Global Issues in Water Policy 28

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Water Law, Policy and Economics in Italy

Between National Autonomy and EU Law Constraints

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Introduction

The idea of this volume dates back to 2017, when two of us (Marco and Paolo) were working on a booklet on the implementation of the European Union (EU) Water Framework Directive and Floods Directive in Italy.[1] That publication, in Italian, was written from the point of view of lawyers, thus focusing on some legal aspects of Italy's struggle with a difficult, piecemeal reform of its water governance system. However, that booklet was one of the outputs of a project that had seen the volume's editors collaborating side by side with experts with different scientific backgrounds and expertise, as diverse as sociology, economics and engineering. Discussing with each of such colleagues, Marco and Paolo had learnt a great deal about water issues and, conversely, in each of them Marco and Paolo had found scholars sensitive to the legal facets of the respective subject matters – a textbook example of successful interdisciplinary cross-fertilisation.

The spark that set this editorial project in motion was a journal article whose authors had reviewed the English-language literature on the practical implementation of the Water Framework Directive in the EU. The results of the review were unambiguous: "[w]hat should be clear from this brief survey is that much is known about WFD implementation in northern and western Europe, but relatively little about WFD implementation in Mediterranean countries, including founding members and heavyweights such as France and Italy".[2] The article also ended up in the highlights of a periodic publication of the European Commission, which stressed the point forthrightly: there were "relatively few studies on one of the founder states, Italy".[3] Although the figures would have been different for sure if writings in

[1] Alberton, M., Turrini, P., & Pertile, M. (Eds.) (2018). *La Direttiva quadro sulle acque (2000/60/CE) e la Direttiva alluvioni (2007/60/CE) dell'Unione europea: attuazione e interazioni con particolare riferimento all'Italia*. Naples: Editoriale Scientifica.

[2] Boeuf, B., & Fritsch, O. (2016). Studying the implementation of the Water Framework Directive in Europe: a meta-analysis of 89 journal articles. *Ecology and Society 21*(2):19.

[3] See *Science for Environment Policy*, European Commission DG Environment News Alert Service, Issue 465 of 29 July 2016. Indeed, the survey had counted for France three times the articles on Italy (six against two).

languages other than English had been taken into account by the study, a message was clear: Italian scholars are less used than their fellows from other EU countries to publish their researches in English. And this, from the perspective of scientific dissemination, may certainly be an issue.

Thus, the coordinates had been set. What was needed was an English-language publication that could explain to the non-Italian-speaking academic and professional communities the way Italy deals with water issues. Of course, consideration of such a readership would entail consequences in terms of both content and style. No information of the Italian physical conformation, political setting, legal order or economic situation could be taken for granted, as the purpose was rightly that of providing the non-Italian reader, even the non-specialist one, with plain and thorough information on a wide array of topics. Indeed, the focus had to be greatly expanded from the original, limited view on the two abovementioned EU directives, so as to address several other issues that, presumably, do not receive adequate coverage in the scientific literature in English. After all, Italy offers the scholar of water issues enough materials for being a valuable case study: the uneven distribution of Italian water resources, the different geographical and climatic conditions of a long country that stretches across numerous parallels, the opposite extreme conditions affecting the Italian territory (frequent floods and, at the same time, an impending desertification), the significant role played by agriculture (a water-intensive activity), a lead position in the consumption of bottled water, the lower-than-average prices of water and a far-from-optimal efficiency of waterworks.

Such an ambitious editorial project demanded an interdisciplinary gaze and efforts by scholars not confined within the boundaries of legal studies. Therefore, Marco and Paolo joined forces with Antonio and Alessandro, who, coincidentally, were already musing about a similar endeavour. This was not surprising at all, as it only demonstrated the urgent need for such a work, and the fact that the times were ripe for it. The editors of a handbook on "Water Law, Policy and Economics in Italy" were ready, they just had to take contact with the team of authors. They did, and they are now most pleased to introduce to the reader the outcome of the intellectual labour of a wonderful group of distinguished scholars, all of them leaders in their own fields of expertise.

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The volume is composed of four main parts. Part I is entitled "Water Resources and Their Use and Management in Italy" and it aims at setting the scene, that is, illustrating the main natural and social features of Italy, by means of contributions that dwell upon some general questions from a variety of standpoints.

The book could not but open with a panoramic overview of the country's water endowments. Indeed, in Chap. 1 ("Water Resources of Italy"), Marcello Benedini and Giuseppe Rossi describe the distribution of water resources, highlighting the great variability across the country that is mainly due to geographical and climatic characteristics. The latter factor is of utmost importance in the future availability of water, as climate change could negatively impact on both the amount of accessible water (because of more frequent droughts and different precipitation patterns) and the uses of water (especially economic ones: agriculture but also tourism). This would likely make more pressing the need to find alternative forms of water supply, such as the reclaiming of water, that are being already experimented in semi-arid areas of the country (particularly, in Southern Italy, including the Islands). Clearly, the spatial differences in the availability of water affect, but to some extent are also affected by, the uses of the resource and the development of water infrastructures: such uses are expounded, as are their consequences on the qualitative status of Italian waters. Before ending their chapter with several recommendations, the authors focus on some regions of the Country which they deem to be representative, be it for their large natural availability of water (for instance, the Po river basin) or for the opposite condition (for instance, Apulia).

In Chap. 2 ("Coping with Floods in Italy: Learning from the Past to Plan Future Adaptation"), Renzo Rosso deals with a problematic aspect of water resources in Italy, that is, the rebellious nature of waters, which obstinately refuse to be constricted within narrow boundaries. Recent Italian history, from the birth of modern Italy in mid-nineteenth century to the present day, shows the unpreparedness of the Country in tackling the issue of floods, which regularly hit the Italian urban and rural territory and, with equal regularity, take a heavy toll in terms of human lives and material properties. Lack of memory of the past is not a good premise, especially in a field, such as prediction of floods, where forecasts of the future must overcome challenging technical difficulties. After describing some major failures in coping with natural calamities that hit Italy in the second half of the twentieth century, Renzo Rosso indicates the way ahead and details the fittest measures and strategies to minimise the risk of disastrous events. As this, however, cannot be completely eradicated, societies must work to reduce exposure and enhance resilience, which can ultimately be attained only by raising people's awareness of the inevitability of floods and similar catastrophes.

Whereas Chap. 2 deals with a serious problem that is somehow "inherent" in water resources, albeit possibly worsened by men's ill-considered activities, Chap. 3 ("The Uses and Value of Water in Italy: Evidence from Selected Case Studies in Italy, with a Particular Focus on Irrigation, Industry and Hydropower"), addresses in greater detail an issue touched upon by the first chapter, that is, how Italian waters are utilised. Giulia Vaglietti, Alessandro de Carli, Federico Pontoni and Antonio Massarutto do this from the standpoint of economics, by analysing the most significant literature that focuses on Italy. In particular, the economic value of water is investigated in four main ambits. First, urban water services, a sector that has undergone multiple reforms over the years, whose success is analysed through the lenses of efficiency and sustainability. Second, agriculture, which has the lion's share as far as water withdrawals are concerned and is studied with respect to pollution, droughts and water prices. Third, energy and, in particular, hydropower, which is an important source of renewable energy in Italy: a sector that is considered in light of the growing importance of studies on the water-energy nexus. A fourth, less conventional field is also taken into account, that of recreational uses of water and the value integral to the existence of the resource. The literature review ultimately shows the need for a more interconnected approach among sectors (which is currently lacking due, perhaps, to a fragmented governance), given the possibility of using and re-using water for different purposes. The authors underline that filling this gap by means of more numerous scientific researches focusing on Italy is vital for the future of a resilient water economy.

Another important – actually, the most fundamental – use of water is for drinking purposes. People's habits in this regard may vary greatly across different countries and, within the same country, across different categories of users and can therefore be analysed through sociological lenses. This is precisely what Filippo Oncini and Francesca Forno do in Chap. 4 with respect to Italy ("Testing the Waters: A Sociological Analysis of Domestic Water Use and Consumption"). Italians are well-known for being assiduous consumers of bottled water, to the extent that Italy ranks third in the world as to the purchase of packaged water. This occurs despite the generally good, or at least acceptable, quality of tap water in most areas of the country, and notwithstanding the fact that tap water is really cheap as compared to many other European countries. Filippo Oncini and Francesca Forno interrogate data from recent surveys in order to understand the reasons behind this situation, and find that wealthier consumers tend to buy bottled water in greater quantity than those with reduced financial capacity, in sharp contrast with other cases (such as purchase of local/organic food) where affluent people are more likely to be engaged in environmental-friendly, rather than unsustainable, social practices.

The first part of the volume concludes with a far-reaching overview of the regulatory landscape where water resources are situated. In Chap. 5 ("Water Resources Management in Italy: Institutions, Laws and Approaches"), Emanuele Boscolo draws the lines of the evolution of water governance in Italy, identifying some key reforms implemented in the second half of the twentieth century as collectively constituting a watershed for the way water resources are conceived and safeguarded. Starting from the axiom of the public nature of all water resources on and under the Italian soil, the author explains the most relevant corollary of that postulate, which describes the State as a custodian of all waters: these must be preserved by the former by means of a sound planning policy for the benefit of future generations and, if needed, against the potentially harmful claims of holders of concessions for the provision of water services. Moreover, such services, when concerning drinking water supply to the population, must be affordable to everyone, as satisfaction of human needs is, together with the protection of water ecosystems, the main goal of the "custodial State".

The chapter by Emanuele Boscolo, which focusses (also) on the defence of the hydrosphere, provides a perfect introduction to Part II of the book, whose title reads "Water Management and Environmental Concerns" and is evidently devoted to presenting some major problems affecting the health of water resources.

In order to fully grasp the gravity of the pathology, the natural physiologic conditions must be first described. In other words, the concept of water resources as a complex and fragile ecosystem providing for environmental services has to be expounded. This is done by Riccardo Santolini. Tommaso Pacetti and Elisa Morri in Chap. 6 ("Water-Dependent Ecosystems in Italy"), which introduces the idea of water-related ecosystem services as tasks performed by water bodies in a multitude of ways that include both tangible functions (such as drinking water supply) and intangible ones (like the cultural values associated to water). This concept, in turn, requires that other notions (such as that of natural capital) be explained. These expressions make clear that this field of study stems from the integration of economy (services, capital) with ecology (nature, ecosystem) – a union based on the importance of understanding and quantifying ecosystem services. Such an assessment supports the identification of holistic management strategies that preserve the multifunctionality of ecosystems while enhancing the benefits produced by them. In stressing the positive development of the legal framework both at the Italian and European levels, the authors report on some Italian pilot experiences on the application of so-called payments for ecosystems services, thus drawing some suggestions to support the wider application of these tools in the whole Country.

