower know-how support by the state; targeted subsidies needed;
- A very differentiated willingness among farmers to introduce these procedures, as a result of all the aforementioned issues.



Suggestions for improvement

FATIMA (or other precision farming approach) could help to verify the newly arranged yield level application zones, set for the period 2016-2020 in the Action Programmes of NVZ. Moreover, based on the results from FATIMA Czech pilot site (2016-2017), FATIMA approach could help to delineate these zones more precisely (for sub-field block scale) based on crop yield potential along with detailed, site-specific geomorphological characteristics (slope and soil conditions).

The representatives of Czech Ministry of Agriculture agree that this approach could, to a certain extent, possibly be incorporated into methodological instructions in NVZs in the 5th Action Programme (2020-2024).

The representatives of Czech Ministry of Agriculture agree that the results and experience, achieved in FATIMA CZ site, are helpful for adjustment of subsidies setting, related with precision farming (PF). These subsidies started in August 2016 (under a Rural Development Programme Call) and were oriented predominantly on support for acquisition of PF technics and devices (on-the-go sensors, autopilots, GPS systems, low-pressure tire tractors, tractors for PF). To date (23/11/2017), there are no information available on farmers interest related with acquisition of PF technics within this Call. FATIMA CZ team has suggested, based on the results and experience from FATIMA CZ site, that subsidies could be oriented also for support of knowledge and information, related with PF approaches (the 3E use of sensors, arrangement of crop yield potential maps, specification of differentiated tillage and fertilizer application zones, different fertilizer doses and timing, etc.).

4.2.2 CAP subsidy on investments

The issue of the subsidies related with precision farming was discussed by Czech FATIMA team with the representatives of Czech Ministry of Agriculture several times, in the period 2016-2018. The subsidies related with precision farming are a part of the Czech Regional Development Program 2014-2020 (Program rozvoje venkova ČR na období 2014–2020). The rules and conditions of these subsidies are given by a Call (document no. 42859/2016- MZE-14112), which was issued by Czech Ministry of Agriculture on July 2016 as the very first governmental support for precision farming technics.

As for some other countries, there are several criteria that need to be fulfilled to receive the subsidy: profitability and effect of investment on income, energy efficiency, impact on environment, soil protection, emissions, etc. Organic farms, young farmers and farms in disadvantaged areas receive a premium of 5%-10%.

Within the Call, there was, among many others, an option to ask for the subsidies for acquisition of machinery and devices which follow or enable the principles of precision farming; i.e. on-the-go sensors, autopilots, GPS systems, low-pressure tire tractors, tractors for precision farming, spreaders, sprayers, sowing machines; divided in five items. The expenses for purchasing of these devices were either compensated to a certain extent, or paid, depending on prices and point allocation sum of a particular farming subject within the Call.

Potential Role of FATIMA

FATIMA can hardly improve the performance of this policy instrument, however the tools and approaches developed in the project may stand as a subject of a subsidy. Time-space crop nitrogen recommendations



along with the appropriate tillage, when taking into account the seasonal weather conditions can help to save natural resources and money in rainfed farming.

The subsidy of FATIMA (or precision farming approaches in general) tools may be an incentive to use fertilizers more efficiently. In the current scheme, the focus of the subsidies is solely on hardware. The use of FATIMA tools can be a complementary measure to increase efficiency and make farmers aware of innovative solutions to improve their competitiveness, which fits to the general goal of this policy measure. FATIMA CZ team has suggested, based on the results and experience from FATIMA CZ site, that subsidies could be oriented also for support of knowledge and information, related with precision farming approaches (the 3E use of sensors, arrangement of crop yield potential maps, specification of differentiated tillage and fertilizer application zones, different fertilizer doses and timing, etc.). These suggestions were conveyed to Czech Ministry of Agriculture. Regrettably, to date (28/02/2018), there were no information available on farmers interest related with acquisition of precision farming technics or devices within this Call.

4.3 France

The major issues perceived in the French pilot area are the following:

- Regulation on pesticides (farmers);
- Management of water restrictions (how to organize an equitable sharing of water);
- Manage water abstraction between surface water (to maintain the hydraulic infrastructure) and groundwater (often perceived as an easy resource to mobilize and less constrained by the collective rules).

Overall the territory does not lack water for the moment. Climate scenarios show that this abundance will not always be maintained. In addition, nitrate pollution of groundwater is not a major issue (the powerful runoff of the aquifer makes it possible to reduce nitrate concentration and some of the emblematic cropping systems in the area have little impact).

For the moment, the main lever for the farmers is the financial gain (gross margin of the crop) that has been estimated at 70 € / ha for the cultivation of wheat on low productivity area (less in the whole cultivated area). The absence of financial mechanisms on the environmental aspects does not make it possible to value environmental friendly practices. For the moment there is no regulation, which might regulate a problem that is not considered as such.

4.4 Greece

In the Thessaly Plain roughly 500.000 ha are cultivated; of these, 252.500 ha are irrigated (18,7% of the total irrigated land in Greece). Main crops cultivated in the area include 160.000 ha cotton (63% of the irrigated land), maize, sugar beets and vegetables. The two major basins of the region are the Pinios river basin and Lake Karla basin.

The different topics addressed were discussed by personal interviews organized and carried out by Dr. Thomai Nikoli. 14 different interviews organized with the 5 core farmers of FATIMA experiments, 4 agronomists of Municipality of Larisa responsible for the regulations discussed, the responsible agronomist



of the “Department of agricultural applications and analysis of fertilizers in Central Greece”, and the 4 core FATIMA stakeholders. Data for the report were also provided by the Ministry of Finance and Ministry of Rural Development and Food.

4.4.1 Nitrate Regulations

According to the requirements of the Directive 91/676/EEC (transposed into national legislation with JMD 161890/1335/1997), seven vulnerable zones, with respect to nitrogen pollution from agricultural run-offs, have been identified in Greece and respective suitable action programs have been employed, according to art.5 of the Directive. The adoption of sound agricultural practices, obligatory for all farmers operating in a vulnerable zone, is a key element these programs.

The Thessaly Plain, as an extensively cultivated area, is among the areas supplemented to the regulations from the beginning of the action in 1991. In 2016, the new action of nitrate pollution reduction started (action 2016-2017), entitled “Reduction of water pollution derived from farming activity”, which also includes the regulation “Enforcements for agri-environmental and climatic obligations”. Recently (March 2017), the legislation of the Agricultural Development Program 2014-2020 has added a new action (Measure 10, 177.000.000 €), according to which more areas will be soon supplemented to the Nitrate regulations, now in total 30 “sensitive to nitrates input” areas plus 7 wetlands. The action will be applied to specified farms throughout the five years, and aims to reduce water pollution from nitrates and other sources of pollution, such as phosphates and other crop protection products, concerning both arable and perennial crops, as opposed to former actions that only included arable crops.

In the Thessaly plain, producers that grow autumn cereals, cotton, corn and beat (more than 90% of the cultivated area) are obligated to apply specific quantities of nitrogen fertilizers and oblige to regulations in relevance to amount, time and nitrogen per dose, as defined for each crop and soil type.

According to the measures, which will be probably applied on autumn crops of 2017 and spring crops of 2018, farmers will be obliged to practice fallow and dry crop rotation, as well as green manure for tree cultivations. Furthermore, it is expected that application of the action to areas which are supplemented to the action from the past years will result in stabilization of the low nitrate concentrations or in further reduction of the polluting inputs in water reservoirs of the areas. This five years action also aims to reduce water consumption for farming activity as well, respective to the cultivated area size.

Policy effectiveness

The goal of the policy instrument has been achieved since fertilizers’ use has been significantly reduced. Moreover, compared to the past decades, farmers tend to adopt new and improved practices more easily and to follow the instructions for specific doses, type or time of fertilizer application. However, we cannot ignore the fact that the increase of fertilizers’ price in the last years is a parameter that has importantly affected the fertilizers application rates. **As strongly pointed out by the stakeholders, this fact has also restricted the fertilizers use, perhaps more than the nitrate regulations themselves.**



According to latest estimations for the Greek areas that have been supplemented to the Nitrate regulations, although a general reduction of fertilizers has been recorded, it is a fact that in certain areas there is an increase of nitrates in surface and groundwater. The results for the Thessaly plain are not clear yet, and for the time being conclusions can only be based on estimations and not on scientific statistical analysis as they should.

Nitrate groundwater contamination, as a result of fertilizers overuse over the past decades, still remains an issue which cannot be overcome so soon. Hopefully, a reduction in nitrate groundwater contamination would be apparent within the years to come.

Conclusively, the fact whether the instrument contributed or not to achieve the policy objectives in a persistent way remains doubtful.

Cost-effectiveness

It is a fact that there are cases where a reduction in crop yield has been recorded, due to reduced fertilizers' use, or products of lower commercial value have been placed on the market. This fact has led to reduction of selling prices and consequently of the farmers' income. Consequently, the economic impact of the Nitrate regulations so far, seems to be negative and is expressed as an increase of the production cost for the farmers.

Positive impacts: The afore mentioned practices and instructions provided by the IMP do not only concern the part of the field where the green fertilization is applied but the entire holding, and that adds value to the holding. In the long run, it is expected that products of better quality will be given to the market, increasing selling prices and farmers' income.

Nitrogen fertilization strategies that rely on the monitoring of crop nitrogen needs in a temporal and spatial basis could result in less nitrogen fertilization rates without yield losses. For example, the FATIMA tool that is tested in Greek pilots, could perform variable rate nitrogen fertilization according to the plant needs in a very high resolution. This could be a fertilizer system that could be subsidized and used by farmers in the vulnerable to nitrate leaching regions.

Social impacts

The farmers' main concern is the reduction of their income and the difficulty in affording to pay for fertilizers and crop protection products. They also point out the fear of a long-term loss of productivity dynamics of their fields, as a result of less fertilizer application. So, productivity loss can negatively affect their social life.

On the other hand, proper application of the nitrate regulations in the long run can affect positively the social wellbeing, since people will live in a safer environment and will not be exposed to the possible risk of consuming products contaminated with elevated levels of nitrates or other hazardous chemical substances.

Enforcement and monitoring requirements

Beneficiaries of the actions are obligated to realize laboratory analyses (soil and irrigation water analyses) for their farms, either in accredited private labs or in the labs of the Ministry of Agriculture and Food (Department of Agricultural Applications and Fertilizers Analysis). They are also obligated to have an Input Management Plan (IMP), in order to reassure the efficient and effective management of inputs used



(fertilizers, crop protection products, irrigation water). For the redaction of the IMP, laboratory analyses are taken into account, and several other regulations such as: the Code of Good Agricultural Practice, the Instructions of Integrated Crop Protection for each crop, and the action programmes for zones that are assailable to nitrates. The IMP serves the beneficiary throughout the whole process, as it provides instructions not only for the efficient use of fertilizers, but also for other inputs (water or crop protection products). However, due to the financial crisis over the past decade, the personnel who is responsible for the controls has been reduced and sometimes controls are conducted not by agronomists but by employees of different expertise, such as engineers and economists.

The lack of personnel authorized and specialized in controls for nitrates regulations has led to many non-compliance incidents. Furthermore, the number of controls/samplings is so small and is realized later than the proper season, so that they hardly reflect the reality in many cases. However, penalties recorded for non-compliance are very strict. There should be more personnel, with certain expertise and qualified by the Ministry of Agriculture and other careers, for monitoring. Unfortunately, the Economic crisis in Greece has led to staff decrease.

In certain cases, the fear of production loss tends to make farmers avoid compliance, despite the risk of a possible not warned control.

Information needs

Regulations are given by the respective ministries. There are also agronomists that are responsible for informing farmers, either working for the Municipality or in the public sector. Their role also includes gathering of papers needed for implementation, since this often consists in a difficulty for farmers. All information given however, is for general use and does not take into account any field specific characteristic that could significant alter fertilization management.

In the Thessaly plain, although the nitrate regulations are being applied and controls are performed, results cannot be concluded if statistical analysis is not performed. There must be a career who will be responsible for field data analysis, for example a research institute or a university, in order to monitor the process within the years.

Suggestions for improvement

There is a need of more often controls and results' interpretation. Monitoring of N application, conducted by trained personnel, is crucial in order to prevent cases of over-fertilization. New incentives could be given to farmers of larger areas to use tools like FATIMA, in order to implement the nitrate regulations actions without yield losses. Farmers should be more informed in order to obtain skills that would make them more efficient in following the regulations.

4.4.2 Water pricing

Pinios River Basin, the largest watershed of Thessaly, suffers from the impacts of a long unsustainable water management, especially in the agricultural sector.

Policy effectiveness



Water Pricing, a basic tool of Water Management in the Agricultural sector, is not uniform in Greece, and it is set according to area and not according to consumption. In many circumstances, this has led to over-exploitation of water, with destructive environmental consequences that effect both agriculture and ecology of certain areas. Recently, the Common Governmental Decision 135275/22-05-17 has raised the issue of water pricing again, in the context of Greece's obligations to apply the WFD for improvement of water quality. This regulation was incorporated in the Greek Legislature not earlier than 2003, and Water Management Plans elaboration and approval was finalized in 2014.

Based on the above, the instrument did not contribute to achieve the goals in a persistent way and still in 2017, water pricing remains a great issue for Greece.

The regulations dictate that water pricing for agricultural use will be set through procedures that estimate the environmental cost and the source cost, as well as motives for sustainable water management. Every new or existing legal collective network that is being expanded or synchronized, must have a monitoring system of yieldable water quantities and hydrometers, in the total of the net users. This procedure must be completed within 3 years if it is financially and technically possible. If not, the provider is obligated to submit an Action Plan to the Water Directorship, where the time of the completion of the water measuring system setting will be estimated. This Action Plan will indicate the estimated cost as well, the financing and the progress in annual basis. In any case, all hydrometers must be placed till 2024. This way, water productivity is expected to be improved.

The water resources in the area could not sustain the development trends and are now under severe risk. Negative water balance (deficit) has led to the depletion of the renewable water resources and a significant part of the permanent ones (stored groundwater). The irregular temporal and spatial distribution of surface water resources, the intensive cultivation of water demanding crops, the insufficient development of surface water resources projects within the region, the extensive groundwater pumping resulting in the overexploitation of groundwater resources and the dramatic drawdown of groundwater table, all reveal the extent of the problem. Water quality problems as well as salinization of coastal groundwater due to sea water intrusion in some areas makes water inappropriate for irrigation purposes and causes desertification and environmental degradation of ecosystems.

