
The Audimod Tool

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Short summary

We present the results of a study undertaken on behalf of FAO and then further developed for a Spanish river basin agency to look at whether irrigation modernization projects are effective measures as part of the implementation of catchment plans to help improve the status of water bodies. The tool developed is called *AudiMod* and was tested for two specific sites.

Key Words:

Water auditing, water efficiency, irrigation modernization, EU water framework directive

Issues addressed:

Water resources management (water-use efficiency, integrated water resources management, transboundary cooperation, sustainable extraction and supply of freshwater)

We analyzed both the institutional and governance aspects of irrigation modernization, and how these link up with water use efficiency, giving particular attention to the social, economic and environmental sustainability aspects before and after irrigation modernization.

Water quality (pollution, dumping of toxic materials, wastewater management, recycling, reuse, restore ecosystems and aquifers)

We looked at diffuse pollution before and after irrigation modernization and whether this was reflected in contributing to the better quality of surface water, restoration of ecosystems and aquifers.

Risks (mortality, economic losses caused by natural and human-induced disasters)

Risks only marginally considered from the perspective of resilience of the system before and after modernization to extreme events like floods and droughts, and briefly considered potential impact under climate change scenarios for the basin studied.

Tools for implementation

Governance: Institutions / legal framework: A study was undertaken of the water tenure in two case study areas. *AudiMod* continued deepening the analysis from the perspective not just of water governance but also of water use and consumption. The main lessons learnt were that The tool developed –called *AudiMod*- applied to two case studies in a Spanish river basin is based on the integration of remote sensing data and other complementary data which includes key governance aspects like water rights and allocation. The *AudiMod* method allowed us to compare water demand and consumption before and after irrigation modernisation.

Differences were detected between the figures used by different departments, in particular difference between theoretical demand versus real demand and water use. Thus we characterised the real annual water consumption, based on a methodology to compare and contrast available data, complemented by generated data from *AudiMod*. We also proposed a series of indicators that can translate changes resulting from irrigation modernisation into changes in the status of water bodies in the area affected. These indicators allow monitoring the potential changes in pressures on water bodies built on the basis of existing data, but that can also be generated *ex novo* from data collected by *AudiMod*. These indicators can help then detect changes into the status of water bodies which are attributable to the irrigation modernisation measure implemented, thus helping to evaluate its effectiveness, e.g. on changes in the parameters that measure the ecological state of water bodies. Irrigation Modernisation is a measure that can potentially (not necessarily always) reduce irrigation water demand. Thus the elaboration of scenarios (like a decrease in available resources due to e.g. climatic change) can help link water use, technology and governance aspects like revision of water rights in a changeable context.

Technology: Look at technology from the perspective of shift in agricultural technologies looking for increased water efficiency, from flood irrigation to spray irrigation.

Capacity development: Not specifically, but did consider key role of water user groups.

Who is involved?: The first study was commissioned by the Land and Water Division at FAO and then this was further developed under the auspices of a Spanish river basin agency. The study had the full support of the river basin agency and we also involved additional key local stakeholders, like the different departments within the river basin agency, state companies, the regional government, water user groups, municipalities and environmental groups.

What were the objectives of the intervention?: The objective originally was to test the usefulness and validity of the water tenure concept as a proof of concept study. After this pilot, the potential was identified to continue the study as a basis to develop a Water Audit called *AudiMod*. We would target one of the main measures used in Spain to comply with the EU Water Framework Directive and the good status of water bodies: the implementation of irrigation modernization schemes as a way to improve the status of water bodies across Spain.

The proposal was approved by the river basin agency to develop and test in two cases a robust methodology to evaluate the effectiveness of modernization projects from different angles (environmental, social and economic).

Implementation challenges: The main implementation challenge was to develop the methodology itself, to gather the relevant data, process the data and then apply it to test its validity and whether results proved relevant. The methodology proved robust and unexpected results were detected, that has facilitated deep learning and potential changes in the river basin agency. The methodology could now be

used as a benchmarking method to evaluate additional modernization projects in the basin, as part of the revision of the Water Plan, in compliance with the EU Water Framework Directive to revise water plans in 2014-2015.