A first and most obvious factor that negatively impacts on the status of water resources and imperils their use is pollution. Regrettably, Italy's record in protecting its waters from defilement is not astonishing – not in the positive sense, at least. Although the situation over the territory is uneven, certain areas suffer from heavy pollution, to the extent that even provision of safe drinking water is an issue. However, the normative framework has recently changed, demonstrating a new awareness of the severity of the problem. In Chap. 7 ("Water Quality Control Policies and the Criminalisation of Pollution"), Giovanni De Santis and Matteo Fermeglia tell the reader that such legal bonds aimed at curbing polluting practices have a double origin: on the one hand, EU directives (whose obligations, however, Italy tries to dodge by making frequent use of derogations) and, on the other, domestic laws, both of administrative and criminal character. The latter category, in particular, has brought about, through a 2015 law on environmental crimes, what the authors define a paradigm shift in the fight against water pollution. As this piece of legislation is only a few years old, time will tell whether it will suffice to effectively discourage polluting practices.

A second acute problem affecting water resources is scarcity. This can be the outcome of non-environmentally-sound human activities, but also of natural phenomena such as climate change, that multiplies droughts and accelerates desertification. This is the case of the Po river basin, which is thus considered even though Southern Italy is most commonly associated with water scarcity. Indeed, in Chap. 8 ("Managing Water Scarcity and Droughts: The Po Experience"), Antonio Massarutto and Dario Musolino inform the reader that this area is one of the most advanced in the Country, also due to its prosperous agricultural sector. Unfortunately, it is also a region increasingly hit by droughts – which could become even more frequent in the future – and the two authors devote their attention to the socio-economic impact of such events. Thus, they show that droughts engender not only losses but also gains, at least for farmers. From the point of view of institutions, the authors highlight a problem that seems to characterise Italy's approach to water-related disasters, as it is quite similar to the way the Country copes with floods: the adoption of a reactive rather than a proactive strategy. Things are slowly changing but further efforts are needed by planners.

The problems described above can, of course, present themselves in an international context, as water bodies do not necessarily follow State boundaries. Thus, interstate cooperation is needed to prevent harm to water resources and to take common measures for the recovery of deteriorated water bodies. As Mara Tignino and Benedetta Gambatesa explain in Chap. 9 ("The Management of International River Basins: The Case of Transboundary Water Cooperation Between Italy and its Neighbours"), international law has progressively developed several principles regulating the conduct of co-riparian States, be they positioned upstream or downstream. But more specific rules were laid down by the EU, which elected the river basin as the primary geographical (albeit not administrative) unit for the governance of watercourses: if two Member States share a river basin, then they must take steps to implement the Water Framework Directive in a co-ordinated way. Describing the case of Italy, Mara Tignino and Benedetta Gambatesa analyse the examples provided by a couple of lakes shared with Switzerland (which is not an EU Member State) and a river shared with Slovenia (an EU country): although none of them regard major water bodies, the joint efforts of the States involved represent interesting case studies in transboundary water management.

The overview given by authors of Part II of causes for environmental concern also encompasses a "hidden" phenomenon. Indeed, according to a now well-established theory, water-scarce countries or, more simply, water-stressed areas should not use their water resources to produce goods that the country or area can import from elsewhere. This relies on the concept of "virtual water", which Stefania Tamea, Marta Antonelli and Elena Vallino apply to Italian trade patterns in Chap. 10 ("The Italian Virtual Water Trade and Water Footprint of Agricultural Production: Trends and Perspectives"). The reader will discover that Italy is a net importer of blue water embedded in agricultural goods – one of the largest importers in the world, actually – and that this fact might be related to a constant reduction in cultivated land, which is not accompanied by a crisis of the agricultural sector. In fact, Italy has seen a constant increase in the value of its food exports, also thanks to a higher crop productivity that has come with an improved efficiency in water use. The authors analyse these trends by categorising goods in different classes and describing how the relative weights of such goods in Italy's exports has changed over time, and then focus on trade in wine and oil, two products that see the Country at the top of the exporters' ranking. According to data, the authors suggest, agricultural imports do not seem to be driven by Italy's impossibility of producing goods locally due to domestic water deficits.

Part III of the volume deals with "The Provision of Water and Sanitation Services". Whereas the previous section conceives water as a natural element to be protected, especially against humans' deplorable actions, this section sees water as a resource to be exploited by men and, thus, as a means capable of providing services.

At any rate, just to make clear that this human-centred approach has, at its heart, the well-being of the service user rather than that of the service provider, Part III begins with a contribution on the right to water. In Chap. 11 ("The Human Right to Water in Italy's Foreign Policy and Domestic Law"), Paolo Turrini and Marco

Pertile take stock of Italy's efforts in implementing the international duty to ensure the universal right to water. Such an obligation – whose actual existence is called into question by some – is binding upon the Country but, absent concrete measures to promote access to water for everyone, part of the population would see their right infringed. The human rights discourse in water matters has been particularly intense in civil society's initiatives in the last decade, incorporating battle cries like "water belongs to commons" and "water is a good to be managed by public bodies". Thus, it cannot be excluded that these stances have somewhat influenced the relatively fast evolution of the legislative framework in this field. Indeed, in the very last years some laws have been passed that required the regulatory authority to take into account the basic needs of users in setting the pricing scheme of water provision. Problems remain, but the significance of this improvement cannot be underestimated. Moreover, the reiterated reference in Italy to the fundamental right to water can explain some attempts at furthering it abroad.

The subsequent two chapters can also somehow be read in the sign of the right to water. Indeed, the public water movement managed to leave a mark on the Italian water governance system, although other pulling factors also contributed to determining the current, unfortunate situation. As recounted by Giulio Citroni and Andrea Lippi in Chap. 12 ("The Permanent (De-)Institutionalisation of Multi-Level Governance of Water Services in Italy"), the civil society's campaign against the privatisation of water services managed to set a constraint to governmental action, but the Government itself has proven to be split between the opposite poles of institutionalisation and de-institutionalisation. Over the last 25 years, politics has taken a wavering stance on the governance of water services, doing and undoing – or adjusting, or putting on hold – what had been done, sometimes for primarily political or budgetary reasons. Obviously, this process of continuous re-designing of the water system has had an impact on both the market of water services (as companies are not keen on investing in a sector characterised by legislative uncertainty) and the overall coherence and effectiveness of the legal and institutional architecture of water service provision. The governance palace is unguarded, the central Government currently being unable to call local actors to arms towards a sensible goal.

The same scenario is observed, albeit from a legal rather than a political science perspective, by Vera Parisio in Chap. 13 ("The Integrated Water Service in the Italian Legal System Between Solidarity and Competition: An Overview"). In the mid-1990s, the Italian Government inaugurated an important reform that merged the various segments that had composed till then the world of water-related services: water catchment and management of sewers, water supply for all kinds of uses and water purification were brought together to form the integrated water service. The running of such service has been, since then, the object of different laws, that have created new territorial units and new administrative bodies meant to organise the service under new rules: although such laws differ in their normative content, they all share a common approach, which is based on the idea of the provision of the service under market conditions. After all, as established by both legislation and judicial decisions, water services in Italy fall within the category of "services of general economic interest" devised by the EU. According to the idea of free administration, the Union is neutral with respect to a Member State's choice as to the methods of delivery of these services, provided that some principles are complied with. Italy, too, allows for the adoption of one of several managing models, of both public and private nature, although preference for the latter type is evident. Fortunately – here the right to water comes up again – solidarity values are now embedded in the activity of ARERA, the body in charge of regulating the water service sector.

But has the new architecture of governance of water services delivered what it had promised in terms of quality of water provision and efficiency of providers? This is how the driving question of Chap. 14 ("The Evolution of the Italian Water and Wastewater Industry in the Period 1994–2018") could be phrased. There, Donato Berardi, Francesca Casarico and Samir Traini give an answer that partly overlaps with that offered by the authors of Chap. 12. After all, the institutional and legal context described by all these scholars is the same: a fragmented and non-linear framework that has hindered thus far the development of a mature water service industry. Things have started to change, however, with the creation of a central regulatory authority – the already mentioned ARERA – that in the last few years have successfully performed a task of standardisation in the sector. Although the process is still far from being complete, as not all local administrations have promptly responded to the stimulus (which is sustained by a carrot-and-stick philosophy), the Authority has managed to enhance the financial performance of the companies running the water service, to improve the quality of such service in several areas of the Country and, ultimately, to set up a more investment-friendly environment. Further progresses are expected to occur in the near future.

The protection of water resources as an environmental "subject" (Part II) and the conditions of their utilisation by men as an economic object (Part III) presuppose a rational and foresighted water governance. This is where Part IV comes up. Since water bodies are now governed according to the rules dictated by EU law, this section is entitled "The Implementation of the EU Water Framework Directive and the EU Floods Directive", which are the main pieces of legislation in the field.

Unlike regulations, EU directives are binding on Member States but only set out the principles governing a certain ambit, leaving to each Member a certain (variable) leeway in the definition of the means to reach the directives' goals. In Chap. 15 ("Water Governance in Italy: From Fragmentation to Coherence Through Coordination Attempts"), Mariachiara Alberton provides a historical overview of Italy's efforts in implementing the Water Framework Directive and its younger sister, the Floods Directive. When, in 2006, the former directive was incorporated in the Italian legal order, the Country had already begun (by means of a pioneering 1989 law) to reform the organisational structure for the governance of water bodies. Despite this promising start, aligning with the EU obligations has proved harder than expected. If a main culprit may be identified, it is probably the conflict between the central State and Regions on the correct way to interpret the partition of competences operated by the Italian Constitution, which just a few years before, in 2001, had been amended to grant the State exclusive powers in the domain of environmental protection. This clash caused delays in the implementation of the EU directives, and although the reform process is now basically over (after many years and many laws), the heritage of these frictions is a governance system prone to inter-institutional conflict.

As said above, one of this book's strengths is – in the eyes of its editors – the multidisciplinary approach, whereby a given fact is seen through the lenses of diverse academic subjects or standpoints. This is why the path towards the implementation of the two abovementioned directives is described also from the point of view of practitioners involved in the administrative process. In other words, if Mariachiara Alberton's account is a larger picture taken by a lawyer, Chap. 16 ("A Practitioners' View on the Application of the Water Framework Directive and the Floods Directive in Italy"), written by Marta Martinengo, Antonio Ziantoni, Fabio Lazzeri, Giorgio Rosatti and Riccardo Rigon, zooms in and provides a sight "from within" of the actors, processes, outcomes and problems of the implementation stage. The result is unique in its bringing together engineers and public officials with a view to critically analysing the main turns of the whole process, and especially its shortcomings. As to the latter, one of the most challenging is probably the incomplete – and, in any case, difficult – integration of policy-making and science. Indeed, on the one hand, politics must finance science in order for the latter to be updated and, thus, effective; on the other hand, science can only be useful to politics if the latter puts in place an input transmission system capable of turning knowledge into action. This is the next test for Italian lawmakers.

Speaking of the role of science, it must be stressed that one of the most innovative duties stemming from the Water Framework Directive (its Article 9, to be precise) is the one that goes under the name of "full cost recovery principle". It requires that States, in the management of water services by means of public or private companies, cover through tariffs both the expenses for running the service and the value of water, which must include also the environmental and resource costs of using it. Calculating such costs is a knotty scientific problem, as is the balancing of different interests and goals. In Chap. 17 ("Economic Regulation, Water Pricing, and Environmental and Resource Costs: The Difficult Marriage Between Financial Sustainability, Investment Requirements and Economic Efficiency"), Antonio Massarutto addresses this challenge. He provides a thorough overview of both the management system and the financial structure of Italy's water governance scheme, broken down for different sectoral activities, which get water via different channels and follow different financial practices. Most such sectors, in any case, have now accepted the principle of the full recovery of all running costs, and this marks the success of a reform, enacted in the 1990s, that aimed at alleviating the burden of water provision on the public budget. When it comes to environmental and resource costs, however, no coherent idea of taxation has emerged yet. This is a pity, as recovering such costs could ease the mobilisation of much needed investment for the improvement of the water network, by means of a financial structure based on the co-participation of private and public capitals. At the same time, this financial project should use the full cost recovery principle as a leverage to promote sustainable behaviours on part of users, with economic benefits for those who save water and reduce pollution.