Over irrigation still remains an issue of concern, since the absence of a uniform water pricing scheme restrains the controlled use of water and consumption, in many cases, depends on the farmer's will. Furthermore, a gap exists in the regulation of the access to water resources, which has led to improper water resources management and to an inefficient use of irrigation water. Generally, there is a lack of well-structured state water authorities to supervise the irrigation activities of private user.

Cost-effectiveness

Nowadays, economic impacts regarding the use of water resources in the Pinios river basin include mainly the crop selection, the price of irrigation water, and the irrigation technology used. Cropping pattern planning in irrigated agriculture has been traditionally based on the concept of maximization of the net benefit in regard to water availability. When irrigation water was available, irrigated crops with high yielding capacity, like cotton, maize and industrial tomato, were cultivated. In contrast, when water availability was not sufficient or was expensive to use, rain fed crops like wheat were selected.



Moreover, the continuous fall of the groundwater table leads the farmers to open new deeper bores. According to data of the local organizations of land reclamation, during the last twenty years about 10% of the bores (3.000 bores), were abandoned or replaced. It is noticed that replacement cost amounts to about 30.000-33.000 € per bore. This means that the total cost of bores replacement amounted to about 100 million €. The cost of bore construction is very high since the depth of groundwater table sometimes exceeds 350 m.

In regions where collective systems are absent, private users' agricultural water demand is usually met by local groundwater through a simple, yet fairly uncontrolled licensing system. To start their irrigation activities, farmers get rather easily a free licence to abstract water, still, later on, they suffer from extra costs, related to borehole deepening and increased water level drawdown, due to the over pumping of local aquifers by numerous abstractors.

One of the main economic impacts due to water scarcity in the past was the reduction of yields. In the period of 2000-2001 the yield of an area of about 40km² were destroyed due to the lack of irrigation water. The yield losses caused by drought events during the last 50 years were more than 40% compared with the yield potential of the area of Thessaly. Taking into account predictions for future drought events, severe economic impacts in the agricultural economy of Pinios river basin are expected, unless appropriate measures are taken.

It is estimated that 76.950 ha are being irrigated through collective irrigation networks supplied mainly by boreholes, under the jurisdiction of the local organizations of land reclamation (L.O.R.L.), and 112.450 ha through private boreholes. The most dominant pricing regime for collective networks is an area based payment, where the farmers pay based on the irrigated area and the crop type. The price only covers operation and maintenance costs, which are nevertheless relatively high, mainly because of significant energy costs needed to pump water from higher depths and of open canal networks with significant water losses due to high evaporation and absorption.

Because of the high installation costs and its relatively short life-span, drip irrigation is currently being introduced primarily in areas that combine intense water shortage problems and lack of irrigation networks with high crop yielding capacity

The main positive contribution of the instrument will be the setting of the uniform pricing of water consumption for agricultural use. The water pricing system will include a) a stable cost, based on the irrigation per ha and b) a cost which will depend on consumption per cubic meter. The environmental cost is also included. These regulations will prevent the over-exploitation of water, and also, the codes of Good Agricultural Practices will be followed and indexes relevant to crops, irrigation systems and climate zones will be taken into account.

For the irrigation of Thessaly crops new tools, like WebGIS "Spider", could provide a useful help in achieving the optimum irrigation strategy after monitoring crop development, weather conditions and plant needs.

Social impacts

Sustainable water management could have a positive impact on the social wellbeing. Lately for example, in the Pinios river Basin, some farmers have installed hydrometers in drillings themselves, in order to control water use. Some of them had previously participated in the "Hydrosence" project, and as a result, they are



more informed and motivated to find ways to make a more careful management of resources. Therefore, it can be assumed that there has been a positive social impact of the instrument's application, to a certain degree.

On the other hand, in the Pinios river basin the human activities that exert pressures on the environment as a result of the above driving forces include:

1. Abstraction of ground water
2. Water resources pollution
3. Extension of water demanding crops / increase of irrigated land
4. Illegal bores /barriers
5. Water losses through water transportation

Unfortunately, farmers tend to underestimate the true value of water and there is a lack of any motivation to conserve water. This consists in a drawback in terms of environmental sensibility and ecological thinking.

Enforcement and monitoring requirements

In line with the provisions of the Water Framework Directive, Greece has established and recently revised a national monitoring program for the assessment of the status of surface water and ground water, in order to obtain a coherent and comprehensive overview of water status within each river basin district.

The revised monitoring program takes, among others, into consideration the analysis of pressures and impacts associated with each water body and is fully operational since 2011. More than 600 surveillance and operational monitoring stations refer to surface waters (inland, transitional and coastal) and 800 stations refer to groundwater. The program monitors biological, general physicochemical, and specific chemical parameters, as well as priority pollutants and morphological and quantitative data. Additional site specific and action programs related monitoring programs provide further information of investigative nature. The data and information obtained are stored in electronic data bases, including the National Data Bank of Hydrological and Meteorological Information and the National Environmental Information Network and processed for reporting, and dissemination purposes. Furthermore, the necessary software tools have been developed, enabling further data processing aiming at an effective protection and management of the water resources.

According to the new regulations, a monitoring system will be created through an informational system of the Special Secretariat for Water, in order to monitor and improve the water services. The provider is obligated to enter electronically data relevant to its activity, on an annual basis. This system will allow the comparative evaluation of the providers' efficiency, motivating this way the improvement of service providing to the consumers, as well as water saving for different use. Annual reports will be redacted in order to control and evaluate policy effectiveness.

Due to the non- strict enforcement of the legislation on water resources management (National Law for water resources management 3199/2003 and EC 2000/60 directive), uncontrolled water abstractions occurred. Among the reasons for the non-satisfactory enforcement of the legislative framework are the non-satisfactory monitoring due to the inadequate and inappropriate staff, the lack of public understanding of the environmental concerns and cause – effect relationships, the high monitoring cost as well as the lack of incentives to comply with legislation.



Information needs

The Local Organizations of Land Reclamation, in this case Pinios LOLR, are responsible for irrigation water management, acting as a tool for environmentally-friendly policies performance, as well as for informing farmers.

Consultation with stakeholders would help in identifying meaningful/site-specific parameters of the Pinios river basin. A continuing communication with experts of the local authorities responsible for the water resources management of Pinios, as well as a collection of data from various agents (Local Organization of Land Reclamation of Larissa, General Organizations of Land Reclamation, Regional laboratory monitoring of surface waters of Thessaly, Directorate of Land Policy, Land Reclamation and Water Resources), or data from existing reports and management plans, could contribute in a substantial degree.

Suggestions for Improvement

Monitoring of water application and performance of the new water pricing scheme are the most determinant factors that will improve the policy effectiveness.

The water resources management in Pinios River Basin has not been integrated and sustainable so far. The enforcement of relevant legislation has to be coupled with the modernization of the bodies responsible for the water management. Policy measures in the near future have to include the environmental rehabilitation of the ground water bodies and the gradual reduction of ground water resources used for irrigation purposes. The political desire coupled with a comprehensive planning are among the most important parameters in achieving the sustainable use of water resources in Pinios river basin.

Water pricing as a single instrument for controlling irrigation water use is not a satisfactory tool for significantly reducing water consumption in agriculture. This is because consumption does not fall until prices reach such a level that farm income and agricultural employment are negatively affected.

- If water pricing is selected as a policy tool, a significant decrease in water demand and farm income will characterize the agricultural sector. The impact of this decrease on rural areas that are dependent on irrigated agriculture will be catastrophic.
- When water consumption decreases as a consequence of substitution of crops with high water demands (cotton, sugar beets and tobacco), there will be a significant loss of employment both directly on farms and indirectly on processing facilities.

Water pricing leads to a significant reduction in fertilizer use as a result of reduced water consumption through changes in crop plans, as less productive crops are introduced. This will obviously have a positive impact on the reduction of non-point chemical pollution by agriculture. But the environmental impact of fertilizer use could also be reduced significantly by improved agricultural practices.

4.4.3 Agri-environmental payments

A key change in the new CAP is the application of new 'Greening' rules, in order to highlight the benefits that farmers provide to society as a whole on issues such as climate change, biodiversity loss and soil quality. Under this system, 30% of the Direct Payment envelope, paid per hectare, is linked to three environmentally-



friendly farming practices: crop diversification, maintaining permanent grassland and conserving 5% of areas of ecological interest or measures considered to have at least equivalent environmental benefit. Since 2015, Greece applies the Basic Payment Scheme (BPS) and makes a division between 3 regions: grazing areas, arable land and permanent crops. The small farmers benefit from a flat-rate simplified system of support (the Small Farmers scheme), with a maximum of EUR 1250 support per farmer: this scheme reduces the administrative burdens for small farmers, lessens the controls on cross-compliance and exempts them from greening rules. The Greek authorities have decided to earmark 7.42% in 2015 to 8% in 2019 of the Direct Payments envelope for voluntary coupled support (targeting mainly sheep and goats, beef and veal and fruit and vegetables). With the goal of achieving a fairer distribution of the support, the amounts of Direct Payments for the largest beneficiaries will be capped at EUR 150 000.

There are two main categories of agri-environmental payments in Greece:

- a) Input reduction: This category of measures includes reductions in nitrogen fertilizers;
- b) Organic farming: This is a clearly defined and controlled approach to farming which incorporates a wider range of measures e.g. input reduction, rotation, extensification of livestock. Expected impacts include: enhanced soil quality, preserving water quality, and biodiversity enhancement.

The agri-environmental programme (Agri-Environmental payments, Action 2.1.4) was to be implemented from 2009 until 2014 (five-year cycle). It opened for applications in April 2012.

Policy effectiveness

Greece is one of the developing countries of the EU that performs organic agriculture since the 80's. In 1993, the EU Regulation EEC No 20192/91 comes into force and over the next years an increase in the organic area due to support from the EU is recorded. More specifically, organic holdings have tripled between 2005 and 2007, but later halved in 2010, probably due to the financial crisis. Later in 2011, a fall in organic area and the organic market, due to the financial crisis and delays in compensatory payments for organic farming was recorded. It is estimated that over the past decade until today, about 7-8% of Greece's cultivated land consists of existing organically-farmed areas and areas in process of conversion.

Data of 2012 showed that, of the total organic area of 462.618 ha, 60 % consists of permanent grassland and grazing areas, 15.5 % permanent crops, 21.8 % arable land and 2.7 % other agricultural land. The key arable crops are cereals (51.544 ha), green fodder from arable land, including temporary grasses and grazing areas (36.859 ha), and protein crops (3.727 ha). The key permanent crops are olives (62.702 ha), grapes (4.997 ha) and citrus fruit (1.521 ha).

Greek organic production is certified according to EU legislation on organic farming and other regulations, which is fully implemented; some farmers have an additional certification (Demeter). Some products, usually those which are to be exported, are certified according to the private standards of other countries (e.g. Germany, Switzerland and USA).

In some regions of Greece, certain investments and activities of organic farmers were subsidized through the EEC Regional Programs. As Agenda 2000 brought about an overall orientation towards the production of quality products, organic production gives advantages to applicants in all investment programs (Leader, Youth start, Processing of agricultural products etc.). In some cases (wine making, processing of olive oil), the existence of organic raw material is the only possibility to get subsidies out of EEC programs. Agenda 2000



demands crop rotation programs as well as nature protection and reduction of fertilizers even from conventional farmers. These obligatory means of “good agricultural practice” pushes conventional farmers towards more friendly methods and improved farming practices of land cultivation.

The 1257/99 referring to organic agriculture is implemented since February 2001 onwards. Each farmer has to pay for his own agronomist-consultant who will be responsible for annual cultivation programmes and reports as well as for a detailed Environment Management Plan. In order to make it worthwhile applying for the programme, the annual subsidy must be higher than the payment for the agronomist. This is the case for farms bigger than 6-10 ha vine or 15-20 ha arable crops or olives. The average organic farm size, however, is 4.3 ha. Therefore, this condition excludes small organic farmers from funding. Other problems of the programme are the small subsidy for arable crops and especially horticulture, the limitation of the programme to a 5 years conversion period and the high demand for documents and data from the farmer. The 1257/99 programme is believed to be one of the most difficult EC programmes to apply for – especially if one takes into account the small amount of money, which a small organic farmer will be paid. The main problem, however, is not so much the constant changes in legislation and the general shortage of funds, but the poor level of information, the negative attitude towards organic agriculture and the difference in the interpretation of the national regulation by most of the local departments of the Ministry of Agriculture.

Another basic failure is the lack of scientific personnel who is authorized to perform the controls. In the early 2000s, the Greek Ministry of Agriculture and Food had hired more than 150 agronomists who were trained to perform the controls of organic farms, however later, due to the financial crisis these employees had to be transferred to other job positions. As a result, the control’s structure had to change and nowadays private companies are the ones who are responsible for monitoring.

Cost-effectiveness

Organic agriculture has high compliance costs, and also there is an income loss that derives from the years that the field is on fallow. Furthermore, there is an added cost which includes expenses, such as the cost for entering the 834/2007EK regulation (in cases of non-edible products), the cost for diagnosis of environmental problems of the holding in order to choose the appropriate method and type of compliance (15€ /ha), cost of laboratory soil and water chemical analysis (30€ / year).

On the other hand, in some cases consumers seem to consider that organic products are too expensive and that prevents them from buying them. There are also consumers that question the quality of organic products or whether the products are legally certified as such and sometimes hesitate to buy them.

Organic agriculture contributes in the development of agricultural areas since it has low input requirements (fertilizers and plant protection products). It also helps in achieving environmental goals in all priority sectors (soil, water and biodiversity protection, increase of soil organic matter and improvement of the gas emission balance). All the above have a positive financial impact through the unit added value of the holdings that are implemented to the instrument. However, the most significant positive impact is that it offers guaranties to organic farmers who will not confront problems in branding their products in the market, which is extremely important in these years of crisis.