Main task/activities undertaken: The main tool used was a method called *AudiMod*, was based on a series of steps based on gathering relevant data, contrasting and validating data in relation to a set of specific criteria in our case related: first, to water consumption before and after irrigation modernization, second, to the positive/negative/neutral impact of the modernization measure on the status of the affected water bodies, and third, a stress test to see the extent to which the area of study would be resilient to changes in either supply e.g. due to climate change predictions of a drop of 6% water resources by 2021 ,or in demand in case e.g. that the most water consumptive crop became the dominant crop in the whole water irrigated area within the allocated water rights.

Main outcomes / impacts (what has changed?): As a result of *AudiMod* a number of main outcomes and impacts have taken place. First of all, in terms of *procedural outcomes*, we have developed a set of procedures to evaluate changes before and after modernization, as well as a list of nexus indicators than can detect changes from irrigation modernization on the environmental status of water bodies. Second, in terms of *substantive outcomes*, the evaluation has demonstrated that the measure was effective since the status of water bodies has improved as a direct result of the irrigation modernization measures. What is important however is not only the substantive outcomes but particularly the robustness of the methodology which is transferable, and can help to monitor and follow changes before and after interventions in the main water consumptive sector in the area, which in the case study area accounts for 97% of the water used.

Lessons learned

Triggers: The main trigger for the study is double fold: first, the previous study for the FAO demonstrated the relevance of the water tenure concept to pin down the governance aspects from the perspective of water rights vs real use. Second, the river basin agency faced an important moment due to the calendar of implementation of the EU Water Framework Directive and the need to know/test whether the measures implemented to comply with the directive were effective and/or the indicators that monitor the status of water bodies sensitive to detect the changes attributable to the measures in the basin plan included in the first cycle of implementation (2009-2014), in our case irrigation modernization in the Programme of Measures.

Drivers: The drivers are different in the sense that, for agriculture the main drivers lie, in the case of the EU in the Common Agricultural Policy and prices of agricultural commodities, and more recently in Spain from energy liberalization and its knock on effect on water use as a result of the increase in energy prices. Meanwhile, in the case of water resources, the main drivers have been regulatory to improve the status of water bodies and the overall ecological integrity of aquatic ecosystems in the EU, badly degraded. The main problem for the Southern European countries is that often the dominant use- irrigated agriculture- puts pressure on the environmental status of water bodies from both a quantitative and qualitative perspective. It has been difficult often to find measures to create synergies between both agricultural and water policies rather than trade-offs.

Barriers: The main barriers for implementation can be analyzed from two perspectives: *from the perspective of public policy*, and from the perspective of *implementing AudiMod* itself. In the first case (from the public policy perspective), the barriers pivot around ensuring that the potential reduction in water use as a result of irrigation modernization is capitalized by taking pressure of the overall irrigation system with no loss in agricultural productivity and in fact, an improvement in the quality of life and wellbeing of the rural population. In our cases all these objectives were successfully achieved, thus ensuring

synergy between sectors. In the second case (implementing *AudiMod*) the main barrier detected at the onset was ensuring good quality data to evaluate and assess the level of robustness and quality of the different data available. This was addressed by gathering and contrasting as much data as possible, triangulating the data to be able to evaluate the robustness of the data and degrees of uncertainty. This is important to ensure that changes can be monitored and most important, management and governance changes can be taken based on a solid basis (e.g. review of water rights, changes in abstraction points, management of the reservoir, etc.).

What has worked well?:

- The development of the methodology itself, which is robust enough to be able to monitor changes and also to be useful for decision making.
- It proved the effectiveness of the measure implemented- in our case irrigation modernization- to reduce the pressure on water resources from both a quantitative and a qualitative perspective.

What can be improved?: Through the development of additional projects, the robustness would be further tested and improved, possibly with the addition of more indicators to be able to track and monitor changes. At the moment, the qualitative aspects in terms of information from water users and their perceptions have to be better integrated. Important issues were raised that would go to the heart of governance across different levels including the potential for co-management and the interaction between water user groups, the river basin agency, the regional government and state companies.

The way forward: The idea is to further apply *AudiMod* to additional sites to both strengthen the methodology (including its qualitative/governance and coordination aspects), as well as be able to use it to assess the effectiveness of key measures as part of pro-active governance on regulation by the river basin agency. The method is potentially strategically important because it targets the dominant water user in a water scarce area: irrigated agriculture. It also helps to evaluate the potential for synergies across policies, in our case agricultural policy, water resources management, environmental protection and energy consumption. Overall the tool helps alignment with the EU policy on resource efficiency and environmental resilience.

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