Further considerations on the issue are offered in Chap. 18 ("Environmental and Resource Costs Assessment and the Case for Reforming the Italian System of Water Abstraction Charges"), where Vito Frontuto, Silvana Dalmazzone, Paolo Mancin, Alessia Giannetta and Davide Attilio Calà portray their proposal to internalise the environmental and resource costs applied to public water abstraction charges. They do so by describing a pilot experience that is being tested by the water authorities of the Piedmont Region (in the northwest of Italy), that provides a perfect case for studying the practical difficulties in implementing Article 9 of the Water Framework Directive. As the ultimate purpose of assessing the environmental costs entailed by water use is the protection of water resources by making users pay in a way that is proportional to their "share" of the costs, so as to promote efficiency in the use of water and discourage wastages, measuring the abstraction of each user becomes a precondition. Equally fundamental is the devising of a method for calculating environmental costs. Should these be too high, however, their rescaling based on the affordability principle would be required, so as not to impact too much on the income of users – without renouncing to proportionality. Transparency and flexibility are two additional features of great importance to ensure the success and diffusion of this kind of pricing schemes, which might help better define the users' conception of the role of water in preserving the environment.

So far, we have seen the involvement of many experts in the implementation of the two EU directives. Lawyers, engineers, economists, governmental officers: all have a say in the process due to their specific expertise. However, both the Water Framework Directive and the Floods Directive provide for the participation of the public at large. This is exactly the topic of the last chapter of the volume. Indeed, in Chap. 19 ("Public Participation in the Implementation in Italy of the Water-Related Directives"), Elena Fasoli, Massimo Bastiani and Francesco Puma have a look at the EU law framework – which, in turn, has been influenced by a trend at the international level towards an ever-greater involvement of people in environmental affairs – and examine the state of the art as to Italy's compliance with the EU obligations to let the public take part in decision-making processes. As always, the Country's performance is mixed. Although possibilities of participation are generally on the rise, the situation varies greatly across Italian regions, as to the actors involved, the methods of such involvement, and the information provided. Chronical delays in meeting the deadlines set by the EU are yet another factor that curbs the spaces – in this case, the time-windows – of participation. However, positive aspects are present, too. Some river basin districts do not fare bad, as it is the case of the Eastern Alps district on which the authors focus. And the experience of river contracts is pretty lively in Italy, providing another interesting means of cooperation between governmental bodies and civil society.

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The book's farewell consists in a couple of brief sections that aim at zooming out on Italy's water law, policy and economics. These two sections offer different views, respectively, from the outside and from within Italy. The former tries to answer the questions: what can the Country learn from other States? And what can it teach to them, either through its good practices or its avoidable errors? The latter section, instead, briefly sums up some lessons emerged in the book, following a few *fils rouges*. Thus, such a “view from within” is not just a view from within the editors’ Country: it is also, and no less importantly, a view from within the editors’ book. Because editorial projects such as this can be a fertile ground for a fruitful dialogue among scholars of different subjects, and among scholars and practitioners. This observation must be intended as a “thank you” to all our authors and the wish that our readers may find in similar exchanges the same valuable inputs we did find.

A final, brief remark must be devoted to the aspect of translation. As this book focuses on Italy, very often the authors have faced the problem of how to best render a concept whose original name is in Italian. Sometimes, the best solution is the most linear one. Therefore, whenever they deemed it appropriate, the authors as well as the editors gave a literal translation of the concept, accompanied by an explanation integrated in the text. Thus, for instance, the idea of “*servizio idrico integrato*” was simply translated as “integrated water service”, and if the context required the reader to understand the reference, then a sentence was added to clarify that, in Italy, such a service include the catchment, intake and supply of water for all kinds of uses, and sewerage and depuration of waste water. We hope that this suffices to build an additional bridge between the culture of the readers and that of the writers.

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Part I
Water Resources and Their Use and Management in Italy

Chapter 1
Water Resources of Italy

Marcello Benedini and Giuseppe Rossi

Abstract Due to its geographical position, Italy denotes great meteorological variability from one Region to the other, which affects the availability of natural water resources. The main rivers and the largest lakes are located in the northern and central parts of the Country. A discrepancy characterises also the availability of groundwater, which is conditioned by the variable geological pattern of the Italian territory. An evaluation of water resources is based on the available data collected during a long sequence of years by the responsible structures belonging to the central Government and the Regional administrations. More recent data, focusing on the hydrological balances in selected zones of the country, allows the potential and the usable resource to be evaluated. For the present time, the current withdrawal meets principally the urban and domestic demand, but other fundamental sectors, like agriculture, industry and electric energy generation, request large amounts of water, which often gives rise to undesirable conflicts among users. A widespread discharge of polluted wastewater is now responsible of the low quality level of some receiving surface and underground bodies, reducing the amount of usable resources. An intensive activity is in progress to achieve the ecological standards imposed by the European Union on wastewater by means of treatment plants and to guarantee the ecological flows in the watercourses. Unconventional resources, like desalinated sea and brackish water and treated urban and industrial wastewater, contribute to increasing the availability of usable water. Recycling treated wastewater can be a promising solution for reducing freshwater demand. Some assumptions on climate change have been considered, which could affect the availability of water resources in the various Regions of the Country.

Keywords Italian water bodies · Water resources · Water uses · Water resources management · Water pollution control

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1.1 The Country's Outlines

The national territory of Italy stretches across more than 10° of latitude, between the Alps and the small southern islands facing the African shore, with a total area of 301,336 km^2. With its maximum altitude of 4810.90 m above sea level at the Mount Blanc's peak, the Alpine chain is the natural border of the Country, which is almost completely inserted in the Mediterranean basin, with the exception of some small Alpine valleys, at the border with Austria, which belong to the Danube catchment. The geographic structure of Italy consists of a large continental area surrounded by the Alps, and of a long peninsula leaning into the sea, with some islands, the major ones being Sicily (25,707 km^2) and Sardinia (24,090 km^2). The peninsula contains the Apennines chain, with the maximum altitude of 2912 m above sea level at Gran Sasso Mount.

The total length of the coasts, including that of the islands, is 7456 km. The peninsula is surrounded by the Adriatic Sea to the east, the Tyrrhenian Sea to the west and the Ionian Sea to the south (Fig. 1.1).

The Italian territory is the effect of a sequence of million years of Earth's evolution. Massive limestone predominates in the Alpine zone and in the central parts of the Apennines, beside some limited extensions of alluvial areas, surrounding the most important rivers. Mounts cover 35.2% of the territory, while the remaining part includes hills for 23.2% and plains for 41.6%, located principally in the northern valleys. The coastline in the peninsula and islands is mostly made up by cliffs, shaped by the sea erosion. Extended sandy beaches and shallow seawater characterise the coastline around the large plains and surround the mouth of the rivers discharging into the sea.

The central parts of the peninsula and eastern Sicily denote volcanic origins. Some eruptive phenomena are still there at Etna and in Eolian isles, while Vesuvio has been silent for more than 80 years. Hot water springs are present in almost all the Country.

In some Regions, deep geological faults in subsoil give rise to ground instability and, consequently, large parts of the Country are subject to frequent seismic phenomena. Recently, unpredictable earthquakes have caused conspicuous damages and casualties. Moreover, other local instability phenomena, in form of massive landslides, often worsened by improper man-made intervention, characterise the territory and, during unexpected events of intensive precipitation, they invade large dwelling zones and infrastructures, with casualties and serious damages. The landslides alter the natural course of rivers and streams, causing uncontrollable floods.

The water availability and all the problems concerning water resources use and protection, as well as the flood defense, are strictly related to the actual political and administrative aspect of the national territory, which is structured in 20 Regions, as shown in Fig. 1.2 (Rossi and Benedini 2020).

Every Region has its own institutional bodies, working under the supervision and the coordination of the central Government, in line also with the laws enacted and the policies promoted by the European Union.

Fig. 1.1 Principal characteristics of the Italian territory. (Source: Rossi and Benedini 2020)

1.2 Surface Water Resources

In spite of careful estimates carried out during the last decades, a reliable assessment of surface water availability in the various regions is still lacking. Estimates carried out with reference to meteorological and hydrological variables are not representative of current conditions, which are affected by significant changes in

Fig. 1.2 Political and administrative partition of the Republic of Italy, with the centres of Regional administrations. (Source: Rossi and Benedini 2020)

climate and soil utilisation. On the other hand, recent application of water balance to the national territory did not consider the water amounts of the different territorial aggregations in the Country. Anyway, a comparison between estimates that differ in basic data relied on and methods of assessment can provide some useful evaluations (Benedini 2020; Rossi and Benedini 2020).

The water resources have been distinguished in natural, potential and usable.

Considering the average values for the 1921–1960 period, with the total precipitation being 296 km^3/y (990 mm/y), the *natural* surface resources was estimated to be 155 km^3/y (510 mm/y). A further approximate assessment estimates the *potential* surface resources as 110 km^3/y and the *usable* surface resources as 40–45 km^3/y. These figures can be accepted as an order of magnitude, also confirmed by recent investigations.

More recently, following the hydrological balance carried out by ISPRA (2015a, b) using the 1966–2015 data, the amount of surface runoff has been assessed as 65 km^3/y (217 mm/y), with an estimated infiltration of 68.7 km^3/y (227 mm/y).

The EUROSTAT data of 2019, with an actual precipitation of 241.1 km^3/y, prospects a *renewable internal water amount* of 86.3 km^3/y, with a *total actual outflow* (surface and groundwater) of 115.9 km^3/y (EUROSTAT 2019).

The natural consistency of surface water reflects the overall characteristics of climate. The northern and central regions have greater water availability than the South and large islands, and a better distribution in time and space. Such disparity characterises the nature and the hydrological aspects of all surface bodies.

The natural hydrographic network of Italy consists principally of numerous rivers discharging directly into the sea. Their length is normally restricted within a few hundreds of kilometres, while the catchment seldom exceeds 10,000 km^2. These rivers originate from the local highland and are characterised by a flow greatly variable during the year. This configuration is typical of large part of the peninsula, where the rivers originate from the Apennines, and of the large islands of Sicily and Sardinia.

A remarkable exception are a few large rivers, principally Po, Adige, Reno and Brenta in the Northeast, originating from the Alps and discharging into the northern Adriatic Sea. Exceptions are also the rivers Tiber, Arno and Volturno, in the peninsula, originating from the Apennines and discharging into the Tyrrhenian Sea.

The main characteristics of the most important rivers are in Table 1.1.

Several rivers are harnessed for human purposes, primarily for irrigation and electricity generation.