Social impacts

Some enforcement given to farmers that cultivate higher water demanding crops (corn, sugar beets, cotton, etc.) perhaps has helped them to have a higher income, which leads to a positive social impact. Furthermore, organic products prices are generally higher which means that farmers' income is positively affected. Organic farming contributes to rural economies through sustainable development, offering new employment opportunities in farming, processing and related services. Other than environmental advantages, these farming systems bring significant benefits both to the economy and the social cohesion of rural areas. The availability of financial support and other incentives for farmers to convert to organic production is designed to help the sector grow further and to support associated businesses throughout the food chain.

Enforcement and monitoring requirements

The enforcements for organic agriculture are working. The Certification Company makes the first control 60 days after the contract signing, in order to check data given by the producers. Then, all organic farms are checked in an annual basis. These controls include the inspection of all steps of the production process (production, transfer, storage, labeling etc.), so they take place at the fields, pastures or other establishments, warehouses and also all farmers' files are checked for invoices, cultivation calendars, input/sales data etc, according to the regulations 834/2007/EC and 889/2008/EC. However, controls are conducted without notification to a random sample of 10% of the organic farms, once a year.

The Ministry of Agriculture supervises the inspection and certification process by collecting figures from the certification bodies and checking archives and data. Since the implementation of the EU Regulation 2078/92, district Departments of the Ministry of Agriculture have started to make random checks on organic farms. Authorities have the capacity to apply penalties for non-compliance however this happens rarely since organic farmers tend to follow organic farming regulations. In general, there are few denunciations for non-compliance.

In general farmers follow regulations of organic agriculture, and strict controls do not permit providing wrong information.

Agricultural subsidies distort farmers' choices about what crops to grow.

Information needs

Information is provided by Certification Companies, the Ministry of Agriculture and research institutes of the country.

Interlink farmer community and institutional /governance can contribute in improving policy effectiveness.

Suggestions for improvement

Nowadays in Greece, it is recorded that young and highly educated people express their will to be employed in farming. This new generation of future farmers is more aware as far as the environment and the quality of products are concerned, and of course they are more susceptible to adopt new practices, deal with new technologies and obtain skills, equal to the rest of the European farmers. So, new incentives in organic agriculture could definitely give potential future farmers the motivation to occupy with organic agriculture.



Furthermore, interlink farmer community and institutional /governance can contribute in improving policy effectiveness.

4.4.4 Cross-cutting issues

Other relevant aspects horizontal to the 3 policy instruments

Food security and stability of food prices - New policies which can be implemented with the arrival of FATIMA tools can improve the stability of food chain in terms of quality, quantity and price affordability for both farmers and consumers. In the long-run the implementation of FATIMA tools can enable better planning of agricultural production to cover future needs of an increasing population.

Technological/technical feasibility: New policy instruments can be implemented only with the use of FATIMA (or similar) tools. The success depends on the economic impact.

Funding needs: External financial resources are needed in the starting period to support the instrument until it can be self-sufficient. In any case this technology can be used mainly by a group of farmers and not by a typical Greek farmer with a small size farm. In any case this approach will allow the farms to be more competitive.

Generated revenues: The instrument can go further to penalize farmers who are not complying with “improved farming practices”. These penalties can be in the form of fertilizer, water and energy taxes.

Accountability/transparency: FATIMA tools can help authorities to locate farms where resource abuse occurs. This procedure can be open to the public, guaranteeing that any budget coming outside the farming sector is well used.

Legitimacy/social acceptability: Policy instruments that are in the direction of “improved farming practice” are already legitimate in European Union level. They are also compatible with International Trade Agreements because they don’t create market distortions. The dissemination actions of FATIMA project can ensure the acceptance of the policy instrument on behalf of the farmers who will realise that they must follow the policy instrument in order to avoid the suction.

Empowerment: The FATIMA concept by default diffuses knowledge to the final user making him personally responsible for his improvement. This feature cultivates the sense of identity even for the small holdings. They may not be first in production or revenue, but they can be first in efficiency, which now is accounted and can be rewarded. The acquired knowledge amplifies the feedback we receive from the community and this is a form of participation in decision making.

Flexibility/adaptiveness/adjustment to local conditions/predictability: As precision agriculture products, FATIMA tools are designed to adapt in space and time changing conditions, either in short term (daily forecast) or long term (future scenario modelling).

Institutional context and requirements: The instruments should be applied by Agricultural Ministries and be connected with other Electronic Governance Platforms such as tax network. This will reduce work for both authorities and public because it will be part of a system they already know.

The lack of open, free, reliable and recent data is a major obstacle in all studies in the area: Increased use of satellite, remote sense systems and land observations are certainly suggested. Open, real time environmental



data for Europe must be a central target for EU Environmental Policy. There is a need for farm specific data that could improve irrigation and fertilization management plans. Earth observation systems seem to be a promising tool that could help in this direction in the very near future.

Potential role of FATIMA

FATIMA Variable Rate Application of nitrogen fertilization tool could be used in Greece for reducing total quantities of nitrogen fertilizers without negative effects on yields. Yield stability, coupled with economic viability, remain the most significant factors for the adoption of new technology/tools from Greek farmers. The reduction of total Nitrogen inputs without any yield losses of VRA technology could be an option that meets economic and environmental prerequisites. In comparison to the relevant nitrogen pollution measure, VRA systems could sustain yields and economic benefits for the farmers with real environmental improvements in regard to nitrogen pollution.

SPIDER web GIS tool could help in irrigation management in the farm level with environmental and economic benefits. The transition from an empirical irrigation management to the observation of plant needs at farm level scale could help in a significant reduction of irrigation water used. Volumetric pricing of irrigation water remains the main incentive in this level that has to consider the socioeconomic state of the Greek farmers nowadays in order to be realistic and applicable.

The transition from an experimental project to the everyday application of the FATIMA tools remains the main challenge for further use of FATIMA tools in the Greek agriculture. “After FATIMA” period is of a crucial importance for the wider use of VRA systems and SPIDER Web GIS for the Greek farmers.

FATIMA tools have to be used as much as possible in order to be promoted, and potentially subsidized, by EU. A proposal for implementation of FATIMA tools not only to a number of experimental fields rather to a relative large agricultural area could be the first step for gathering needed information for the incorporation of the FATIMA tools in real policy suggestions in the future.

The proposed technology, combined with ground sensors and satellite data, is part of the precision farming industry. The result of its implementation will be to reduce water and nutrient inputs where and when needed. The first experimental results have already shown a saving of 30% in nitrogen fertilizers without reducing yields. With regard to irrigation, this technology is already being implemented in other countries participating in the project. In Greece, where irrigation and fertilization applications are almost entirely empirical, a technology like this will give spectacular results. It goes without saying that such actions are also developing the wider mentality in the agricultural field, making users demanding some self-evident practices that have not been implemented so far, such as hydrometers. A typical example is the sophisticated water supply with cards used in Serbia Kozani, with a 40% reduction in water consumption. Finally, this logic of water consumption measurement and its targeted implementation will help farmers cope with the additional fee that has been introduced recently (environmental costs - cost of natural resources).

The main challenge identified is that despite the good experimental results of the first trials there is not enough field data to prove that the project is ready for operational application in any pedoclimatic condition.

Having covered a 100 km² of farmland with HD WV2 satellite images for 3 years now we are capable to expand the VRT trial ground to all this area. The various pedoclimatic conditions that are included in combination with the various plant behaviour that images have uncovered, give us the best chance to prove



the efficiency of the method and make it known to a broader community. It is recommended that the selection of these proving grounds should incorporate one more criterion: the farmer's personality and his/her ability to become a FATIMA pioneer.

Secondly, we must approach young and educated people from traditional farming families who in the future will inherit their parents' properties. Women of farming families can also be suitable for this purpose, giving the more flexible female nature to apply the non-conventional practices of FATIMA tools.

4.5 Italy

4.5.1 Common Agricultural Policy Payments

Description of the instrument

The EU CAP regulatory framework is followed in Italy by national regulations, with three different institutional levels: the Ministry for Agriculture, Food and Forestry Policies (MiPAAF), the Agency for Agricultural Payments (Agea) and the Regions.

The regulation EU No 1305/2013 establishes a set of 20 measures M [and related sub measures (SM) and type of operation (TO)], to be implemented in the RDPs. Regions have built their own RDPs according to the characteristics of agriculture and rural areas of their own territories, by activating the measures that better fit with the needs of their own rural area. In Italy the Second Pillar is organised into 21 (one per each Region) Rural Development Programs (RDPs) and 2 National Rural Development Program.

Table A (annex) reports the measures/sub measures/type of operation of the EU regulation No 1305/2013 and its implementation in the RDP of the Lazio Region (where is located the FATIMA Pilot area).

The National Rural Network (NRN) groups the organizations and administrations involved in rural development and aims to:

- increase the involvement of stakeholders in the implementation of rural development;
- improve the quality of implementation of rural development programmes;
- inform the broader public and potential beneficiaries on rural development policy and funding opportunities;
- foster innovation in agriculture, food production, forestry and rural areas
- works in connection and coordination with the European Network for Rural Development (ENRD), which has the function of linking national networks, organizations and administrations working in the field of rural development.

As regarding for the First Pillar of the CAP the beneficiaries are:

- For direct payments the so called "active farmer".
- For intervening on agricultural markets both Public authorities (bought/store/disposal of products and export refunds) and private operators (storage of products). For sector-specific support (e.g. for fruits and vegetables, wine, olive oil sectors, school schemes) active farmer, producer organisations and their associations, interbranch organisations.



The Second Pillar of the CAP - the RDPs - address the economic, environmental and social development of the EU rural areas, encompassing a broad range of activities than Agriculture, such as Tourism; Handicraft; Instruction; IT infrastructure (e.g. broadband infrastructure creation, improvement and expansion); Employment; business (non-agricultural activities) in rural areas development; investments in the setting up, improvement or expansion of local basic services for the rural population, including leisure and culture, and the related infrastructure; studies and investments associated with the maintenance, restoration and upgrading of the cultural and natural heritage of villages, rural landscapes and high nature value sites, including related socio-economic aspects, as well as environmental awareness actions; promoting social inclusion, poverty reduction, etc., so that all the society living in rural area is interested in the Program application, as shown in Table A (annex).

The CAP governance is multilevel, oriented, co-founded and controlled at European level, involving several institutional representatives, as stated in the *Partnership Agreement*.

As regarding the RDPs according with the provisions of Art. 65 of Regulation (EU) No. 1305/2013, for the implementation of the Rural Development Program, the Region identifies the following authorities:

1. Managing Authority: responsible for managing and implementing the programme in an efficient, effective and correct way
2. Accredited paying agency: responsible for execution and accounting of payments, carry out the controls provided for by Community legislation
3. The certification body: responsible to ensure the correctness of certification and statement of expenditure
4. Monitoring Committee: ensures the performance and effective implementation of the Rural Development Program.

In Italy for the period 2014-2020 a total of 52 billion € are allocated for the CAP, as shown in the following table.

Fund	EU	National	Total
Direct Payment	27,0	0	27,0
CMOs	4,0	0	4,0
Rural development	10,5	10,5	21,0
Total	41,5	10,5	52,0

Direct Payments have been a key safety net for farmers (EUR 3.9 billion in Direct Payments in 2014). Moreover, in 2014, the EU spent more than EUR 614 million on market measures in Italy, targeting mainly the wine and fruit and vegetables sector.

The main financial instrument, co-financed by EAFRD, and implemented in CAP are loans, to help farmers and their families diversify their sources of income by developing complementary activities, microcredits (smaller loans made to people sometimes excluded from access to finance), guarantees, and equity, most relevant for higher risk and potentially higher growth firms (SMEs).



The National Industry Plan 4.0 provides fiscal incentives dedicated to the agricultural and agro-food industry, linked with the RDP measure related to investments in physical assets (e.g. precision farming equipment; tractor, seeder, spreader, field sensor systems etc.) giving the opportunity to obtain tax savings by using the hyper-depreciation, which allows (for tax purposes) to increase by 150 percent the cost of instrumental assets that are functional to the technological and digital transformation of the enterprise in the direction of Industry 4.0. In addition, 40 percent (super-depreciation) on the purchase cost of intangible fixed assets (some software, IT systems and system integration activities) is expected to be added to those who benefit from hyper-depreciation.

The following sections describe the evaluation of the measures included in the Rural Development Programme (RDP) 2014-2020 of the LAZIO Region according with the criteria that have been defined in the FATIMA policy analysis framework.

Policy effectiveness

As the call to apply for the incentive scheme [for the Rural Development Programme (RDP) 2014-2020 of the LAZIO Region] come out at the end of the year 2016 (December 2016) is not possible to give any elements about this item, because the evaluation process can be achieved only at the end of the RDP (ex-post evaluation), through the analysis of input, product, result and impact indicators, as reported in the “TECHNICAL HANDBOOK ON THE MONITORING AND EVALUATION FRAMEWORK OF THE COMMON AGRICULTURAL POLICY 2014 – 2020”; (without those indicators any opinion of the stakeholder would be not correct and questionable).