Table 1.1 Principal rivers of Italy

River	Region	Catchment area (km^2)	Length (km)	Average Flow (m^3/s)	Receiver
Po	North West	74,000	652	540	Adriatic Sea
Tiber	Centre	17,370	405	230	Tyrrhenian Sea
Adige	Trentino-Alto Adige, Venetian Plains	12,100	410	235	Adriatic Sea
Arno	Tuscany	8228	241	110	Tyrrhenian Sea
Reno	Emilia-Romagna	5965	212	95	Adriatic Sea
Brenta	Trentino-Alto Adige, Veneto	5840	174	80	Adriatic Sea
Volturno	Molise, Campania	5550	175	82	Tyrrhenian Sea
Liri-Garigliano	Abruzzo, Lazio, Campania	5020	168	120	Tyrrhenian Sea
Simeto	Sicily	4186	113	25	Ionian Sea
Piave	Venetian Plains	4127	220	125	Adriatic Sea
Isonzo	Fiuli-Venezia Giulia *(and Slovenia)*	3460	136	172	Adriatic Sea
Livenza	Veneto, Friuli- Venezia Giulia	2221	112	85	Adriatic Sea

Table 1.2 Principal lakes of Italy

Lake	Region	Area (km^2)	Max. depth (m)	Connected river	
				Tributary	Emissary
Garda	Lombardy, Veneto, Trentino-Alto Adige	370.0	346	Sarca	Mincio
Maggiore	Lombardy, Piedmont *(and Switzerland)*	212.0	370	Ticino	Ticino
Como	Lombardy	145.0	410	Adda	Adda
Trasimeno	Umbria	128.0	6		
Bolsena	Lazio	113.5	151		
Iseo	Lombardy	65.3	251	Oglio	Oglio
Varano	Apulia	60.5	5		
Bracciano	Lazio	57.5	151		
Lesina	Apulia	51.4	<2		
Lugano	Lombardy *(and Switzerland)*	48.7	288		
Orta	Piedmont	18.2	143		
Varese	Lombardy	15.0	26		
Vico	Lazio	13.0	48		
Idro	Lombardy, Trentino-Alto Adige	10.9	122	Chiese	Chiese
Santa Croce	Veneto	7.8	44		
Albano	Lazio	6.0	168		
Pergusa	Sicily	1.8	12		
Nemi	Lazio	1. 7	33		

Large natural lakes are in the North, at the foot of the Alps, connected to the main rivers, and in the Centre. Sicily hosts the small Lake Pergusa. The characteristics of the most important lakes are in Table 1.2.

High dams, often more than 100 m tall, create large reservoirs with storage capacity of millions of cubic metres, particularly in mountain areas. Currently, the Italian territory hosts more than 540 large reservoirs, whose total capacity, all over the country, exceeds 13.8 km^3. Besides, small ponds have been constructed in hilly areas with a storage capacity of few thousands of cubic metres, with dams up to 10 m tall.

Numerous water bodies of transition, someone with salt concentration, are located along the coast. Some characteristics of the most important bodies are in Table 1.3.

Very important is the Venice Lagoon, connected to the Adriatic Sea, whose tidal alternations give rise to frequent and worrisome variations of the inner water level.

Table 1.3 The largest lagoons of Italy

Lagoon	Region	Area (km^2)	Depth (m)
Venice	Veneto	550.0	1.0–21.5
Marano	Friuli-Venezia Giulia	93.3	7.0–13.0
Valli di Comacchio	Emilia-Romagna	110.0	1.5–2.0
Orbetello	Tuscany	26.9	0.5–2.0
Stagnone	Sicily	5.4	0.5–3.0
Capo Peloro	Sicily	0.7	0.5–1.0

Table 1.4 Estimated groundwater resources (MAF 1990; Rossi and Benedini 2020)

Region	km^3	Region	km^3
Piedmont	1.49	Marche	0.29
Aosta Valley	0.05	Lazio	1.03
Lombardy	2.59	Abruzzo	0.21
Trentino-Alto Adige	0.20	Molise	0.04
Veneto	1.31	Campania	0.93
Friuli-Venezia Giulia	0.20	Apulia	0.33
Liguria	0.31	Basilicata	0.18
Emilia-Romagna	0.66	Calabria	0.41
Tuscany	0.44	Sicily	1.15
Umbria	0.10	Sardinia	0.22
		Italy	12.15

1.3 Groundwater Resources

Large amount of water is stored in the subsoil of all the Italian Regions, favoured by the geological characteristics and as an effect of the particular climate. Due to the complexity of the underground storage and the way of natural recharge, an assessment of the groundwater amount cannot be done with acceptable precision, and only estimates can be proposed for the national territory. The significance of the aquifers varies from one Region to the other. An estimate of the total amount of water in the subsoil has been done following numerous local investigations, proposing some values that can now be accepted. The main aquifers are in Table 1.4 (Rossi and Benedini 2020; Civita et al. 2010; MAF 1990).

Large aquifers are in the North, at various depths and in various geological formations, and along the Apennine chain. The aquifers of Apulia, in carbonate rocks highly permeable for fracture and karstic alteration, have large losses into the sea. Sicily hosts several aquifers in volcanic rocks and Sardinia has only a few aquifers, mostly in the coastal areas. The small islands surrounding the peninsula, as well as Sicily and Sardinia, have limited aquifers fed by a scarce precipitation. Large coastal aquifers are contaminated by intruding seawater.

1.4 Unconventional Water Resources

To date, most demand for urban and industrial uses has been met with the available natural freshwater, but in large part of the southern Regions the semiarid climate requested the development of unconventional resources (Rossi and Cirelli 2020), in spite of the high cost of their exploitation.

Marginal and discouraging is still the desalination of sea and brackish water. Large plants have been built only in some petrochemical factories and thermoelectric plants, where the relevant cost can be recovered by selling the production output. Reverse osmosis is the predominant process, with plants able to treat up to 15,000 m^3/d, but large industrial establishments have proper evaporation plants. Chemical and electrochemical processes are in operation in restricted cases relying on local availability of brackish water with low salt concentration. Some plants supply potable water to the small islands with high touristic demands, where the alternative solution of shipment from mainland would have higher costs. The option of desalination facilities has also been devised as an emergency measure in case of severe droughts with shortage of drinking water.

According to a recent survey (ISTAT 2012), the Country relies on 31 large plants, in Sicily, Apulia, Tuscany and in small islands. The annual production of desalinated water has been estimated in 3.80 hm^3/y for potable supply, 8.89 hm^3/y for petrochemical industries and 5.14 hm^3/y for thermoelectric production (*ibidem*).

Reclaimed wastewater is another unconventional resource, coming from industrial and urban discharges. Suitable treatment processes are necessary in order to achieve an acceptable quality. Treated wastewater is mainly used for irrigation and protection of landscape amenities, as well as for industrial processes, but there are also promising cases of use for non-potable urban demand and for the recharge of aquifers not destined to drinking. This already occurs in semi-arid zones of the Country.

Although advanced researches have emphasised the key-role of water reuse to abate pollution and reduce the withdrawal of natural freshwater, the implementation of wastewater reuse systems, planned in almost all Italian Regions, has been limited. After the first experiences of reusing municipal wastewater, since the 1980s, some projects have been developed only in Emilia-Romagna, Lombardy, Sicily, Apulia and Sardinia, especially for irrigation. The San Rocco and Nosedo treatments plants can be mentioned, which, since 2006, supply about 86 hm^3/y to the area of Milan.

An updated and exhaustive survey of the implemented projects for agricultural, industrial or multi-purpose reuse is still lacking. The delay in the development of projects for using treated wastewater can be explained considering the constraints imposed by the relevant legislation in terms of water quality standards, which, in particular, are concerned by the health risk of microbiological contaminants. Determinant is also the high cost of additional treatment processes as compared to the supply costs of available conventional water resources (Rossi and Cirelli 2020).

1.5 Water Quality and Environmental Protection

The Italian water resources face now the threat of pollution, due to a massive discharge of solid and liquid wastes coming from the various activities directly or indirectly connected with the use of water. The main objective of water management is therefore to preserve the quality of water bodies, in order to guarantee the levels requested by human activities and to ensure the preservation of the environment. Consequently, the concepts of “minimum acceptable flow” and “ecological flow” have been developed and introduced in the law in order to protect the aquatic species (Alecci and Rossi 2020). The ecological flow in a river introduces severe constraints to the withdrawal of water. Moreover, the reservoirs built for storing the usable freshwater must release a conspicuous amount in order to maintain the minimum flow in the downstream reach of rivers, reducing therefore the amount of usable water.

Water pollution problems were officially considered during the 1970s with Law no. 319/1976, which recognised the real situation all over the Country and figured out some solutions in political and administrative terms. Today, in spite of several interventions, carried out with appreciable results, several cases of pollution still affect some parts of the Country.[1]

1.5.1 Evaluation Tools

One of the first actions taken to tackle the pollution problems has been the introduction of some methods for analysing the water quality, with a long list of physical, chemical and biological indicators, with a particular attention to the pollutants at little concentration.

More recently, some criteria for a first-hand evaluation of the pollution in surface water have been proposed, capable of identifying some “classes”, according to well-defined concentration limits of the most significant indicators. A classification has been proposed also for groundwater, with three levels of assessment based on the most significant indicators that can affect the use for drinking purpose.

Following the Water Framework Directive (Directive 2000/60/CE of the European Union), the Italian action was centralised based on Decree no. 260/2010 of the Ministry of the Environment. The decree contains the main instructions for defining two kinds of classes, namely the chemical and the ecological ones, according to the specific nature of pollutants. The directions are mandatory for the Regional agencies in charge of environmental protection (ARPAs – *Agenzie regionali per la protezione dell’ambiente*) and put forth specific procedures for rivers, lakes and groundwater. Every Regional administration, under the supervision of the central Institute for Environmental Protection and Research (ISPRA – *Istituto superiore*

[1] On pollution see also, in this volume, Chap. 7 by De Santis and Fermeglia.

per la protezione e la ricerca ambientale), is working out specific rules, according to the level of local water pollution.

The fundamental aspect of the chemical status is identified according to the limits imposed for “good” and” not good” classes. They can be applied to rivers, streams, natural lakes and artificial reservoirs, as well as to groundwater. More complex is the assessment of the ecological status, for which six classes are considered based on the possibility of using the water (Benedini 2020b).

Following the WFD, any deterioration or improvement of the ecological status in surface water should mainly refer to the response of the biota, rather than to the changes in physical and chemical parameters. The identification of certain “biological quality elements” is therefore compulsory. These include the composition and abundance of aquatic flora and benthic macroinvertebrates, as well as the abundance and age of aquatic fauna. A specific monitoring system is used for the benthic macroinvertebrates in rivers, following appropriate guidelines.

1.5.2 The Identification of the Pollution Sources

Large amount of wastewater is released from the dwelling quarters, characterised by high oxygen demand and ammonia concentration. The increasing number of domestic washing machines adds remarkable presence of phosphorous. Frequent also is the trace of medical compounds and pesticides.

The urban sewerages, which normally contain metals and chemicals due to the handicraft and industrial activities, which are very common in many Italian urban agglomerations, receive also considerable amounts of hydrocarbons, often associated with lead due to the diffusion of private vehicles.