For the previous RDP [2007-2013] exist the official documentation “The ex- post evaluations of RDP-LAZIO region”² edited by an independent advisor company. The report, as regarding the AE, identify the following aspects:

Agri-environmental payments have determined:	Achieved outcomes/limits
1) Increased biodiversity of natural species and habitats	<p>Positive impact</p> <p>The goal is deemed to be satisfied. The planned results were achieved both in terms of the extension of the agricultural areas affected by the commitments (130% of the target) and their potential effectiveness in terms of improvement/ maintenance of high-value agricultural areas and the containment of the negative impacts of intensive agriculture on biodiversity in agricultural land.</p> <p>Identified limits</p> <p>Numerous improvement margins are possible and desirable in the evaluation activities of such effects, by extending monitoring of avifauna and/or other sensitive species.</p>
2) Reduction of agricultural inputs pollutant for water	<p>Positive impact</p> <p>The goal is judged to be fulfilled by achieving the intended outcome and impact goals. In approximately 118,000 hectares of regional agricultural area (value above the planned target), management methods and agricultural practices have been</p>

²http://www.agricoltura.regione.lazio.it/binary/prtl_psr/tbl_cds_documentazione/All. 1 Rapporto Valutazione Ex Post PSR 2007_2013.pdf



	<p>implemented to reduce the potentially polluting agricultural inputs (fertilizers - 6% reduction in nitrogen - and pesticides) in surface and groundwater at regional level.</p> <p>Identified limits</p> <p>The limits of the intervention can be identified in the overall territorial impact less than the needs (approximately 13% of the regional UAA is involved) especially with reference to plain areas with higher levels of agricultural intensity level (e.g. NVZ) in which greater could be the environmental improvement margins resulting from the application of the AE payments.</p>
<p>3) Improved soil quality; In particular with regard to reducing pollution, increasing organic matter and defending from water erosion.</p>	<p>Positive impact</p> <p>The goal is judged to be satisfied with reference to the extension of the areas affected by agri-environmental commitments, above the programmed target. The analyses carried out show significant impacts in the areas of intervention in terms of increase in the contributions of organic matter in the soil</p> <p>Identified limits</p> <p>However, these results do not appear to be able to interrupt the general process of organic matter loss in the soil present at regional level; there is a need for greater integration between agricultural and livestock systems, also in view of the fact that livestock waste, unblocked from the cultivated area, constitutes a major risk factor for water quality, with economic and health consequences.</p>
<p>4) Reduction of greenhouse gas emissions from agricultural activities.</p>	<p>Positive impact</p> <p>The goal is a satisfied in terms of extension (higher than planned target) of agricultural areas affected by agri-environment commitments that can reduce greenhouse gas emissions. This is done through three main ways, linked to the goals previously examined:</p> <ul style="list-style-type: none"> - the reduction in total nitrogenous fertilizer yields results in a consequent reduction in nitrogen oxide prototype emissions, gas with a significant climate change effect; - the maintenance or increase in organic matter content in the soil results in a positive effect in terms of seizure of carbon (carbon sink) - organic animal husbandry, stimulated by Measure 214, has a more favourable carbon footprint. <p>Identified limits</p> <p>The absence of quantified programmatically targets for the emission reduction entity does not allow an analysis of effectiveness based on this indicator.</p>

Cost-effectiveness

The commitment – on a volunteer basis - undertaken with the AE payments can affect the farm performance in terms of additional costs and income foregone. Aims of the AE payments is to fill this gap, but often the payments are not sufficient (mainly in the intensive agriculture plain areas) to cover the real costs sustained by the farmer.

Positive impacts: Higher incomes for organic farmers



Transaction costs [costs of signing the commitments in terms of time to find information on agreements (opportunity cost) and money outlay to acquire the skills needed to apply the new techniques], are also covered, although not always reflect the real costs.

Social impacts

The main positive social impacts associated with the application of the instrument are:

- Improve public image of agriculture;
- Improve the health security for both farmer and citizen;
- Promote food safety education
- Mitigation of climate change
- Counteract the trend towards the loss of animal and vegetable genetic heritage of agricultural interest.
- Environmental and identity heritage for the whole community and functional for the strengthening of rural development processes based on the quality of productions and the valorisation of the territory.

Enforcement requirements

Ex-ante, interim and ex-post evaluation reports area available. Monitoring is conducted by an independent body. Authorities have capacity to monitor/validate information and apply penalties for non-compliance. There are penalties in case of non-compliance, which are applied.

Information needs

Information needed for good implementation is available at Regional level, needs of more detailed information at sub (local) Regional level.

There is a need of new information tools to be used by farmers/environmental authorities to improve the instrument effectiveness. The commitment undertaken with the AE payments requires a set of information on e.g. selection of species and variety, soil preparation system, crop rotation, plant protection, nutrients management, and irrigation if needed. All those data are characterized by high space-time variability, thus tools and strategies to manage this variability are needed.

Other aspects

Food security and stability of food prices issues are mainly covered by the direct payments instruments of the CAP (Pillar I).

The AE payments instrument aims to preserve and promote the necessary changes to agricultural practices that make a positive contribution to the environment and climate. To implement such operations farmer needs to acquire new knowledge and information about improving crop production efficiency and reducing its environmental impact. In that sense FATIMA results and products can help farmer to fine-tuning the management of variability of their cropping system, both in space (geographic location, topography, soils) and time (climate, weather, phenological growth stage).



At beginning of the Programming Plan the financial resources allocated to the Measure are based on the established target, and progressively refined in function of the effective performance of the Measure and its various components, in terms of applications submitted, surface beneficiaries concerned.

Institutional requirements

The processes adopted in the design and implementation phases, as well as outputs and outcomes are Fully observable, all the documents are available online. The annual implementation report includes information inter alia on financial commitments and expenditure by measure, and a summary of the activities undertaken in relation to the evaluation plan.

The instrument is a Measure of the RDP regulated by the Reg. EU No 1305/2013, which establishes also the Governance structure of the program.

The effectiveness/efficiency could be hampered in the new RDP by different barriers:

- delay in the publication of the call
- increasing burdensome bureaucracy (both for farmer and the Public Administration due to the increase in the complexity of administrative and on-site controls as well as the Electronic Information System for collecting and analysing data and, ultimately, related administrative costs), due to the demonstration of the No double funding with the greening payments
- delay in the payments

General speaking about the CAP reform the AIEAA (Associazione Italiana di Economia Agraria Applicata), joined the public consultation on “Modernising and Simplifying the Common Agricultural Policy”, by editing a “Discussion Paper on the CAP after 2020”.

This paper has been the basis for the workshop “La PAC post 2020. Idee per una riforma” jointly organised by AIAA and CREA the day 6 ottobre 2017 in Rome where the main stakeholder (scientific community, farmer association, policy maker) discussed about the evaluation of the main themes related to the CAP in the light of the latest research findings and the promotion of a first debate between the actors in the agri-food system and the Italian rural world.

The main elements – among other – reported in the documents refers to the farming models of European "agricultures", distinguishing between “large and competitive farms that ensure the security of the food supply chain and manage a major share of the rural space, and other models of small or alternative agriculture. They provide both commodities and public/social goods, often in marginal and fragile areas, as in urban and peri-urban agriculture, in the growing sector of social farming, in forms of integration oriented to solidarity between farmers and consumers or in forms oriented to the sustainability of rural economies. Such a variety of farming models are likely to follow different personal motivations and economic incentives. In front of this variety of European "agricultures, the current framework of the Cap mainly refers to an entrepreneurial-based and market-oriented model of farming, unsuitable to fit other forms of agricultural production and to adapt to marginal and disadvantaged rural areas. The European society faces a further decline of these forms of agriculture with the risk of losing much more in terms of public goods than in terms of private goods. As, for example, in case of the local economies and social cohesion in marginal areas, the

^{3 3} <https://agriregionieuropa.univpm.it/it/content/article/31/49/discussion-paper-cap-after-2020>



conservation of valuable element of landscape linked to no longer profitable forms of cultivation, the countryside stewardship in rural areas.”

Suggestions for improvement

Aspects considered most determinant to improve policy performance (e.g. effectiveness) include:

- Information tools: nitrogen accounting, monitoring N/water application
- Linking instruments: simplification of the relationship with the ‘greening’ policy instrument
- Improve farmers skills to provide them the appropriate technical and professional knowledge (also by promoting the use of Farm Advise Service) to improve the farm competitiveness and efficiency, sustainable management of natural resources, preserve the environment and consumer health
- Better evaluation of the additional costs and income foregone and transaction costs.

Potential role of FATIMA

There are a several of measures [M] and sub measures [SM] of the RDP that can be directly related to the FATIMA approach and objectives:

1 Multi-actor community platform and prosperous farming community	Expected outcome	Measure [M] and sub measure [SM] of the RDP
To strengthen and empower the user community by setting-up and maintaining a multi-actor participatory process in all pilot areas, which puts the users in the driver’s seat of development and piloting.	A strong user community of networked local nodes, organized around the FATIMA toolset in a participatory environment.	M1/SM 1.1 – 1.2 M2/SM 2.1 M16/SM 16.3 – 16.4
2 Integrated EO-and WSN-assisted toolsets	Expected outcome	Measure [M] and sub measure [SM] of the RDP
To develop Earth observation (EO)-and wireless sensor network (WSN)-assisted pre-operational tools and services for effective and efficient precision farming and agri-environmental management.	Multi-level toolsets for farm input/yield planning, control and management.	M4/SM 4.1.1 M16/SM 16.1 – 16.2
3 On-farm nutrient management	Expected outcome	Measure [M] and sub measure [SM] of the RDP
To review the sustainability potential of state-of-the-art soil and crop management and cropping systems and to optimize and fine-tune nutrient management at subplot to plot scale and beyond.	Strategies and guidance for soil conserving and crop improving nutrient management practices; methodology for variable rate application; nutrient and yield calculator	M4/SM 4.1.1 M10/SM 10.1.4 - 10.1.5 M11/SM 11.1 - 11.2 M16/SM 16.1 – 16.2
4 On-farm water management	Expected outcome	Measure [M] and sub measure [SM] of the RDP



<p>To optimize and fine-tune irrigation water management from subplot to irrigation scheme scale.</p>	<p>Strategies, tools and guidance for sustainable water management practices; irrigation calculator</p>	<p>M4/SM 4.1.1 M4/SM 4.3 M16/SM 16.1 – 16.2 WFD payments [M12/SM 12.3] In the Lazio Region this measure is not implemented. In the Campania Region the support is around 50€/ha until 50 ha, over is reduced of 50%. Mandatory standards are:</p> <ul style="list-style-type: none"> ○ Respect the specific requirements defined inside the River Basin Management Plan (RBMP); ○ Adhere to the Regional Plan of Irrigation Advisory service.
<p>5 Pilot demonstration and validation</p>	<p>Expected outcome</p>	<p>Measure [M] and sub measure [SM] of the RDP</p>
<p>To validate and demonstrate the tools and services in a set of pilots (representative for a wide range of intensive crop production systems: cereals, potato, corn, rape, vegetables, vine, fruit) and prepare their sustainable operation.</p>	<p>Pre-operational services established that provide continuous flow of EO-assisted information for the intensive farming community in 7 pilot areas</p>	<p>M16/SM 16.1 – 16.2</p>

The potential role of FATIMA technologies/approach in improving the policy performance includes:

- Strategies and guidance for soil conserving and crop improving nutrient management practices; methodology for variable rate application; nutrient and yield calculator.
- Strategies, tools and guidance for sustainable water management practices; irrigation calculator.

4.5.2 Water Pricing

The current Italian water management system comes from a deep reform of the old framework which referred to 1933 Consolidation act. Such process started in 1989 with the Law 183 which introduced for the first time the concept of a new territorial entity, called river basin. The river basin becomes the territorial reference unit, it is considered as a place for interaction between people and environment that puts human being within a wide and complex environmental system. Therefore, the notion of hydrographic basin acquires a political, ideological and operational value. The water basin, which in the past used to be meant as a physical body to capture, divert, store and deliver at specific locations and times, now becomes also a habitat.

From the law 183/89, throughout the law 36 of 1994 (concerning water pricing and cost recovery principles), in 2006, the reform of national water management system has been completed with the law 152 that, referring to principles and objectives of WFD 2000/60/EU, define current Italian framework concerning water resources. It considers the River Basin Management Plan (RBMP) as main tool to gain European environmental quality objectives, aimed at defining and monitoring the environmental status of water bodies



(physical, chemical and biological) proposing Programme of Measures (PoM) and strategies to achieve “Good” quality status of all water bodies.

Water quality is the main goal of the WFD. Due to the fact that FATIMA approach aims to obtain a better sustainability of agriculture through the adoption of new farming strategies and tools, mainly focused on input reduction (fertilizers and water), it’s important to show how, a better (different from traditional) fertilization approach, based for example on organic compost, can reduce the impact on water quality, thus enhancing the contribute of “sustainable agriculture” to the environmental protection objective, in the specific, on water quality status.

The WFD was transposed in Italy by Legislative Decree no. 152 of 3 April 2006. Since the definition of river basin districts and their Authorities, the planning activity started with the definition of “River Basin Management Plans” (RBMPs). The management plan is the instrument for achieving the objectives of Directive 2000/60/EC, to be set up for each river basin district within the national territory within nine years of the publication of the Directive. The management plan can be supplemented by more detailed plans and plans for sub-basins, sectors, problems or water categories in order to address particular aspects of water management.

Following the adoption on December 17, 2015, the first update of river basin management plans was approved on March 3, 2016 for six of the eight districts located in the national territory: Padano District, District of the Eastern Alps, North Apennine District, Pilot Hydrographic District of Serchio, Central Apennine District, Southern Apennine District. For the district of Sicily and Sardinia it has been provided at regional level.

Even if in river basin management plans actions and measures aimed at increasing water quality status are targeted on national or local policies, they also affect directly and indirectly farmers activity. Irrigation consortia for instance, are asked to provide more efficient water pricing policies able to reflect the whole (economic, social and environmental) value of water and also to plan actions for a better control of irrigation volumes.

The Legislative Decree no. 152 of 3 April 2006, Art. 64 divided the national territory into eight river basin districts and for each district has been drafted a RBMP, assigning specific planning and operational competence to the District Water Authority. In the expectation of the full operation of the District Authorities, Decree Law no. 208 of December 30, 2008 converted with amendments in Law no. 13, which introduces extraordinary measures on water resources and environmental protection, stated that the adoption of Management Plans should be carried out by the Institutional Committees of the National Basin Authorities, supplemented by the components designated by the regions whose territory falls in the district to which the plan refers. The organisational diagram is shown in Figure 7.



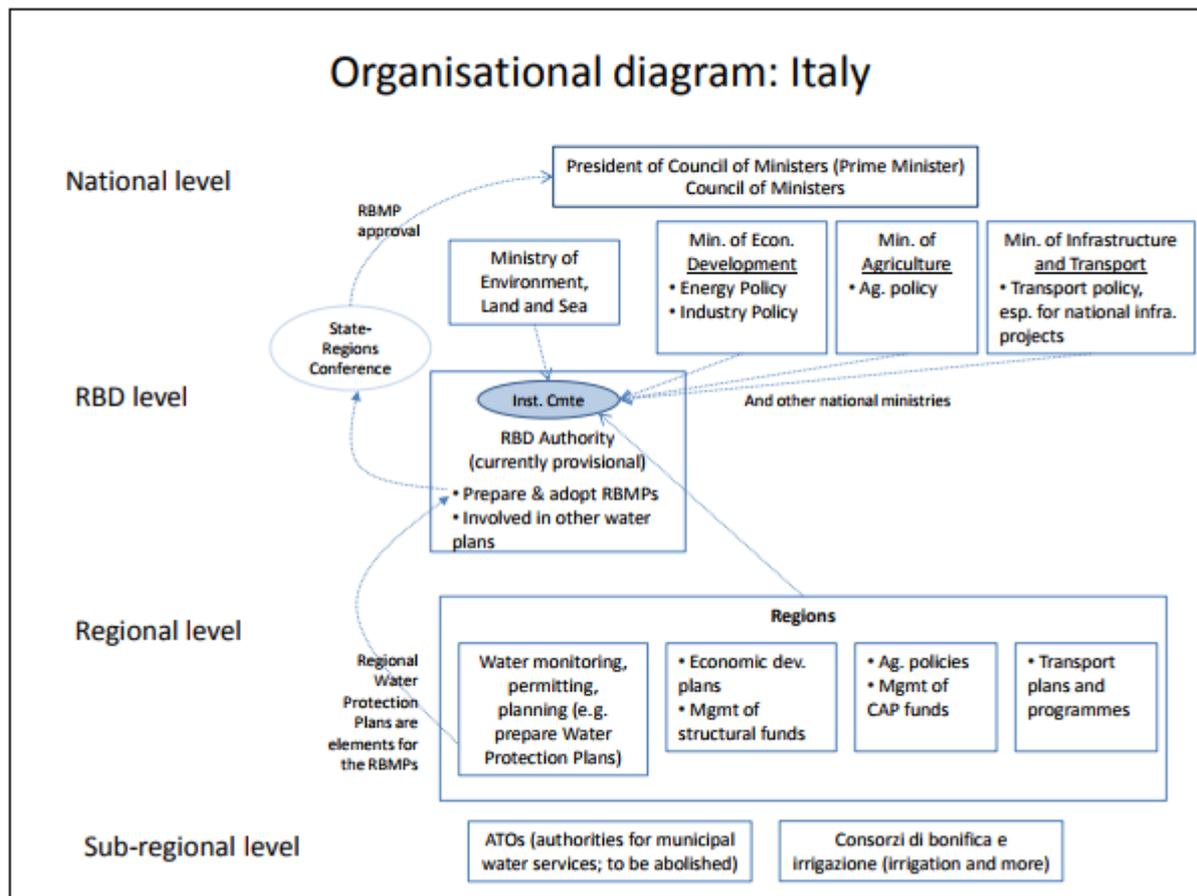


Figure 7 – Organization of WFD implementation in Italy

One of the most innovative elements of the Water Framework Directive (WFD) is the important role that economic analysis is assigned in achieving its environmental objectives. Full recovery and polluter's pay principle, environmental and resource costs, are some of the main economic issues that WFD promote to gain a fair allocation of scarce water resources, also under economic perspective. No specific funds have been invested to perform such economic analysis, even if specific rural development measures were dedicated to the requirements of WFD. Subsidies for the farmers action or constraints due to WFD were established for example in Measure 12 of the RDP.

Concerning "Water pricing schemes", the instrument is not completed activated at national level, but since 2015 Italy has working on two themes:

- a water price policy that provides adequate incentives for users to use water resources efficiently;
- an adequate contribution to the recovery of water service costs incurred by the various water use sectors at a rate set in the approved river basin management plan for investments supported by the programs.

Two new programmes were started: "Linee guida MATTM - DM 24 febbraio 2015 n. 39" (Water Cost recovery) e le "Linee guida MiPAAF - DM 31 luglio 2015" (The water irrigation volume quantification).

The next steps will concern:



- Implementation of the Regulations,
- Diffusion and promotion of incentive prices

Policy effectiveness

Main contributions of this instrument from the point of view of the managing body are:

- Greater uniformity in payment methods;
- payment methods based on quantified volumes (measured or estimated)
- homogeneous databases for all managing entities;
- preventive, fair and rational allocation of water resources where this is not able to fully satisfy the demand of the users;
- take turns and withdrawal times to eliminate possible imbalances between users located at different locations in the same irrigation area and / or in case of insufficient flow;
- reducing the possibility of undue water withdrawal;
- possibility of developing night irrigation with consequent reduction of daytime peak peaks and excessive consumption due to daytime evaporation due to heat);
- involvement of users in the distribution process.

From the point of view of the users, the main contributions are:

- knowledge, at the beginning of the irrigation season, of the volume of water he can have, allows him to set compatible cultivation systems;
- Certainty that there will not be an early closure of the irrigated season for resource exhaustion as no one can pick up a quantity of water higher than that allocated to the beginning of the season;
- elimination and reduction of users' conflicts resulting from a water allocation made on daily reservations.

Main failures are basically related with the perceived slowness in the application of the regulations.

Cost-effectiveness

One of the negative economic impacts of the instrument is due to the fact that the expenses of the water meters are in charge of the farmers: This is an increase expense for farmers without compensation or they have to pay the water they use in addition. Only in few Region there are some support for buy the water meter more efficient.

Positive economic impacts are related with the Water economy (water payment based on water volume used) and the Economic recognition of the multifunctional role of irrigation.

Social impacts

This instrument has positive social impact, such as:

- better water resource management with greater certainty that there will not be an early closure of the irrigated season for the resource to run out as no one can pick up a quantity of water higher than the one assigned to the beginning of the season;



- eliminating and/or reducing conflicts between users resulting from a water allocation made on daily reservations.

Enforcement requirements and capacity

This instrument has been applied for some time now, but management bodies are working on it. Authorities have some capacity to monitor compliance, but there is a lack of tools and services to detect non-authorized water abstractions.

Information needs

The application of this instrument implies that there is a need of water metering, and in this context remote sensing data can help to the quantification, through the water balance, of the availability of resources, current and future needs, the "picked up" and the used resource, the resource returned in the water bodies.

The Ministries and water user association are working on dissemination.

Other aspects

The Water price instrument aims to promote an efficient use of irrigated water that makes a positive contribution to the environment and climate. To implement such operations, farmers need to acquire new knowledge and information about improving crop production efficiency and reducing its environmental impact. In that sense FATIMA results and products can help farmers to fine-tuning the management of variability of their cropping system, both in space (geographic location, topography, soils) and time (climate, weather, phenological growth stage).

Suggestions for improvement

Main suggestions for improvement refer to the development of Information tools for water management monitoring, improve farmers skills on new technology, incentives for new water meter and Decision Support System tools.

Potential role of FATIMA

Strategies, tools and guidance for sustainable water management practices; irrigation calculator, Applying Earth observation to detect non-authorized water abstractions.

4.5.3 Nitrate Directive

The Nitrate Directive aims to protect water quality across Europe by preventing nitrates from agricultural sources polluting ground and surface waters and by promoting the use of good farming practices. Lazio Region with Regulation no. 14 of 2007, Implementation of Regional Law n. 17/2006, establishes the Action Programme for the "Vulnerable areas by nitrates of agricultural source (NVZ)", areas already identified in 2004 and Operational Plans that single farms are required to submit to demonstrate good agronomic use of manure and nitrogen fertilizers. Within NVZ farmers are obliged to respect Good Agronomic Practices Code reducing nitrogen fertilizers, organic ones and livestock effluents.



The ND has been designed at EU level, but implemented at national, and for Italy, regional level. Every Italian Region has applied the Nitrate Directive in a specific territory after a process of zoning (NVZ). In Lazio Region there are 2 NVZ areas, representing almost 2% of regional areas. Both of them are situated along a coastal area: one in the north part of region in the territory between the municipality of Montalto di Castro and Tarquinia (24,000 ha) in the province of Viterbo, the other in the south part in the municipality of Sabaudia, San Felice Circeo and Terracina (17,300 ha) in the province of Latina. The FATIMA pilot area is inside the NVZ area.

The first transposition of ND in Italy was in 1994, with the law 146 of February 22nd. Some missing requirements were partially completed with the approval of Ministry Decree of April the 19th 1999, regarding the Code for Good Agronomic Practices foreseen by the ND. Finally, Legislative Decree of May 1st 1999 n. 152 (regarding water protection, urban wastewater and Nitrate directive from agriculture) states the first definition of the Nitrates Vulnerable Zone in Italy. It is still in place, as every four years regions have to redesign local Programmes, following the results of monitoring and effectiveness evaluation activity.

The ND involves both public and private sectors: it is targeted to national/regional authorities, in charge of promoting local activities and strategies (planning, monitoring, etc.) as well as to farmers, asked to adopt new farming strategies (best practices) in order to reduce the pollution of Nitrate.

In the transposition of the ND from Member States, region has been defined as the reference institution for its implementation. They have faculty of definition of additional NVZ, and the task of set mandatory Action Programs to be adopted and how to apply. Furthermore one of the main tasks of Regions is the monitoring of the status of Nitrate pollution (in Lazio Region there are 60 monitoring stations), the information and involvement of farmers, as well as the development and application of tools for monitoring and verifying the effectiveness of action programs.

Required funding/funding sources/revenues generated;

Considering financial data of RDP measures, we can state that from 16.6 Million Euros of the Rural Development policy in Italy, almost the half of that budget is dedicated for the measures interested in Nitrate reduction. This highlights the important given to Nitrate when allocating such resources.

Links to other relevant instruments

In the framework of national agricultural policy (National Rural Development Plan - NRDP), water quality protection is one of the main target. It can be achieved financing farmers that apply sustainable agronomic practices coherent with qualitative protection of water resources, mainly through a lower use of Phosphorous and Nitrogen. This approach is particularly important in the NVZ. On the other side investments at farm level and in infrastructure, in the framework of WFD 2000/60, and in bioenergy production (in line with CAP measures) are also relevant economic instrument adopted to fulfil the ND requirements.

Particularly in CAP we can list a set of actions that, directly or indirectly can affect ND:

At First Pillar level:



- Direct payments, basic component supplements cross-compliance rules, mainly linked with the Statutory Management Requirements (SMRs) and Good Agricultural and Environmental Condition (GAEC) standards

Standard	Subject
SMR1	Protection of waters against pollution caused by nitrates from agricultural sources
GAEC 1	Establishment of buffer strips along water courses
GAEC 3	Protection of ground water against pollution

- Direct payments, greening component supplements additional cross-compliance rules such 'Ecological Focus Areas', particularly the use of nitrogen-fixing crops.

At regional RDP:

- Investments for farm's modernization;
- Agri-environment-climate payments to reduce Nitrogen use;
- Diversification of farm's activity (bioenergy production).
- Joint action undertaken with a view to mitigating or adapting to climate change

Link to FATIMA

One of the objective of FATIMA project is to optimize the external input management (nutrients and water) for a sustainable productivity. Finding a good methodology for a sustainable use of nutrients can help farmers that in the study area need to respect the Nitrate Directive without money loss. A reduction on Nitrogen due to fertilization activities, affect Nitrate loss by leaching groundwater.

4.6 Spain

4.6.1 Nitrate Directive Regulations:

Policy effectiveness

The control instruments, currently available and covered by the local transposition of European legislation, are indirect and purely bureaucratic, there is no reliable and real information of farmers' practice. Beyond the potential dissuasive component of the regulation, due to its punitive effect, it is not possible to affirm categorically that it has been very effective.

In addition, training and information are scarce. The prohibition and the limitation does not work, as it has been proved in a good part of the European exploitations. Improving fertilization management can contribute to good yields with controlled amounts of fertilizer and provide a worthy outlet for farmers, who currently do not know how to act.



Cost effectiveness

The actual management of fertilizers has not changed substantially, but obliges the farmer to bureaucratic procedures and sometimes to make some administrative or accounting “adjustments” to bypass the letter of the regulation.

Positive impacts: farmer's awareness that he must manage nitrogen fertilization with care.

Suggestions for improvement

FATIMA can contribute to develop the Action Programs applicable to nitrate vulnerable zone through the different tools developed in the project, in a clear and concrete way, highlighting the following points:

- Moments and form of application of fertilizers, preferably in a fractionated way, following the absorption rhythm of each crop, minimizing the waiting time of the fertilizer in the soil until it is absorbed by the crop.
- Management and application of fertilizers providing technology for application equipment, with sufficient precision and regulation for the distribution of the required dose with maximum efficiency and uniformity of distribution.
- Maximum nitrogen doses and specifications per crop, through the completion of a nitrogen balance completed with soil analytics that support the calculations made.
- Training and dissemination measures: actions aimed at improving training and information for farmers and cattle breeder.

4.6.2 Water Framework Directive:

The transposition of the WFD (Directive 2000/60/EC) into Spanish law was made by Article 129 of Law 62/2003 regarding fiscal, administrative and social measures (Spanish Official Gazette (BOE) No. 313 of 31 December 2003) which amended the consolidated text of the Water Act, approved by Royal Legislative Decree 1/2001. A number of minor regulations closed transposition gaps and enabled the planning process in the first cycle.

The Ministerial Order for Hydrological Planning (ORDEN ARM/2656/2008 sobre Instrucción de Planificación Hidrológica (IPH) is a complementary intra-ministerial regulation tool that defines precisely the procedures for the planning process and other substantial obligations such as the conditions for granting exceptions and the monitoring and classification of the ecological and chemical status of surface waters. However, the IPH applies only –to rivers that flow through different regions and not to rivers that are completely within the territory of one region. This is due to the distribution of competences between State and regions established by the Spanish Constitution (Articles 149.1.22 and 148.1.10), where catchments shared by more than one Region are the exclusive competence of the State, and intra-community catchments are the exclusive competence of the Regions, although established procedures are applied for all river basins.

The Spanish pilot area, Mancha Oriental, is into the Júcar River Basin and under administrative regulation of the Júcar River Basin District. This Júcar River Basin District was a pilot river basin for the verification and evaluation of the guidance documents of WFD in 2004.



Policy effectiveness

This is a very complex and ambitious regulation. At the national level, a lot of work remains pending. At the local level, in the La Mancha Oriental aquifer, user communities have made a great progress in establishing self-regulation and regulation measures, in line with the objectives of the Framework Directive. Not so much in the aspects of price, as in those of efficiency and sustainable use.

For all the above, perhaps it has been the need in some areas, rather than the Framework Directive itself, the engine of achievements.