Worrisome is now becoming the presence of small particles of plastic materials that ordinarily should be disposed together with solid litters.

In line with the European Union directives, the control of outlets is concentrated on the wastewater treating process, fostering the construction of plants at the end of collecting networks, before the final disposal into the natural receiving body. The majority of plants are designed for the abatement of the organic pollutants identified by oxygen demand, which can be directly assessed in relation to the equivalent population. Other kind of treatment is necessary for numerous pollutants, especially metals and synthetic compounds with complex molecular composition.

1.5.3 The Treatment of Municipal Wastewater

The current situation of treatment plants for urban and domestic wastewater has been in the object of a survey of the National Institute of Statistics (ISTAT 2017). At the end of 2015, Italy relied on more than 17,000 plants, a figure still valid today.

The Imhoff process is still predominant, amounting to about the 47% of the total treating capacity in the Country. This very simple process, which is able to abate pollutants expressed in term of oxygen demand, is especially adopted in the small urban communities that are not in a position to install more efficient and expensive facilities. However, this process can release a considerable amount of residual pollutants to the receiving body.

More efficient are the plants with primary level of treatment (9% of the total number in the Country) and those with both primary and secondary levels (30% in number), while more than 2000 plants have a complete line with a tertiary level.

Regarding the situation all over the Country, Piedmont has the largest number of plants (about 22%), followed by Lombardy (11%); both Regions belong to the River Po catchment. Conversely, the highest number of plants with secondary and tertiary treatment level are in the southern Regions.

Beside the pollution of surface water bodies, several aquifers, in all Regions, are contaminated due the seepage of uncontrolled domestic and urban wastewater. This occurs particularly in small dwelling places scattered in the countryside, where the construction of treating plants is not easy (Passarella and Caputo 2006). Unfortunatly, several Italian urban centres are still late in complying with national and European norms**.**

1.5.4 Pollution from Agriculture

Quite different is the pollution originating from agriculture, due to the use of fertilisers and pesticides strewed on the cultivated land. The residual contaminant, not absorbed by the crop, reaches the water body after seeping along the embankments or through numerous small streams not easy to identify and control. Nitrogen and phosphorus are the main fertiliser components, while the pesticides contain complex molecular compounds, very often persistent in water. In the receiving surface bodies, the presence of fertilisers enhances the eutrophication, a form of pollution that is becoming more and more worrisome. The chemicals reach the underground aquifer, thus causing a pollution which is very difficult to control and abate.

The amount of fertilisers, herbicides and pesticides has become now really conspicuous and their use does not always follow rational criteria, in a frame of advanced agriculture that foster environmental protection (IRSA 1998). Consequently, agricultural pollution is further aggravated because it occurs in form of "non-point source", that is, in a way that cannot be easily identified.

An evaluation of the pollution due to agriculture can be done by taking into consideration the amount of chemicals utilised in the Country. According to a survey of the Nationl Institute of Statistics for the year 2015, the total amount of fertilisers was more than 4,000,000 ton and that of phytosanitaries exceeded 130,000 ton. The current use of fertilisers is greater than 0.30 ton/ha (ISTAT 2017).

Agriculture also includes animal breeding, which, especially in northern and central zones, is carried out in large farms with thousands of animals (FAO 2018a). Their abundant wastes, rich of organic matter, request special plants with advanced treatment processes; very often wastes are directly used as fertilisers in nearby cultivated fields.

Agriculture is therefore considered the most worrisome source of contamination.

1.5.5 Pollution from Industry

As to the discharge from industrial activities, the Italian situation shows the presence of a large number of small factories, often run at family level and located inside dwelling settlements. Their wastewater, normally characterised by high oxygen demand, benefits from the same facilities in use for urban and domestic discharge. Larger and more complex industrial factories have normally their own facilities for collecting, treating and disposing the relevant wastewater. Similar facilities are established for "industrial areas", consisting of several factories concentrated in a common location, sharing the same general services.

Attention is, however, to be paid to the waste of productive lines that requests specific treatment, like metals and advanced chemical compounds. Specific plants are recommended and suitable pre-treatment process is requested before the inlet into the common facilities.

Some surface water bodies, especially in inland zones of the North, receive the hot discharge of thermal plants operating both for industrial production and energy generation. The abatement of the residual heat occurs normally in exchangers with large amounts of freshwater withdrawn from the natural bodies and eventually returned to them with an increased temperature. Even though such increase can be low (normally below 4 °C), the discharged stream can alter the aquatic environment in the receiving body. The adoption of cooling towers, which could prevent this from occurring, is not frequent in Italy yet.

An evaluation of the total amount of industrial wastewater in Italy is not easy, given the mentioned dissemination of the productive factories. Only some estimates can be done and the National Institute of Statistics has been able to estimate, for all the Country and for the year 2015, a total amount of organic biodegradable charge due to 160,000,000 equivalent inhabitants, 38% of which of industrial origin. The urban treating plants receive a total charge due to about 14,000,000 equivalent inhabitants. A comparison with the situation in 2012 shows an appreciable reduction of such amount, which is partially an effect of the increased number of separate plants destined specifically to industrial discharge (Benedini 2020).

1.5.6 The Qualitative Status of Italian Waters

According to the National Institute of Statistics, the facilities for water quality monitoring have noticeably improved during the last decades and most Regions show an acceptable level of monitoring potential. As far as the whole national territory is concerned, an encouraging evaluation of the quality status can be made, in line with the objectives set by the European Union.

Particularly in the rivers, the monitoring structure has highlighted, for the 2009–2013 period, a chemical status consisting of 1805 gauging places labelled as "good" and 283 places labelled as "not good". On average, "good" situation in the Country is attested by 73% of all the existing measuring stations, with values greater than 90% in several Regions in the North and the Centre (ISPRA 2015a, b). Only few Regions show unsatisfactory statuses, particularly those with high concentration of industries and an advanced agricultural activity that requests a large amount of chemicals. Similar considerations can be drawn also for the lakes, the majority of which show a "good" classification, even though someone of them is not yet classified.

Concerning groundwater, the chemical status still denotes the existence of local contaminations, mainly due to the seepage of polluting discharge. At the national level, the "good" class reached 54% of the bodies, while 18% of the Regional relevant sites were still unmeasured. These conditions can be explained by recognising that some Regions rely on efficient treatment plants, able to control the polluted discharge of urban and industrial wastewater, while traditional agricultural practices enhance a rational use of chemicals. Similar analyses have been conducted for the ecological quality of rivers (ISPRA 2015a, b), where more than 37% of gauging stations denote acceptable quality and only 3% bad quality – even though about 26% of them were still unmeasured. A similar situation is true for lakes, where biological indicators reveal the existence of "good" classes in the northern Regions. The status of groundwater denotes more than 60% of "good" sites, while more than 25% of them are still uncontrolled.

1.6 Water Use

Although the new environmental awareness still considers the in-stream flow a very important requirement for using the available water, most surface and groundwater resources continue to be devoted to meeting the demand of the traditional municipal, agricultural and industrial sectors (ISTAT 2016; Benedini 2020). Beside the difficulties of satisfying the increasing demands of households due to the increasing population and to improved living conditions, new problems have arisen from the deterioration of water quality due to polluted wastes that require advanced treatments. Moreover, climate change is expected to increase the frequency and severity of droughts, with consequent high risk of water shortages.

1.6.1 Urban and Domestic Uses

In a large portion of the national territory, the demand for urban needs is satisfactorily met, even though a few situations of scarce availability persist. The current structures for withdrawing, conveying and delivering the water to users can generally satisfy the domestic use. At the same time, urban facilities are frequently called on to meet also the requests of essential services like firefighting, street washing, and gardens and amenities preservation, and frequently those of industrial and commercial activities located in urban areas (Rossi and Di Natale 2020).

The water request at national level has been estimated in 2015 by a census of the National Institute of Statistics. The total annual amount of water withdrawn from natural bodies and entering the Country's network has been assessed as amounting to 8320 hm^3. This is the overall amount that impends on Italy's water resources, in competition with other existing and foreseeable utilisations.

The amount delivered to users has been deemed to be 4875 hm^3/y, also taking into account the losses in the conveying and delivering networks. Several causes determine such losses, principally the leakage from the pipelines, which in several Regions, and especially in the old delivering urban systems, reaches the 40% of the conveyed amount.

The largest demand is by Lombardy, where a large number of users can widely benefit from lakes, rivers and underground waters. The overall values take in due account also numerous non-potable uses that share the infrastructure of potable water, like intakes from natural bodies and storage reservoirs.

Satisfactory is also the situation of the other northern Regions, where, especially in the main cities, efficient works have been in operation for many decades now. The adoption of advanced treatment technology currently allows to use the water of large rivers.

Acceptable is the situation in the Centre, where withdrawals can meet the demand of aggregated and loose users. In Lazio, the demand of Rome is remarkable, with conveying and delivering structures designed for more than 16 m^3/s of water, which supply the town and the surrounding places for the benefit of more than 3,000,000 inhabitants (ACEA 2019).

Scarse local resources characterise the southern Regions, even though some efficient networks can now supply the principal urban agglomerations. Remarkable is the situation of Apulia, where from the beginning of the twentieth century the Apulian Aqueduct, a masterpiece of the Italian water engineering, can partially integrate the limited local resources (Viggiani 2001).

The National Institute of Statistics (ISTAT 2019) has carried out a census of the natural bodies from which water is withdrawn. The major sources are springs and wells, fed by the natural aquifers normally recharged during the annual rainfall. Artificial reservoirs of medium and large size, located in all the Regions and especially in the South, provide for the annual regulation.

Normally, the quality of water supplied for urban and domestic purposes complies naturally with the potable standard imposed by the European Union and is frequently controlled by sanitary authorities. Suitable treatment is necessary for the original sources affected by unacceptable pollutant concentration.

Beside the networks for large urban centres, a great number of users directly withdraw from local water bodies, preferably aquifers. This is frequent for scattered dwellings in the countryside, often without any control by the responsible authority.

The few situations that do not work properly induce the users to rely on bottled water, purchased at a remarkable price in a flourishing market, the total amount of which is estimated around 8,000,000 m^3 every year.[2]

Several measures have been adopted in order to guarantee a good service also in case of shortage of natural resources, now and in the future. Rationing the amount delivered to users is a frequent way out for temporary scarcity, but more efficient and reliable interventions should be devised. An efficient way for reducing water demand is to induce users to avoid unnecessary withdrawals by means of suitable tariffs proportional to the used amount.[3] A promising solution, already successfully tested in some limited cases, is the "dual network", consisting of two independent schemes, one for pure drinkable water and another for "grey water", safe from the sanitary perspective but undrinkable because of unacceptable substances. In an urban context, this solution can save the high-quality water for the benefit of potable needs.

1.6.2 Water for Agriculture

Agriculture is traditionally a primary activity in about 74% of the Italian territory. Its impact on water resources is mainly due to irrigation, which varies from Region to Region and is necessary to increase the crop productivity in a climatic context of great variability. The territory potentially suitable to be irrigated, defined as "irrigable area", has been estimated of the order of 4,000,000 ha (ISTAT 2016). An evaluation of the farms currently served with technical and economic tools has identified an "irrigated area" of about 2,500,000 ha for the whole Country, with an average of more than 11 km^3/y of used water. High values are requested where the irrigation practice is more developed.

In the wider framework of water resources management, the abovementioned quantities, which refer to annual values, are in practice restricted within the irrigation season, normally lasting a few months during the summer. Watering activity is therefore split down to a sequence of short periods, in accordance with the growing of the crop and the availability of usable water.

[2] On the purchase of bottled water see, in this volume, Chap. 4 by Oncini and Forno.

[3] On the water tariff as a means for achieving environmental and social objectives (including a reduction in consumption) see, in this volume, Chap. 17 by Massarutto and Chap. 18 by Frontuto, Dalmazzone, Mancin, Giannetta and Calà.

The majority of irrigation schemes are now oriented to the sprinkler, in many cases by means of devices capable of serving large fields with automatic control. In some Regions, particularly in the South, there is a trend in favour of the drip, which entails an appreciable saving of water. In northern Regions the procedures of flowing and infiltration persist.

In the largest irrigation schemes there is now a trend toward advanced watering procedures, which take in due consideration the phytological needs of the vegetal species. Specific conceptual and simulation models, often connected to automatic devices, help to deliver the water in a rational way to the cultivated fields. The development of irrigation has to face, during the various steps of growing, the issue of the use of fertilisers and pesticides, which can affect the usable amount of water.

Various are the natural sources, from which the water is withdrawn. The majority of farms rely on large aqueducts (56% of the total irrigated area), connected to rivers and lakes, mostly realised and operated by local farmers associations ("consortia"). Direct withdrawals from groundwater (27%) and from surface bodies (17%) are also frequent for scattered plots (Bazzani et al. 2004).

The need for a sufficient amount of water during the irrigation season has motivated the responsible institutions toward the construction of reservoirs capable of storing the water during the rainy period. Today, more than 200 large structures are in operation, often sharing their stored water with urban supply and electricity generation. In the hilly territory, ponds with a capacity of less than 100,000 m^3 are frequently realised, while in many parts of the Country the family plots still avail themselves of cisterns and sumps to store the rainfall water.

All the above considerations presume the use of freshwater, of acceptable quality, as available in natural rivers, streams and lakes, as well as underground.

Like the other uses of water, irrigation has to consider a reduction of the amount of water withdrawn from natural bodies. A promising alternative for reducing the amount of natural freshwater is the use of urban and industrial wastewater, after a low-cost treatment that abates the pollutant concentration down to values acceptable for the protection of both the environment and human health. Several projects are already working in various parts of the Country, with encouraging results. It should be recalled that the use of urban wastewater was already experienced centuries ago in Lombardy with the so-called "*marcite*", meadows cultivated with grass. This practise, abandoned decades ago, could be now another low-cost solution (Rossi and Benedini 2020).

Meteorological frost occurrences in winter or early spring can cause serious damage to the extensive cultivations in the hilly lands. Fruit trees face every year the risk of losing their product, very often with sizeble effects. Farmers have now developed the practice of sprinkling water on the trees during the frost period, with encouraging results. Special watering systems are activated when a low air temperature is expected, for a treatment that can last several hours, mostly during the night. Normally, up to 40 mm are sprinkled for 5–8 h, with a seasonal amount of more than 300 m^3/ha of water. Such treatment is practised especially in Lombardy, Piedmont, Emilia-Romagna and Trentino-Alto Adige and is destined to increase, given the high commercial value of the fruit market.

In recent years, the occurrence of droughts and the concurrent increase in fresh water demand for urban and domestic sectors have hindered the supply of water for irrigation.[4] In these circumstances, the use of reclaimed wastewater can be an acceptable solution (Lopez et al. 2006; Portoghese et al. 2013). A survey on the national treatment plants has estimated the total annual amount of treated effluent at 2,400,000 m^3, potentially usable for irrigation (Libutti et al. 2018). Nowadays, treated wastewater used for agricultural irrigation concerns more than 4000 ha.

Wastewater treatment is carried out by means of simplified processes, mostly membrane filtration. Municipal wastewater has been traditionally used for a long time in the South. In northern and central Regions, where available water resources meet the demand for different purposes, the use of wastewater could play an important role also in controlling the pollution of water bodies.

The recent development of intensive animal farming, conducted according to industrial criteria, requires conspicuous amounts of water and gives rise to worrisome problems of wastewater disposal. Intensive farming has become prominent in geographically limited areas, located in the flat lands in the North and in some Apennine valleys. The total annual amount of water for livestock is about 317 hm^3/y (FAO 2018a; ISTAT 2016).

Aquaculture has become now an important sector of national agriculture and in 2014 the annual production of freshwater fish amounted to 40,700 ton. This activity is normally carried on beside the natural bodies, where the necessary water is available at an acceptable cost. A large amount of water is necessary to keep the best vital conditions for fishes, as well as to meet the sanitary needs of all the farm premises, which undergo frequent health controls. Water runs almost continuously through the ponds and eventually returns to the natural bodies. Only a small quantity is consumed through evaporation, losses and secondary services in the farm (FAO 2018b).

1.6.3 Water for Industry

Industrial activities normally request freshwater, withdrawn from rivers, lakes and the underground, for processes, washing and cooling. The national industrial sector is structured in a few large production plants accompanied by a very great number of small enterprises, often conducted at family level, located across the whole Country, mainly in northern and central Regions. This fragmentation is accentuated by the great variability of the productive plants in terms of size, labour force and technology level. Consequently, a reliable evaluation of the amount of water used in this sector is difficult at national level.

An attempt that can be still valid today is the survey carried out by the Water Research Institute, in cooperation with the National Institute of Statistics, in the early 1970s (Giuliano and Spaziani 1985; Benedini 2020a). Data available at that

[4] On the costs of droughts for the agricultural sectors see, in this volume, Chap. 8 by Massarutto and Musolino.

time allowed to identify a criterion of analysis based on the amount of water required for the unit output of the industrial plant, in terms of cubic metres of water per one ton of produced goods. The survey concerned only the amount of water withdrawn in some significant samples of the various industrial settlements that responded to specific questions. Many industrial factories withdraw water directly from surface and underground bodies, very often without any control on the part of the responsible authority, and the amount of water they use is unknown.

Taking into due account the significance of the usable data, an annual amount of 7.8 km^3 at Country level was estimated for the year 1971. Various attempts were carried out later, but gave only values limited to particular cases and locations. Now the amount of water at national level should be less. Such a decrease is justified principally by a scaling down of some productive plants, due to an increased import of manufactured wares from other counties at a very low cost, but also as an effect of the widespread trend towards the adoption of tools and technologies suitable for working efficiently with a lesser amount of water. Recycling and reusing the water discharged from upstream utilisations are also developed strategies. Consequently, a total annual amount of 5.5 km^3 can be considered sufficient for today and the near future.

1.6.4 Water for Electricity

The national electric energy production is still insufficient to meet the demand of all the economic sectors and a considerable amount of kilowatt-hour is imported every year from nearby countries. During the last century, water, alias the “white coal”, was the main source for the production of electricity and numerous power plants were constructed from 1900 to 1960. Subsequently, the share of hydropower began to decrease in favour of other productive ways. In 1980, it fell below the 25% of total annual production. The technical and economic limits of the “hydroelectric potential” have been reached (Lehner et al. 2005). At the same time, an increased efficiency of thermal electricity has favoured the development of numerous thermal plants, which, after the nuclear energy was definitively banned (following a national referendum in 2011), could benefit from natural fuel imported at an acceptable cost.

Today, the overall needs of environmental protection foster the enhancement of renewable sources, among which hydropower still remains very important. The main objective of the national hydroelectricity policy is therefore to improve the efficiency of the existing plants.

The current size of Italian hydropower includes more than 3000 plants with a total installed power of 23.9 GW. The latter value includes both the plants of more than 10 MW and the mini- and micro-plants producing just a few kW, officially recognised by governmental institutions. The majority of greater hydroelectric plants (343), located in mountain zones, are structured with storage reservoir, while 2393 run-of-flow plants are located along large rivers or artificial channels. Today, 22 reservoirs, in various parts of the Country, are equipped for pumped-storage production.

During the last decades, the mini- and micro-plants have been favoured, and this has increased withdrawals from natural bodies. The effects of water abstraction from rivers and streams are those of altering the original aquatic life, giving rise to serious environmental problems. The need to restore and preserve the “ecological flow” in rivers and streams is a restriction for hydropower production. In the plants with large reservoirs another constraint is the need to leave sufficient empty volume for storing the foreseeable floods.

Today, the main impact on water resources due to electricity production is represented by the thermal power plants that release the water they use for cooling. For this purpose, a large amount of water is withdrawn from the natural bodies, to which it is returned with an increased temperature. The water demand is around 0.30 m^3/MWh for a plant using mineral oil or gas, and 1.05 m^3/MWh for a plant using coal. High quality is requested for the primary water to be transformed into steam, which sometimes makes a preliminary treatment necessary.

The plants are located in almost all of the Italian Regions, mostly in the North, where high is the energy demand. The current figures of the Country’s thermal power are 1097 plants for a total of 74 GW installed. The main plants are in Piedmont and Lombardy, where the freshwater for cooling is withdrawn from large rivers and lakes, sometimes also from the underground. In other northern Regions, such as Liguria, Veneto and Friuli-Venezia Giulia, some large plants are located on the coast, where they can benefit from using seawater. In the aggregations of the Centre, the South and the Islands the coastal location and the use of seawater predominate. Following a survey of the National Institute of Statistics (ISTAT 2016; ISTAT 2019; Benedini 2020a), the total demand of freshwater for thermal plants in the year 2012 was estimated to be more than 75 hm^3 for the primary use and 2200 hm^3 for cooling.

To reduce withdrawals, some plants have adopted cooling towers, which request a small amount of water – about 1.0 m^3/s – to replace the amount lost through evaporation.

Severe constraints, which are expected to increase in the future, are imposed to national production of thermal power, so that the current situation should be considered the maximum reachable limit, with a possible reduction in the number of existing plants.

1.6.5 Secondary Uses of Water

Inland navigation was prosperous during the past centuries, to connect large rivers, lakes and lagoons for low-cost transportation of passengers and bulky materials. Now, the development of more efficient transportation means, especially by road, has greatly reduced this activity, which survives only in some zones, also for the benefit of touristic resorts.

The affordability of low-cost transportation in places of great economic interest has allowed the rediscovery of the opportunity of inland navigation, to freight large quantity of raw materials and liquid fuel necessary for civil constructions and for running industrial plants. An efficient inland navigation for massive goods may be restored only in northern Italy, particularly in the lakes and rivers of Piedmont, Lombardy and Veneto. In the Venice Lagoon, navigation remains the only means of transportation. In the lower reaches of large rivers in central Italy, like Tiber and Arno, freight transport has disappeared and only local transport for touristic purposes survives, in conjunction with sport and recreation facilities.

Proper installations, especially locks, ports and mooring facilities, make the accomplishment of navigation easier. Artificial channels connect the natural streams, in a wide intersection of ducts open to high-tonnage vessels. An evaluation of the present situation estimates an annual capacity of 29 million tons of freight for the whole Italian network, with a large increase forseen for the future. The development of inland navigation in northern Italy is conceived in view of an extended interaction with all the transportation systems existing or designed in neighbouring countries (Mantua 2011), as part of a great political action in the European Union.