Cost effectiveness

Of course, the controls and limitations in the use of water are an obstacle that prevents the creation of new irrigation systems. But the reality is that water is scarce, and these regulations are essential.

Positive impacts: the general awareness that regulation and limitations are essential to ensure the sustainability of water use in agriculture.

4.6.3 Agri-environmental payments:

Policy effectiveness

The criteria and rules for agri-environmental payments are constantly changing. Ultimately, they depend to a large extent on local governments, and their design is often due to short-term political interests. So, the reality is that the farmer perceives that agri-environmental payments are a kind of reward to those who fulfil largely arbitrary requirements, rather than a long-term policy to encourage farmers' environmental awareness.

The greening payment is being accepted by the farmers, partly because the amount is around 50% of the total value of the payment rights. The areas of ecological interest (SIE), included in the greening, are also having acceptance, although in decline in the current campaign due to the prohibition of the use of plant protection products.

The afforested agricultural areas are decreasing and this policy is not having the acceptance that it had 10-15 years ago, due to the low compensatory and maintenance premiums.

Cost effectiveness

This is perhaps the most controversial policing instrument, because of the constant normative changes and because of the inconsistency of some of the imposed measures. Perhaps they do not have a direct economic cost that is too important for the farmer, but they do force him to modify some management guidelines with the sole purpose of complying with the regulations.

Positive impacts: the farmer's conviction that society values his environmental function, even above his role as a food producer.



4.6.4 Horizontal aspects

Policy effectiveness

The existence of any legislation is already a promoter of awareness of the problems and a trigger for the education of the people affected. Apart of this it would be very difficult to list specific and well-defined achievements related to the implementation of these three policy instruments.

However, many of the regulations that affect agriculture suffer from a lack of constructive spirit, are often too ambitious and move away from the reality of the day to day, so farmers see in them an obstacle to save to continue working and receiving subsidies, rather than a means to solve relevant structural problems that will affect them more severely in the future.

Cost-effectiveness

As already mentioned, it is difficult to directly link impacts, both negative or positive, attributable directly to each of these three policy instruments. On the other hand, it is undeniable that they have an awareness effect that may have induced farmers perception of some of the limitations as logical and normal, and that therefore they are assumed and not perceived as limiting impositions.

Perhaps, the general comment is that not enough has been achieved, except for the aforementioned case of water. So, the question would be how to improve effectiveness with similar resources.

Social impacts

Overall, there is a negative social impact. Public opinion perceives that the farmer has no interest in the environment, and he is the direct cause of environmental problems. So, the farmer feels constantly persecuted for doing honestly a job he thinks is necessary.

Enforcement requirements vs capacity

Enforcement is working to a certain extent, and unevenly in each of the cases.

Because of its transcendence and importance in La Mancha Oriental aquifer, the instruments and institutions for water regulation work well. In the other two cases, the political correction would say yes, but the practical application is far from desired. In the aquifer of La Mancha Oriental there is a complete system that ensures control of all farms, and ensures that farmers meet their obligations regarding water use, or otherwise are sanctioned. In the case of nitrate regulations and agri-environmental payments, control is much more deficient, based on administrative forms and random inspections of a small number of farmers. Of course, there are penalties for non-compliance, but the system is less fair.

Except in the case of water, and for the reasons already discussed, farmers have a motivation to by-pass regulations. Regardless of the reality, a well-filled and documented form is sufficient. However, most people do not like to have the feeling that they are bypassing regulations, and this contributes to the fact that little by little farmers try to adjust themselves as much as possible to the spirit of the regulations.

In the particular case of water, in the last decade the social perception of the farmer who did not comply with the regulations has changed, before he was seen as an astute person now as an irresponsible one.



Perhaps in the cases of nitrate and agro-environment, the main problem regarding enforcement is the credibility of the measures proposed by the regulations, either because farmers do not perceive it as a real problem, or because the proposed actions are difficult to justify from the perspective of prevailing agronomic management. In the case of water, where there is a need and evidence that measures need to be taken, the enforcement is more fluid, although it is not easy.

Information needs

Information for good implementation is generally not available. More didactic work is needed to explain the underlying reasons for the different measures proposed by the regulations. The farmer must understand why and not perceive them as threats.

There is a need for new information tools to be used by farmers/environmental authorities to improve the instrument effectiveness. An objective and reproducible methodology is needed, similar to that applied in the control of water use in the aquifer of La Mancha Oriental, so farmers will assume that controls are equal and fair. The authorities also need a system or methodology that allows easy access to real and reliable information, to be able to monitor large areas, and where appropriate to entrust them to external entities or companies

Main needed contributions:

For farmers: knowledge and specific training on new technologies and systems to take agronomic management decisions, in relation to the application of water and nutrients, which take into account the variability of the plots and in addition to the economic optimum, its environmental implications.

For the authorities: GIS and remote sensing systems with capabilities to measure, in any area of the territory, specific parameters related to the issues to be controlled, and manage the huge amount of data generated.

Suggestions for improvement

In order of relevance:

1. First establish a technological methodology capable of generating objective and reliable information about the N and water accounting.
2. Second, linking the agri-environmental payments, or some type of similar CAP subsidy, to the adoption of the available technological which allow the optimization of inputs (for example VRT, moisture soil sensors, etc.).
3. Third, design a plan to promote technical assistance that allows farmers to adopt these new technologies.

FATIMA Potential Role

The technological possibilities that the satellite imagery time series, used in the FATIMA project, offer to make water accounting in large territories, in an economic, objective and reproducible way, have already been demonstrated in previous European projects and are applied in the case the aquifer of La Mancha Oriental.



The methodology developed in FATIMA assumes the validation of similar methodological approaches, but in this case for biomass accounting and the N used by some crops.

Therefore, it is clear that satellite imagery time series could be integrated into a control system specifically designed to implement compliance of nitrate regulations.

Logically, certain technical and logistical difficulties are foreseen, but by far the main challenges to overcome will be administrative:

1. First, the political authorities will to comply with the regulations, without blaming or shifting the responsibility to the farmer.
2. Second, the resistance to change of the bodies of officials responsible for the controls of the CAP subsidies.

Suggestions:

In the specific case of nitrate regulations, it could be illustrative to present a real case, which includes a balance:

Farmer's declaration:

- Target nitrogen balance and proposed doses per crop and plot.
- Map of the real application of N at variable doses, as registered by the GPS of the fertilizer spreader.

Set of validation maps, obtained through the FATIMA methodology:

- Maps throughout the crop cycle representing the nitrogen nutrition index.
- Map of final production and extractions.
- Maps of complementary measures in the periods between crops (for example nitrogen capture through the development of weeds, volunteers of the previous crop or specific cover crops)

4.7 Turkey

Inventory on the regulations in force and information about the prevailing conditions for execution, monitoring and inspection of the policy instruments in Turkey were compiled from the archives of the Official Gazette of Turkey as well as the legislation portals of the relevant ministries. As regards the effectiveness measures of those regulations, there were almost no reported information directly accessible from the official sources due to the facts that either most have been recently introduced or some do not have direct relevance with external input management and/or productivity at the farming systems level. Instead, foresights toward potential and anticipated impacts were collected from different stakeholders, including farmer associations, agricultural research institutes and involved policy-makers, in order to have early views about the coverage ratio of the introduced policies in securing the regulation objectives.

4.7.1 Nitrate regulations

Regulations in force related to protect the water bodies against nitrate pollution are:



- i. Regulation for water protection against nitrate pollution originating from agriculture (No: 29779, Date: 23.07.2016),
- ii. Regulation for chemical fertilizers used in agriculture (No: 28228, Date: 09.03.2012),
- iii. Regulation for market surveillance and audit of fertilizers (No: 28956, Date: 29.03.2014),
- iv. Regulation for production, import, export and marketing of organic and antiviral fertilizers, soil conditioners and other products containing microbial, enzyme and organic substances (No: 28956, Date: 29.03.2014),
- v. Regulation for monitoring of surface-and groundwater (No: 28910, Date: 11.02.2014).

The regulations i, ii, iii and iv identify several aspects relating to the nitrate fertilizers used in the agricultural sector, but covering those only for fertilizer production, naming, marketing, packaging, market supervising, chemical composition, importing/exporting rather than the selection, limitations or guidance needed to be applied based on agricultural crop types, agricultural basin priorities or with environmental concerns. The only most relevant regulation is the vth item that focuses on the monitoring of non-point pollution from agricultural activities, but again with no direct relevance to the types or quantities to be applied at the parcel or basin levels.

Policy effectiveness

These instruments have been recently introduced, therefore, there is not enough data to validate their contributions at either national, sub-national or pilot scales.

Main failures associated with this regulation are:

- Delayed entrance into force of the instruments targeting nitrate control, reduction and removal, thus already deteriorated soil and water quality conditions specifically at the pilot area scale but more generally in basins where the agriculture is intensively practiced.
- There is no targeted regulation addressing nitrate applications while the current regulations focus more on the production of fertilizers on the supply side, marketing rules and distribution of the products. Therefore, there is no regulation that provides guidance about nitrate applications, monitoring basis and definite thresholds that follow national/international standards.

Cost effectiveness

The application of the nitrate regulations can entail:

- Additional costs of nitrate applications in controlled quantities advised by the regulation (dosage techniques and machinery purchase/hiring/maintenance costs).
- Increased costs (staff/equipment costs, etc.) for regular monitoring and inspecting nitrate applications.

The main benefits expected are:

- Overuse of fertilizers is prevented and soil fertility is retained/improved which may then together indirectly affect the economic use of agricultural soils.
- Saving in fertilizer costs.
- Saving in rehabilitation/protection costs for securing soil and water quality and sustaining the environment.



- Probable use of greater land sections for agriculture with increased environmental concerns (e.g., through use of organic fertilizers with very limited or no fertilizer applications) in previously environmental/drinking water protection sites.

Social impacts

Increased social welfare (sustainability of soil quality, and sustainability of agriculture itself, in areas where reduced rates are applied) and health conditions (good quality drinking and domestic water, less infection risks and decreased odours from organic fertilizer storages) to be achieved with the environmental protection that will be provided with less nitrate implementations are the most direct results expected.

Enforcement requirements

The following regulations are already enforced:

- Regulation for chemical fertilizers used in agriculture is enforced on producer and distributor levels. Inspections are regularly realized by MoFAL officials.
- Regulation for production, import, export and marketing of organic and antiviral fertilizers, soil conditioners and other products containing microbial, enzyme and organic substances is enforced on producer and distributor levels. Inspections are regularly realized by MoFAL officials.
- Also, there are private companies which are certified to inspect organic agricultural production.

Authorities have limited capacity to monitor enforcement and apply penalties for non-compliance because of physical and labour deficiencies. There is an intention among some of farmers to search for alternative and simpler shortcuts to bypass regulations to obtain some advantages. Peer pressure by community is a reality for self-enforcement. Farmers obey regulations if they believe to obtain short term benefits.

4.7.2 Water pricing schemes

The most relevant instrument that relates to water pricing in Turkey is the “Regulation for water usage control and reduction of water loss of irrigation systems (No: 29981, Date: 16.02.2017)”. The objective is to regulate the principles and procedures of efficient use of irrigation water in irrigation systems, water conservation, reduction of losses and prohibition of unauthorized consumption and ensuring reduction of supply, allocation and consumption costs of irrigation water. The scope of this regulation is about the principles and procedures of supply, conveyance and allocation of irrigation water, renovation and efficiency enhancement of existing system, conservation of water, reduction of water loss and prohibition of unauthorized consumptions, which involves the Ministry of Forest and Water Affairs (MoFWA), the Ministry of Food, Agriculture and Livestock (MoFAL), the State Hydraulic Works (DSI), local administrations, metropolitan municipalities, municipalities, irrigation unions and public irrigation unions which belongs to one natural or legal entity who irrigates areas larger than 100 hectares from one water source, who are providing irrigation water supply and consumption services.

Another means of providing contribution to water funding is through farmers’ participation into the investment in irrigation water conveyance systems, which brings in increments of irrigation water prices and which reflects the initial investment cost as the participation cost to the farmers.



Policy effectiveness

The effectiveness of water pricing approaches in general is well reflected by the farmers and stakeholders through dedicated communications. Stakeholders believe that, input costs will be decreased by the equitable allocation and lesser use of water in the long term. On the interviews, participation costs have been commented as high by the farmers. Operation and maintenance costs said to increasing, which is a factor that will increase the water unit price.

Water pricing instruments are thought to be very much linked to the use of pressurized systems on parcel level (drip/sprinkler irrigation), such that water input will decrease and water unit price will also decrease due to controlled consumption of scarce water resources in the region relatively. Better operational irrigation managements with EO and GIS tools according to renovation of the systems that would go in parallel with accurate and precise measurements and reporting of consumed water is foreseen to be an urgent requirement both for sustainable management of water resources and improving agricultural productivity at the regional scale.

These instruments have been recently introduced, therefore, there is not enough data to validate their contributions at either national, sub-national or pilot scales. Nevertheless, there are positive impacts expected from the instruments designed to this end. For example, pricing water agricultural use as a commodity would help to increase water saving in the sector by eliminating over-irrigations. Besides, applying different pricing rates in different regions (e.g., positive discrimination in areas where agriculture is promoted or agricultural practices are handicapped) would contribute to fair implementation under different priorities/handicaps.

Main negative aspects pointed refer to:

- Applying water prices higher than tolerable levels that small farmers can manage would lead to farming withdrawals in the middle-class.
- Implementation of lower default interest rates in delayed payments and/or commonly practiced tax/fine amnesties in Turkey at the national level is a driver which refrains payers from making regular payments.

Cost effectiveness

Introduction of water fees or pricing of water higher than tolerable limits by small farmers due to several reasons (e.g., limited water availabilities in good quality, infrastructure development costs, treatment costs of the waste water supplied for irrigation purposes, etc.) can lead to farming withdrawals which may then affect the socio-economy of the agricultural communities and of the region itself. This may generate abandoned land which may lose soil fertility character or be subject to fragmentation due to inheritance sharing (as a result of reduced significance as a non-agricultural property).

On the other hand, water pricing schemes may lead to enhancements in water saving among the farmers and lowering of unit cost of water in the long run.

Social impacts



There is a consensus and common understanding among the farming communities about the need for pricing water uses for water saving and secured supply of water in required quantities when needed. Yet, farmers' participation to high capital costs of infrastructure investments will decrease their social welfare.

Enforcement requirements

Regulation for water usage control and reduction of water loss in irrigation systems are monitored by DSI in collaboration with MoFAL.

4.7.3 Agri-environmental payments

There are different instruments that directly or indirectly address agri-environmental practices, measures and payments. Good agriculture practice supports provided by the Ministry of Food, Agriculture and Livestock (MoFAL) as in the examples of applied supports of 50 TL/da⁴ for fruits and vegetables, 150 TL/da for greenhouse farming, 100 TL/da for ornamental, medical or aromatic plants with the prices of 2016 is a direct measure.

Crop subjected to subsidy	(0.01TL/kg)	Addition under agreement (0.01TL/kg)
Sunflower (oil)	40	6
Cotton (unginned)	75	-
Soy Beans	60	3
Canola	50	4
Maize (grain)	2	-
Safflower	55	9
Olive Oil	80	-
Wheat, Barley, Rye, Oat, Triticale	5	-
Beans, Chickpea, Lentil	30	-
Rice	10	-
Tea	13	-
Potato and Sunflower, Safflower, Canola and Soy Beans produced in Adana, Afyonkarahisar, Aksaray, Artvin, Ankara, Bursa; Gümüşhane, Iğdır, Kayseri, Niğde, Nevşehir, Ordu, Sivas and Trabzon	Additional 50% subsidy	
No subsidies given to the maize parcels in which groundwater shortage has been detected by the ministry. Additional 50% subsidy is given for lentil and chickpea in these parcels.		

Citation for the application of the decree for the support of the producers who prefer the programme of preservation of environmentally intended agricultural areas (No: 29670, Date: 31.03.2016) is another direct measure. In this practice, 1st Category agricultural practices which require minimum cultivation, 2nd Category

⁴ Da: decar; 1/10 of a hectare. 1 da = 1000 m²



practices which contribute to the preservation of soil and water structure and prevention of erosion and 3rd Category practices which include environment friendly agricultural techniques and cultural applications are supported in amounts of 30 TL/da, 60 TL/da and 135 TL/da, respectively.

As other financial instruments, governmental subsidies provided for certain types of crops in forms of deficiency payment subsidies for wheat, maize (grain), cotton (unginned), oat, fodder, olive (oil) in Menemen and deficiency payment subsidies of Turkish Agriculture Basins can be considered in links to agri-environmental concerns such that the agricultural characteristics and the ecosystem functions can be maintained by preserving the production of regional agricultural crops.

Though not being targeted with direct financial measures, land use restrictions applied by law on the agricultural parcels additionally contribute to agri-environmental practices in the region. No. 6537 legislation of soil preservation and land use and the requirement for the minimum land use for agriculture orchards by 0.5 ha and others by 2 ha are the most prominent examples to this end.

Policy effectiveness

Instruments have been recently introduced, therefore, there is not enough data to validate their contributions at either national, sub-national or pilot scales. Since promoting only intensive agricultural practices through other policy instruments is a threat to biodiversity, agri-environmental payments would definitely help to reduce such risks to tolerable levels provided that wider implementation at the spatial scale is structured. Yet, it is not possible to quantify such positive impacts considering the data unavailability at all levels.

Supporting certain types of crops in the basin may lead to uniform crop pattern and can risk crop diversity in basin level.

Cost effectiveness

There is not any reported/anticipated negative economic/financial impact of this instrument on national, sub-national or pilot scales.

Positive impacts relate to:

- Increased socio-economic welfare of the farming communities who comply with the implementation of agri-environmental measures in their farming practices.
- Contribution to the agricultural economy at different scales from regional to national due to the motivating effect of funding on the farmers.
- Increased market prices of the agricultural products that are produced with agri-environmental concerns (e.g., products from organic farming).

Social impacts

Subsidies provided for agricultural activities will increase social welfare of farming communities.

In general, policies leading to intensive farming (labour-intensive to machinery-intensive) may result in reduced requirements for labour force. This can make an impact on seasonal workers' social status.

Enforcement requirements



All financial incentives below are implemented. Land use restrictions are enforced during the issuance of farmers licenses, which is mandatory to apply for subsidies.

- Good agriculture practice supports by the MoFAL (2016),
- Citation for the application of the decree for the support of the producers who prefer the programme of preservation of environmentally intended agricultural areas (No: 29670, Date: 31.03.2016),
- Land use restrictions,
- Governmental subsidies provided for certain types of crops.

4.7.4 Cross-cutting issues

Information needs

More information is needed for better implementation of the instruments and follow-up of the achievements due to policy implementations. In many cases, for example, data about fertilizer consumptions, water demand and use, crop yields, amount of applied pesticides, insecticides and fungicides are not available.

Precision farming is a new practice in Turkey. It requires new information tools to be introduced into the sector. Better monitoring practices are required. Time is also needed for validating the functional use of the new information tools from the aspect of increased awareness and cost efficiency.

Main needed contributions:

- Information collection for assessing proper implementation and misuses.
- Near real-time monitoring is one of the factors that needs prior attention for immediate reaction to improper implementations and/or degradations.
- Setting up information channels with stakeholders through periodical feedbacks with the objective to refine policy instruments, practices and measures.

Other relevant aspects

Other relevant issues identified included: Food security and stability of food prices.

- Technological/technical feasibility
- Legitimacy/social acceptability
- Institutional context and requirements

4.7.5 Suggestions for improvement of the instruments

Suggestions for improvement include:

- Setting up an inspection mechanism that works on a regular basis (not achieved yet in the region).
- Ensuring independence (from political/social pressures) and accountability of the inspection teams.
- Continued training activities emphasizing benefits of policy instruments and awareness.
- Shared financial responsibility for infrastructure investments between WUAs and authorities.



4.7.6 FATIMA potential role

In the current state, there is almost no practical use of the regulations that have been recently introduced in Turkey. Besides, no data is available from the monitoring practices that would help assess the return benefits of the instruments. FATIMA tools address directly this sort of developments in the technical knowledge required for improving agricultural practices. As there are no routine applications of the instruments yet, the technology support as such can be placed in the implementation easily, provided that necessary motivation in the farming communities as well as the policy/decision makers is achieved. More specifically:

- FATIMA services are expected to contribute to real-time monitoring needs.
- FATIMA results with respect to precision farming (i.e. less consumption of irrigation water, more effective use of fertilizers, adapted crop patterns) would contribute to facilitated implementation of agri-environment approaches.

The main challenges for implementation are related to:

- Slow reactivity of the managers/policy-/decision-makers in adopting, ruling and practicing innovations and advanced technological uses.
- Limited adaptation capacity to innovations (personally, institutionally, technically, technologically) due to capacity inadequacies.
- Intensive bureaucratic procedures in transferring into new/improved implementation strategies.

Supporting advisory, configurational, operational services to be provided by service providers through subsidies and/or service payments would be an important aspect.



5 Conclusions and recommendations

Tables 1 and 2 summarize the main findings of the policy analysis that was performed in FATIMA pilot areas.

From the results obtained regarding the implementation of the Nitrate Directive, we conclude that in general the effectiveness of this policy instrument remains to be demonstrated, in spite of an overall reduction in the use of fertilizers that has been recorded in most areas. The application of FATIMA tools could contribute significantly to reduce the income losses for farmers associated with N applications restrictions. This regulation has contributed to increase farmers' awareness for the environmental impacts associated with the application of fertilizers and to improve the social image of the farming sector. Monitoring and enforcement of the implementation of nitrate regulations could be substantially improved in all pilot areas. FATIMA tools and services can have a very important role in this.

The application of water pricing systems was analyzed in Greece, Italy, Spain and Turkey. In general, this instrument is still not fully applied and effectiveness is low. There is still a long way to go in the design of effective water pricing mechanisms and in the creation of conditions to ensure their application. FATIMA tools can be used to optimize water use, improve estimations of water consumption and to detect illegal abstractions, but the enabling regulatory framework has yet to be established, in spite of the existing umbrella provided by the WFD.

Policy recommendations will be extracted from this analysis in the upcoming deliverable D4.2.4.



Table 1 – Nitrate Regulations - Summary of findings

Criteria	Austria	Czech Rep.	Greece	Spain	Turkey
Policy effectiveness	Not sufficient but has a stabilizing effect and the situation would be worse without it. Upper limits of N are too high and therefore effectiveness is low. Nitrogen balances are imprecise. N fertilization ban periods work well.	Restrictions have only partially contributed to achieve the goals. AP has contributed to more effective use of fertilizers.	Effectiveness is uncertain. Reductions in use of fertilizers, but no decrease in concentrations in surface and groundwater. Price of fertilizers more important than regulation.	Effectiveness is uncertain.	Too recent to have results. So far, no targeted regulation addressing N applications, but focus on supply of fertilizers.
Cost – effectiveness	Can be economically negative for farmers, since yields are influenced. Economic benefits for society and water suppliers.	Increased efficiency of the use of fertilizers. Sometimes there has been a reduction in crop yields. VRT could allow the same results with lower impacts in crop yields.	Reduction in crop yield and of farmers income. FATIMA tools can help improve cost-effectiveness.	Actual management of fertilizers has not changed substantially, but bureaucratic burden has increased.	Application of N regulations can entail additional costs. Environmental and social benefits are foreseen.
Social impacts	Improve public image of agriculture.	Positive impacts for society in vulnerable areas. Lower incomes and administrative burden for farmers.	Productivity losses impact on farmers' livelihoods. Positive impacts of healthier environment.	Improved awareness of farmers.	Not known yet. Increased social welfare and environmental conditions is expected.
Enforcement capacity	Monitoring is working, but other conditions are not taken into account. Some regulations not applied. Farmers may have incentive to by-pass regulations.	Enforcement works. However, farmers feel restrictions are too strict. Cross-compliance is working.	Lack of qualified staff to control enforcement of Input Management Plans.	Control based on administrative forms and random inspections. Lack of qualified staff to control enforcement.	Inspections are realized. Limited capacity to monitor.
Information needs	Information is available. There is a need for cost-effective tools (field data, biomass maps,..). FATIMA tools can improve N fertilization recommendations.	Information needed is partially available, but difficulties remain.	Need for farm specific information to improve management plans. EO can help.		More information is needed.

Table 2 – WFD, Water Pricing - Summary of findings

Criteria	Greece	Italy	Spain	Turkey
Policy effectiveness	Over-irrigation still remains an issue of concern. Water pricing is not yet fully applied – new regulations are being introduced. Area based is the dominant water pricing scheme.	Water pricing is not yet fully applied. Cost recovery of water uses and volume based pricing are being introduced.	Self-regulation of water users is the main mechanism to control water consumption. Farmers pay Water Users Association area-based fee and support pumping costs.	Too recent to have results. There is expectation that it will contribute to water savings and eliminate over-irrigation.
Cost – effectiveness	Higher irrigation costs and reduced yields associated with water scarcity.	Higher costs for farmers associated with paying for water. High transaction costs associated with water metering (to be supported by farmers).		If water fees are too high it may lead to agricultural abandonment. Water savings are expected.
Social impacts	Improved social well-being with sustainable water management.	Improved water management and increased security in supply. Reduced water allocation conflicts.	Water scarcity constraints development of agriculture.	There is a consensus about the need to pay for water. Social welfare can be reduced due to high investment costs on infrastructure.
Enforcement capacity	Non-satisfactory enforcement, due to lack of resources. Uncontrolled water abstractions still occur.	Authorities have some capacity to monitor compliance, but there is a lack of tools to detect illegal abstractions.	Control of water consumption is effective.	Authorities have capacity to enforce.
Information needs	FATIMA tools could contribute to optimize irrigation strategy and support detection of illegal abstractions.	There is a need for water metering. FATIMA can contribute to improve reliability of estimations in the absence of water metering.		Water measurements are still needed. EO and GIS tools could be used for operational management.

Annex

Table 1 - Regulation EU No 1305/2013 and its implementation in the Lazio Region

Art.	Measure	Sub measure (2 digit)/type of operation (3 digit)	Lazio Region	Beneficiaries	Payments
14	1) Knowledge transfer and information actions General objectives <i>Training and information addressed to all operators in the agricultural sector, agri-food and forestry, land managers, and small and medium-sized businesses (SMEs) located in rural areas with the aim of promoting new forms of knowledge and support the interaction and cooperation between holding; increase the skills of young people in the agricultural and forestry sector.</i>	1.1 - Support for vocational training and skills acquisition 1.1.1 - Vocational training and skills acquisition	X	Persons engaged in the agricultural, food and forestry sector, land managers and other economic actors which are SMEs operating in rural areas.	70% of eligible costs
		1.2 - Support for demonstration activities and information actions 1.2.1 – demonstration/information actions	X		
		Support for short-term farm and forest management exchanges as well as farm and forest visits			
15	2) Advisory services, farm management and farm relief services General objectives <i>Encourage and support a rural development advisory system that contributes to the achievement of the objectives of all 6-priority actions, with particular reference to cross-cutting objectives: introduction of process, structural and organizational innovations, environment and mitigation of climate change</i>	2.1 - Advisory services 2.1.1 - Support for the purpose of helping those entitled to use the services advice.	X	<ul style="list-style-type: none"> • Provider of advice or training • Authority or body selected to set up the farm management, farm relief, farm advisory or forestry advisory service. 	<ul style="list-style-type: none"> • For each Advice (voucher) 1,500 € • Up to 200,000 € for 3 years for consultant training
		2.2 - Support to promote the setting up of farm management, farm relief and farm advisory services, as well as forestry advisory services			
		2.3 - Support to promote the training of advisors 2.3.1 - Advisors training	X		
16	3) Quality schemes for agricultural products, and foodstuffs General objectives	3.1 – Support for quality regimes of agricultural and food products. 3.1.1 - Support for new participation by farmers in quality schemes	X	Farmers and their associations who adhere for the first time	• 70% of eligible costs