Conflicts between navigation and the other uses of water are expected, particularly during the abnormal hydrological events that now occur with an increased frequency. In case of droughts, when the water level can be very low and at the same time the withdrawal for primary uses is high, the manoeuvre of ships is hampered, with a serious impact for some important economic activities. A considerable amount of water has to be left in the river in order to avoid siltation, which is dangerous for the mobility of vessels. Moreover, the water velocity in the river must be as low as possible, in order to allow safe operations. In an overall framework of water management, this means that a suitable amount of water must be left in the water body, subtracted from important in-stream and abstraction uses. The use of vessels of more than 1000 ton requests at least 6 m in water depth.

1.6.6 Preservation of Monuments, Amenities and Touristic Resorts

Beside the water uses described in the preceding sub-sections, serious management problems can emerged on other grounds. A typical and quite frequent issue is the presence of cultural heritage, in the form of monuments and buildings, which represents Italy's grand legacy of the past centuries. All over the Country's territory, art accompanies engineering aspects in which it is not difficult to perceive a connection with water. This occurs especially where water is the principal component of a masterpiece, or when the work is explicitly dedicated to a water body.

The most significant examples are the monumental fountains of great aesthetic value which are present in almost all the Italian towns. Very often, in a perspective that takes into account the current water needs, these monuments' presence can cause a conflict with other water uses normally deemed to be a priority, especially during the occurrence of a drought.

An example is the Trevi Fountain in the city of Rome, erected in the seventeenth century (Pinto 1986), which requests every day more than 80 m^3 of water. It is connected to an aqueduct of the Imperial Period that is more than twenty-one centuries old, which has now to meet an increased demand for essential urban uses. The conflict has been settled by continuously recycling the same amount of water. Many similar situations all over the Country are now adopting this solution.

As for its historical monuments, Italy attracts visitors also for natural amenities, to an extent that makes tourism a remarkable source of economy. Among this kind of attractions, winter sports have become important in many parts of the Country. The meteorological conditions in some Alpine and Apennine locations have fostered the development of skiing resorts, which request a persistent layer of snow on the ground. Unfortunately, the recent climatic changes have reduced the snow precipitation, threatening the sporting activities. To overcome such undesirable situation (Damm et al. 2014), which can engender serious negative impacts on the local economy, an efficient practice is now resorted to, consisting of strewing "artificial snow" on the ground. Special equipment – the "snowmaking gun" – is used, which requests a large amount of water. It consists of a mobile device along the ski slope, able to transform into snow 3000–4000 m^3 of water per hectare of covered ground. One cubic metre of artificial snow requests about 0.5 m^3 of water, for a machine working at more than 0.5 m^3/min. A significant amount of this water is lost through evaporation, while not all the artificial snow on the ground, after melting, returns in form of water to the original body.

This practice is now carried out by more than 70% of the total skiing resorts in Italy. For the whole Country, large amounts of water are requested every season, with a situation not always acceptable for the communities living in the mountain zones.

The need to preserve some natural touristic attraction and enhance the economy of particular places can cause undesirable conflicts. As an example, the Marmore Waterfalls in central Italy, with a flow of 15 m^3/s falling for 165 m, attract numerous visitors, but recently the water is being diverted to a near hydroelectric plant of 654 MW. The conflict has been settled by scheduling two alternative periods, one of "normal" working days, when all water is for electricity, and another one of days when the touristic demand is prioritary, so that water is entirely left to the falls.

The amount of water requested for tourism is normally included in the figure of the domestic use in the Municipality where the resort is located. Touristic water demand is normally restricted to those few months, mostly in summer, when the number of users to be served can increase several times than that of resident population. Since the majority of touristic resorts are located in areas where natural resources are limited, difficult problems can arise, which have not been completely solved yet. In small islands, the conveyance by means of tanker is still the preferable solution, even if sea water desalination begins to be adopted.

An estimate for the whole Country calculates for tourism an annual demand of 118,000,000 m^3, which should be valid also for the future (Goessling et al. 2012).

1.7 Some Typical and Significant Cases

1.7.1 The Po River Basin

The catchment of the River Po, in Northern Italy, is important for the national economy and its water problems are illustrative of those of many other places in the Country. The catchment, which includes the major lakes of the Alpine chain, covers an area of 71,057 km^2, belonging to eight Regions. It lies over about a quarter of the continental part of the Country, with a resident population of 15,800,000. Its importance is principally due to the high concentration of productive activities. More than 3,000,000 people are employed in the industry sector and about 2,800,000 in tertiary activities. Agricultural production is also important, benefitting from advanced irrigation facilities, while animal farming numbers several millions of head of cattle and pigs. Inland navigation is also active, particularly in the main river and its larger tributaries.

The impact on water resources can be expressed with a total estimated withdrawal of more than 20 km^3/y, of which 14 km^3/y from surface bodies and 6 km^3/y from aquifer bodies. Taking in due account the possibility of recycling and reusing, the industrial sector requests about 1.6 km^3/y of water while the domestic use amounts to 2.5 km^3/y. The demand of agriculture is about 16.5 km^3/y (a value larger than the national average), principally for irrigation.

Several hydroelectric and thermoelectric production plants are present in the basin, with many reservoirs, some of which store water also for agriculture and urban purposes.

These utilisations are the result of a long tradition and now specific management problems have arisen, requesting the application of the best technological tools. Several places in the catchment frequently face the risk of heavy inundation due to occasional high flow in the water bodies.

Remarkable has become the problem of water quality control, due to an estimated load of 114,000,000 equivalent inhabitants, 15% of which is caused by urban discharge, 52% by industry and 33% by agriculture. The quality of some water bodies is worsened due to a significant increase in the toxic level mostly referable to the agricultural use of pesticides. Mutagenicity cases have been found in fish exposed to the contaminants in the rivers, confirming a genotoxic risk. An intense research activity is in progress, under the direction of the responsible authorities, supported by national and international research institutions and by local universities (IRSA 1998).

1.7.2 The Tiber River Basin

Quite important for the economy of the Country are the problems of the River Tiber, whose catchment covers a large, central part of the peninsula (Cesari and Pelillo 2010). The various water uses affect the entire basin, but determinant is the urban agglomeration of Rome, with its high concentration of inhabitants. Occurrences of dangerous high flow have been recorded in past centuries, and now some zones of the catchment, and in particular of the urban settlement, are still facing the potential risk of inundation. An intensive sediment transport, due to the erosion of upstream land, affects the behaviour of the coastal zones and the conspicuous discharge of polluted wastewater reaches the receiving Tyrrhenian Sea in the form of a large dispersion “plume”.

Four great treatment plants of conventional biologic type are now in operation for the Rome’s sewerage, the beneficial effect of which is especially appreciated thanks to the reduced amount of oxygen demand in the low reaches of the river and in the coastal water. Nevertheless, an increasing use of fertilisers, along with municipal and industrial discharges all over the catchment, give rise to worrisome environmental degradation, appreciable also by the value of the principal biotic indexes. Similarly, the concentration of heavy metals and organic compounds has been growing also in some small tributaries, as an effect of industrial and agricultural activities. A severe monitoring activity is in progress and an efficient control of discharges already confirms an acceptable quality status of the lakes and the main aquifers. An exception occurs for some areas of volcanic origin, where a natural concentration of arsenic in groundwater has given rise to problems for drinking uses (Parrone et al. 2013; Preziosi et al. 2010).

1.7.3 The Venice Lagoon

Venice is worldwide known not only for its singular condition, but also because it is a pillar of the historical culture and art of Italy. Great is therefore a the attention for its preservation, by controlling all the natural and artificial aspects that could alter its current and future conditions. The fate of the town is tied to the behaviour of the Venetian Lagoon, separated from the sea by a narrow strip of land, in which some openings (“mouths”) assure the connection with the Northern Adriatic. Beside the discharges of the dwelling areas and those of the agricultural and industrial activities located on the shore, a conspicuous amount of saline water enters the lagoon through the mouths with the high tide. The alternation of tide levels causes remarkable currents inside the lagoon so that the water quality is greatly affected. The numerous factories located at the border discharge predominantly chemical pollutants, while some thermal generation plants release the hot water used for cooling purposes. Moreover, several residential quarters still discharge, directly, untreated or poorly treated wastewater (Ravera 2000). Consequently, a heavy polluting load threatens the town and all the surrounding areas, while the only way of attenuation is the stream that leaves through the mouths during the low tide in the receiving sea. The overall situation is therefore particularly complex and an acceptable solution suitable for a future recovery of the environmental conditions requests a serious commitment by responsible authorities with proper scientific support (Franco et al. 2009).

So far, an efficient intervention was achieved only following the realisation of a sewerage system that collects and treats the discharges of the inland catchment and some separate islands. A large part of the treated water is conveyed to the open sea through a long submerged pipeline.

The water management problems of Venice have been further aggravated by frequent events of inside high water level, which hit the residential areas as well as the historical and monumental places. To prevent this from happening, an outstanding work (known as "MOSE") has been devised and set up, consisting of a set of mobile gates able to shut the mouths and temporarily sever the basin from the open sea during exceptional high tide.

1.7.4 Apulia

A low availability of surface water characterises Apulia, in the South of Italy. It is the combined effect of the scarse natural precipitation and the karstic nature of the soil, which increases the immediate seepage of the rainwater fallen on the ground (Polemio and Casarano 2008). Important is therefore the volume of groundwater, contained in the karstic fractured aquifers, which in the coastal areas face the seawater intrusion. The water demand comes from more than 4,000,000 inhabitants, with developing agriculture and industry, and is partly met by means of numerous wells, but principally by the Apulian Aqueduct, capable of conveying more than 6.0 m^3/s from nearby Regions.

An intensive exploitation of groundwater has caused a remarkable lowering of the natural water table and, consequently, the seawater intrusion has increased. At the same time, the seepage of polluted water coming from domestic and industrial wastes, as well as an intensive use of fertilisers, have caused a qualitative degradation of the aquifers, that are greatly vulnerable. The availability of usable groundwater has therefore decreased, giving rise to outstanding water management problems. Among the numerous aspects concerning groundwater quality, the migration of pathogens has motivated some advanced investigations, taking in due account the behaviour of the pollutants in the aquifers. The typical nature of the subsoil, structured in form of fissured carbonate rocks with high anisotropy and heterogeneity, conditions the behaviour of flows and pollutant transport (Masciopinto et al. 2008).

1.7.5 Sicily

Water problems are traditionally of primary importance in Sicily. A population of more than 5,000,000 inhabitants, several new industrial settlements and, especially, agricultural development put together a water demand that often cannot be matched by natural water resorces. The responsible institutions, with proper scientific support, are therefore committed to taking measures capable of overcoming critical situations that can still hit certain zones of the island. Numerous reservoirs have been built during the last decades to store rainwater, with appreciable benefits for drinking purposes, particularly in the largest urban agglomerations, while an intense effort is ongoing to control and repair the existing supply network. Desalination plants are also being devised, in order to help some stressed places, especially where industrial plants share their facilities with dwelling quarters. Special attention is now paid to the irrigation demand, for which the use of urban treated wastewater is a promising resource. Today, the total amount of useable wastewater is greater than the current water deficit of conventional resources. Several irrigations areas are therefore eligible to receive treated wastewater. The situation described for Sicily can be found in other parts of the national territory.