	<i>Increase agricultural production protected by food quality systems, promoting its promotion and market position.</i>	3.2 - Support for information and promotion activities implemented by groups of producers in the internal market 3.2.1 - Information and promotion activities on quality schemes for agricultural products, and foodstuffs	X	to a quality system	• 3,000 €/year per farm
17	<p>4) Investments in physical assets General objectives <i>Improving economic activity and environment of agricultural and rural businesses, increase efficiency of the market in agricultural products and in the processing sector.</i> <i>As a whole, this Measure will have a multi-objective key role, with particular regard to competition in the global market, innovation, to the environment and to the maintenance and creation of new opportunities work.</i></p>	4.1 – Support of investments on the agricultural holding 4.1.1 – Support of investments to improve the overall performance and sustainability of the agricultural holding	X	Farmers and their associations	40% of eligible costs. in some cases (young farmer, organic agriculture commitment) can be raised to 60%
		4.1.3 - Support of investments to improve the energy efficiency of production processes	X		
		4.1.4 - Support of investments in individual farms to encourage the supply and use of renewable energy sources.	X		
		4.2 – Support of investment to promote the processing and marketing and/or the development of agricultural products. 4.2.1 – Support investments in agri-food businesses (single approach, system and innovation of the EIP)	X	<ul style="list-style-type: none"> • Farmers and their associations • Agri-food businesses 	40% of eligible costs. 60% in case of project realized by enterprises participating to the European Innovation Partnership (EIP) Operational Groups (GOs)
		4.2.2 - Investments aimed at functional agri-food businesses to improve energy efficiency	X		
		4.2.3 - Support of investments in agri-food businesses to encourage the supply and use of renewable energy sources.	X		
		4.3 - Support for investment in the infrastructure necessary for the development, modernization and adaptation of agriculture and forestry. 4.3.1 - Improvement and restoration of rural and forestry extra-farm roads, watering points for livestock	X	<ul style="list-style-type: none"> • Public entities • Private entities 	100% and 80% of eligible costs for public and private entities respectively.
4.4 - Support for non-productive investments related to the fulfillment of agri- environmental-climate objectives. 4.4.1 - Creation, restoration and upgrading of natural areas for biodiversity, of agrarian systems, feature of landscape and naturalistic interest.	X	<ul style="list-style-type: none"> • Farmers and their associations • Territorial public entities 	100% of eligible costs		



				<ul style="list-style-type: none"> Protected Nature Reserve, Natura 2000 Managers. 	
18	5) Restoring agricultural production potential damaged by natural disasters and catastrophic events and introduction of appropriate prevention actions General objectives <i>Promote measures to restore the damaged agricultural production potential from natural calamities and catastrophic events, to stimulate growth and to promote environmental sustainability</i>	5.1 - Support investments in preventive actions aimed at reducing the consequences of probable natural disasters, adverse climatic events and catastrophic events 5.1.1 - Support investments in mitigation action, prevention to reduce the consequences natural disturbances, adverse or catastrophic climatic events.	X	<ul style="list-style-type: none"> Farmers Public entities 	80%, of eligible costs for single beneficiary 100% in the case of associated Farmer or Public entities.
		5.2 - Support Investments for the restoration of agricultural land and production potential damaged by natural disasters, adverse climatic events and catastrophic events 5.2.1 - Investments for restoring holding structures	X	<ul style="list-style-type: none"> Farmers 	100% of eligible costs
19	6) Farm and business development General objectives <i>Creation and development of economic activities in rural areas.</i>	6.1 - Aid for start-up entrepreneurship for young farmers	X	<ul style="list-style-type: none"> Young farmers (18-40 years old) 	70,000 €
		6.2 - Aid for start-up entrepreneurship for non-agricultural activities	X	<ul style="list-style-type: none"> Farmer who diversified with non-agricultural activities Non-agricultural micro-small enterprise 	50,000 €
		Aid for the development of small farms			
		6.4 - Support investments in creation and development of non-agricultural activities 6.4.1 - Diversification of farms activities 6.4.2 – Energy production from alternative sources.	X	<ul style="list-style-type: none"> Farmer who diversified with non-agricultural activities Non-agricultural micro-small enterprise 	40%, of eligible costs, 60% in case of young farmer, EIP-GOs, mountain area investments.



		Annual payments or one-off payments for farmers eligible for the small farmers scheme who permanently transfer their holding to another farmer			
20	7) Basic services and village renewal in rural areas General objectives <i>Stimulate growth and promote environmental and socio-economic sustainability of rural areas.</i>	7.1 - Support the drawing up and updating of plans for the development of municipalities and villages in rural areas and their basic services and of protection and management plans relating to Natura 2000 sites and other areas of high nature value	X	<ul style="list-style-type: none"> • Public entities • Protected Nature Reserve, Natura 2000 Managers. • Private-public partnership 	Up to 100% of eligible costs
		7.2 - Support investments in the creation, improvement or expansion of all types of small scale infrastructure, including investments in renewable energy and energy saving 7.2.1 - Realization, improvement and expansion of infrastructure on small scale. 7.2.2 - Investments to support supply and use of energy from renewable sources for self-consumption.	X		
		7.3 - Support investments in broadband infrastructure, including its creation, improvement and expansion, passive broadband infrastructure and provision of access to broadband and public e-government solutions	X		
		7.4 - Support investments in the setting up, improvement or expansion of local basic services for the rural population, including leisure and culture, and the related infrastructure	X		
		7.5 - Support investments for public use in recreational infrastructure, tourist information and small-scale tourism infrastructure	X		
		7.6 - Support studies and investments associated with the maintenance, restoration and upgrading of the cultural and natural heritage of villages, rural landscapes and high nature value sites, including related socio-economic aspects, as well as environmental awareness actions	X		



		7.7 - Support investments targeting the relocation of activities and conversion of buildings or other facilities located within or close to rural settlements, with a view to improving the quality of life or increasing the environmental performance of the settlement	X		
21	8) Investments in forest area development and improvement of the viability of forests General objectives <i>Stimulate afforestation and forestation in order to improve management of the forestry heritage into a new optics of environmental enhancement, economic and social.</i>	8.1 - Support afforestation and creation of woodland	X	<ul style="list-style-type: none"> • Natural persons • Private and public foresters; • Other private and public law bodies and their consortia; • Municipalities and their consortia. 	700 €/ha for Farmer 150 €/ha for Natural persons and public law bodies.
		8.2 - Support for establishment of agroforestry systems			
		8.3 - Support prevention and restoration of damage to forests from forest fires, natural disasters and catastrophic events, including pest and disease outbreaks, and climate related threats	X		100% and 80% of eligible costs for public and private entities respectively. 700 €/ha for maintenance costs
		8.4 - Support investments for improving the resilience and environmental value as well as the mitigation potential of forest ecosystems	X		
		8.5 - Support investments in forestry technologies and in the processing, the mobilising and the marketing of forest products.	X		40% of eligible costs
27	9) Setting -up of producer groups and organisations General objectives <i>Encourage the establishment of associations and producer organizations in the sector agricultural and forestry</i>	9.1 - Support to facilitate the setting up of producer groups and organisations in the agriculture and forestry sectors	X	New Associations and Producer Organizations in the Agricultural and Forestry Sector	10% of the production marketed during the first 5 years



28	<p>10) Agri-environment-climate General objectives <i>Encourage farmers and other land managers to introduce methods of extensive agricultural production and compatible with the protection and improvement of the environment, the landscape and its characteristics, resources natural, soil, water and biodiversity. Maintaining methods of agricultural production compatible with the ecological and environmental profile contributes to reducing the negative effects of agriculture on the natural environment.</i></p>	10.1.4 - Conservation of soil organic matter, using organic fertilizer to reduce Nitrogen use	X	<ul style="list-style-type: none"> • Farmers and their associations 	€ 250/ha for permanent crops, € 200/ha per annual crops excluding legumes. Inside the "Vulnerable areas by nitrates of agricultural source (NVZ)" those amount is reduced to € 200/ha and € 150/ha, respectively
		10.1.5 – Support for adoption of conservation agriculture techniques	X		€180 (130 inside the NVZ) for crop belonging to group A (e.g. wheat, barley, pie, forage etc.) and 300 €/ha (for all areas) for crop belonging to group B (e.g. Corn, tomato, sugar beet etc.)



29	<p>11) Organic Farming General objectives <i>Contributing to the conservation of biodiversity and the reduction of erosion genetics by reducing the intensity of agronomic practices in agriculture.</i></p>	11.1. - Support to conversion to organic farming practices	X	<ul style="list-style-type: none"> • Farmers and their associations 	<p>Crop group A1 (e.g. wheat, barley, pie, etc.) 180 €/ha; crop group A2 (forage) 150 €/ha; crop group B (e.g. Corn, tomato, sugar beet etc.) 330 €/ha; crop group C (vegetable in open field) 600 €/ha; crop group D (olive tree, apricot, cherry) 390 €/ha; crop group E (Vineyard – grape and vine – Peach, Apple...) 800 €/ha; crop group F (Chestnut fruit, Walnut fruit) 320 €/ha.</p>
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		11.2 - Maintain organic farming practices	X		Crop group A1 (e.g. wheat, barley, pie, etc.) 160 €/ha; crop group A2 (forage) 140 €/ha; crop group B (e.g. Corn, tomato, sugar beet etc.) 270 €/ha; crop group C (vegetable in open field) 500 €/ha; crop group D (olive tree, apricot, cherry) 330 €/ha; crop group E (Vineyard – grape and vine – Peach, Apple...) 670 €/ha; crop group F (Chestnut fruit, Walnut fruit) 270 €/ha
30	12) Natura 2000 and Water Framework Directive payments				
31	13) Payments to areas facing natural or other specific constraints General objectives <i>Promote the permanence of agricultural activity in areas subject to constraints natural.</i>	13.1 - Compensation payment for mountain areas	X	<ul style="list-style-type: none"> • Farmers and their associations 	Maximum of 300 €/ha



33	14) Animal welfare General objectives <i>Increase the introduction of farming systems respectful of the life of animals, with positive effects as well as on different bred species, even on the environment.</i>	14.1 - Payment for animal welfare	X	<ul style="list-style-type: none"> • Farmers 	Dairy cattle and young buffalo, 270 €/LU Beef cattle, 170 €/LU Sheep and goats, 115 €/LU
34	15) Forest-environmental and climate services and forest conservation				
35	16) Co-operation General objectives <i>Promote the cooperative approach. Increased integration between research agricultural and agri-food sector. Support to the - Establishment and functioning of Operational Groups (GOs) of the EIP for agricultural productivity and sustainability and link with H2020 and national research and innovation programs.</i>	16.1 - Establishment and functioning of Operational Groups (GOs) of the EIP for agricultural productivity and sustainability	X	GOs consisting of agricultural, technical and scientific subjects (farmers and their association, holding involved in the processing and marketing of agro-food and forestry products, consultants, public and private research and experimentation subjects etc)	100% of the eligible costs
		16.2 - Pilot projects, development of new products, practices, processes and technologies in the agriculture, food and forestry sectors	X	Operational Groups (GOs) of the EIP	100% of the project eligible costs
		16.3 - Co-operation among small operators in organizing joint work processes and sharing facilities and resources and for the development and/or marketing of tourism services relating to rural tourism	X	Partnership between at least of two small operators	100% for facilities sharing



	16.4 - Horizontal and vertical co-operation among supply chain actors for the establishment and the development of short supply chains and local markets	X	Partnership between at least of two chain actors	100% for the co-operation
	16.5 - Joint action undertaken with a view to mitigating or adapting to climate change	X	<ul style="list-style-type: none"> • Farmers and their associations • WUA • Producer consortia • Forestry holding Protected Nature Reserve, Natura 2000 Managers. • Public entities 	100% of the eligible costs
	16.6 - Horizontal and vertical co-operation among supply chain actors in the sustainable provision of biomass for use in food and energy production and industrial processes			
	16.7 - Support for non-participatory Local Development Strategies (LDS) other than those defined by the Leader			
	16.8 - Support on drawing up of forest management plans or equivalent instruments	X	<ul style="list-style-type: none"> • Partnership between at least of two (public/private) forestry owner • Public entities dealing with water/flood management 	100% of the eligible costs
	16.9 - Support for diversification of farming activities into activities concerning health care, social integration, community-supported agriculture and education about the environment and food	X	<ul style="list-style-type: none"> • Farmer • Onlus • Public entities dealing with person care services 	100% of the eligible costs



				• Private holding dealing with person care services	
		16.10 - Activation and implementation of "Organized chain Projects"	X		100% of the eligible costs
42-43	19) LEADER Local Action Groups (LAGs) <i>Support and stimulate local, sub-regional integrated development, conceived taking into account the needs and potential of the territory and managed by Local Action Groups (LAGs).</i>	19.1 - Support LEADER start-up kit	X	New or existent LAGs	100% of the implementation costs
		19.2 - Support for the implementation of the interventions under the Community Led Local Development (CLLD)	X	Those identified by the LAGs	Established by the LAG
		19.3 - Support for preparation and implementation of cooperation projects <ul style="list-style-type: none"> • preparation of cooperation projects • implementation of cooperation projects 	X	LAGs	<ul style="list-style-type: none"> • 100% for project preparation • 80% for project implementation
		19.4 – Support for management and animation costs <ul style="list-style-type: none"> • management costs • animation costs 	X	LAGs	100% for management and animation costs
51-54	20) Technical assistance	20.1 - Support for the preparation and implementation of the program	X		

Regarding the National Rural Development Program the first one is articulated in three measures considered strategic at National level:

	4) Investments in physical assets	4.3 – investment in irrigation infrastructure	WUA	100% of the eligible costs
36	16) Co-operation	16.2.A - Development of new processes cooperation for livestock biodiversity		100% of the eligible costs



		16.2.B - Cooperation for the creation of a unit management system for livestock biodiversity	Association, Entities ... with experience in the field of animal genetic improvement and biodiversity conservation	
17) Risk management		17.1 - Financial contributions to premiums for crop, animal and plant insurance against economic losses to farmers caused by adverse climatic events, animal or plant diseases, pest infestation, or an environmental incident	Farmer	65% of insurance premiums, for economic losses >30%);
		17.2 - Financial contributions to mutual funds to pay financial compensations to farmers, for economic losses caused by adverse climatic events or by the outbreak of an animal or plant disease or pest infestation or an environmental incident		65% of insurance premiums
		17.3 - Income Stabilisation Tool (IST), in the form of financial contributions to mutual funds, providing compensation to farmers for a severe drop in their income.		65% of the drop income