1.8 Conclusions and Recommendations

The few cases described above can give an overall picture of the specific water problems existing in the Country. A new way of conceiving the water resources is therefore arising, not only among the responsible authorities, but also in the public opinion, for which water has become the main component of the daily life, as well as a concern for the future.

The utilisation of water resources has been a pillar of the economic and social development of Italy since its unification in 1861 until the mid-twentieth century. The municipal water supply networks, the large systems of irrigation and the exploitation of rivers for hydropower or multi-purpose uses have been the prevailing objectives of a stage identifiable as "hydraulic mission" (Allan 2003). New problems have arisen for the abatement of water pollution, with the Italian policy being mainly focused on sewerage systems and wastewater treatment plants. Originally, such problems had affected the Regional planning tools, but now the situation benefits from the intervention of the European Union. Remarkable has been the financial support to address cases requesting particular attention, among which some places in the southern Regions.

The occurrence of frequent dramatic inundations, like that of Florence in 1966, pushed the scientific institutions to analyse the hydraulic and geological risk all over the national territory. Following these analyses, a new law for the defense from flood and landslide was issued (Law no. 183/1989), which was aimed at fostering the implementation of plans at river basin level and improving the emergency actions of the Civil Protection. The directives of the European Union, such as the WFD and the Floods Directive,[5] are now the main guidelines for improving the quality of rivers, lakes, aquifers and coastal waters. More recently, several attempts

[5] On the implementation of these directives in Italy see, in this volume, the chapters comprised in Part IV.

have been made to adopt a comprehensive stance, including an integrated sustainable and equitable approach to water resource management and an improvement of resilience *vis-à-vis* water-related calamities.

The future management of Italian water resources requires a list of institutional and socio-economic innovations, able to improve the governance and the management of the water sector against the more general changes required by the implementation of the Goals and Targets of the 2030 Agenda for Sustainable Development of the United Nations (United Nations 2015). The list should include the following priorities:

- an updated legislation to simplify water planning and to improve the coordination among the different institutions in charge of water management at the national, Regional and local level;
- more effective monitoring systems able to collect reliable meteorological and hydrological data and to monitor the available water resources, the abstraction from surface water and groundwater bodies, the requirements of aquatic ecosystems, the performance of water services and the tariffs for various water uses;
- advanced technologies for reducing losses in the withdrawal, conveyance and distribution systems, as well as for improving the treatment of wastewater and sludge, in order to reduce water pollution and increase the reuse of treated wastewaters, to be considered an important supplementary resource together with the desalination of seawater and brackish water;
- planned efforts for a continuous maintenance of the water infrastructures and for an improved operation of plants through a larger use of information and communication technologies over the entire water cycle;
- a more effective approach to the reduction of flood risk through actions aimed at prevention, also by imposing, in land planning, hydraulic invariance and compulsory constraints in matters of hydraulic and geological risks;
- improved procedures for coping with the risk of droughts and water shortages, based on a better management of storage facilities and groundwater reserves, required to adapt the supply systems to the impacts of climate change;
- an improved coordination between the institutions responsible of water resource management and the Civil Protection Service;
- the adoption of technical, ecological, economic and social indicators able to promote an efficient management of water systems and a better governance of the water resource, with greater public participation in decision-making processes, particularly when a compromise between human and environmental needs is to be found.

The increasing complexity of water problems within a changing context requires broader perspectives to implement an integrated water management that includes not only water supply, water quality and water-related risks, but also the links with food security[6] and energy. This implies, in particular, to take up the challenge of the

[6] On the water-food nexus see, in this volume, Chap. 10 by Tamea, Antonelli and Vallino.

abovementioned United Nations Agenda with a view to achieving a sustainable and equitable development by 2030. The preliminary conditions for this large spectrum of required measures are the pursuit of a multidisciplinary approach to water issues and the recognition of an ethical responsibility by the people involved in all stages of governance and management of water resources (Rossi 2015).

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Chapter 2
Coping with Floods in Italy: Learning from the Past to Plan Future Adaptation

Renzo Rosso

Abstract After more than 150 years from the birth of the Country, Italians should have learnt that coping with floods is a never-ending challenge. The strategies to deal with it require the fundamental awareness that the key factors are not just money, loans and financial flows, but consciousness, knowledge, expertise, sharing, equity. The multiple routes include adapting to climate change, smart forecasting, assessing river basin management, improving the design standards of engineering works, taking care of hillslope and river maintenance, revising dam operation strategies, reducing exposure as well as vulnerability to flood risk, discontinuing land consumption, improving urban resilience.

Keywords Flood hazard · Exposure · Vulnerability · Expertise · Awareness

2.1 Introduction

When investigating flood mitigation policies in Italy – starting from the definitive founding of the nation in 1970 (when Italy captured Rome, which became the capital of the Country) to the third millennium – I realised that many Anglo-Saxon scholars, mainly historians and sociologists but also earth sciences and engineering scholars, looked at Italy as a paradigm of disaster culture (Rosso 2017). For example, Dickie et al. (2002) have stated that Italy, for both historical and geographical reasons, is the most disaster-prone European country. The associated apocalyptic narrative has often justified the exaltation of the extraordinary nature of flood events by politicians, media and academics, as an intrinsic diversity of the Country.

There is no doubt that Italian history is associated with natural events that were classified as extraordinary, starting from the December 1870 flood in Rome, the most severe inundation of the second millennium. Two years later, spring and autumn floods devastated large areas of the lower Po valley: because of the

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extension of flooded areas (700 km^2 in May and further 580 km^2 in October 1872), the recovery required many years and huge investments, in order to refurbish agricultural activities, rebuild improved levees, and restore damaged buildings and infrastructures. The earthquakes of Casamicciola and Western Liguria of the 1880s and the catastrophic landslide of Sasso (later renamed Sasso Marconi) can be seen in this perspective, as well as many other events, such as the cholera epidemic in Naples (1884) or the titanic struggle against malaria undertaken by the Fascist regime in the 1920s and 1930s. To cope with these disasters, always *ex post facto*, emergency policies were launched as the major post-emergency move. Accordingly, it is not surprising that the Department of Civil Protection of Italy pioneered the European civil protection system at the end of the twentieth century. This Department was established after the flood and landslide disasters in Valtellina and Val Martello, which followed other environmental disasters that had occurred in the 1970s and 1980s, including the catastrophic Seveso explosion in 1976.

Despite the unique catalogue of disasters that hit the Country, Italian Governments always fuelled the never-ending inclination to catastrophism, as ranking these episodes as extraordinary has been the general approach. A comic oxymoron – "truly extraordinary" – is often used both in Parliament and in court, and shared by the media, in order to escape personal liability. Awareness is a vain wish. The apocalyptic tone adopted by politicians is not surprising, because it is comfortable to classify as an emergency what decision-makers were not able to tackle by planning and management actions, by daily hard work, and by resorting to appropriate expertise and sound skills.

In the context of natural disasters, the scientific community agrees that risk is the product of the probability of a hazard and its adverse consequences. There is no risk if there are no people or values that an extreme event can strike. Similarly, an event is only termed a catastrophe if it hits people and/or it damages their possessions. The intensity and frequency of a natural phenomenon (hazard) is only one of three major factors that determine the overall risk. The amount of values present in the area concerned (exposure) as well as their loss susceptibility (vulnerability) are crucial for the assessment of the resulting risk. Hence, one can express the risk equation as a function of these three quantities, i.e., using the convolution operator or approximating risk by a multiplicative formula. If risk is insured, a fourth factor, insurance penetration, also plays a role. However, from 1861, when Italy became a unitary State, the focus of public and private policies meant to cope with floods has been on the reduction of hazard by means of engineering works. Although some improvements have been achieved, Italy is still the most flood-prone country in Europe. The concept of acceptable risk is totally missed by media, politicians, and common people, let alone the fact that many academics back this attitude.

2.2 The Unpredictability Karma

Unpredictability is often taken as the ultimate rhetorical weapon to escape liability. If one has observed in the past M years, say 100 years, an extraordinary event and there are no physical reasons that this event cannot be exceeded, the probability of it being exceeded in the next N years, say 10 years, is N/(M + N), according to a very simple formula (see, e.g., Kottegoda and Rosso 2008). The result is 9% if N = 10 with a long memory of M = 100. An event is therefore predictable, in terms of probability, when it is possible to measure the probability with which it can occur. Most of the flood disasters that hit Italy in the twenty-first century were thus quite predictable events based on memory of past floods. An exhaustive list of flood disasters occurred in the last 20 years would require a remarkable part of this book.

Conversely, it is hard to forecast where and when a storm will produce devastating ground impacts. In principle, it can be done, but the time ahead would be so short that no effective real-time action could be taken in practice. The capability of tracking severe European storms 2–4 days ahead at a synoptic-scale was improved by using ensemble forecasts (see, e.g., Pantillon et al. 2017). However, forecasting the trajectory of "medicanes" or severe storms at the mesoscale – such as those that hit Liguria and Tuscany in the 2010s, as well as Campania in 1910 and 1954 – is an unsolved issue. Zhang et al. (2019) suggest that the predictability limit for mid-latitude weather may indeed exist and is intrinsic to the underlying dynamical system and instabilities even if the forecast model and the initial conditions are nearly perfect. Currently, a skilful forecast lead-time of mid-latitude instantaneous weather is around 10 days, which serves as the practical predictability limit. Reducing the current-day initial-condition uncertainty by an order of magnitude extends the deterministic forecast lead times of day-to-day weather by up to 5 days, with much less scope for improving the prediction of small-scale phenomena like thunderstorms. Achieving this additional predictability limit can have enormous socio-economic benefits but requires coordinated efforts by the entire scientific community. In addition, adaptation strategies must rely on better forecasts to reduce the ground impact of extreme weather. The sooner this progress will be achieved, the better adaptation policies will work.

Climate change in the Mediterranean region is expected to increase the number of potentially destructive storms, but one must not underestimate the effects of land use changes. The stationarity of the system is a fundamental issue to be explored. This can be associated with changing stochastic properties of major storms as anticipated, e.g., by De Michele et al. (1998), or it can be driven by a modified snow precipitation regime and snowmelt processes (see, e.g., Groppelli et al. 2011). Global warming is a significant forcing factor of flood hazard, capable of augmenting flood risk in the next future.

Cities are particularly vulnerable to climate risks due to their agglomeration of people, buildings and infrastructures. Guerreiro et al. (2018) assessed future changes in flood impact for all 571 European cities in the Urban Audit database using a consistent approach. For the low impact scenario, drought conditions intensify in southern European cities while river flooding worsens in northern European cities. However, the high impact scenario predicts that most European cities will see increases in both drought and flood risks. Over 100 cities are particularly vulnerable to two or more climate impact factors. For example, Naples is exposed to either global-mean sea level rise or urban flooding caused by an increased severity of Mediterranean storms, and the combination of the two may produce unpleasant feedbacks. A few-decimetre rise in the sea level may reduce the rivers' capacity to properly deliver major flood flows to the sea in large Tyrrhenian cities as well as in towns and villages, especially where the mainstream has been constrained into rigid banks or walls. Moreover, the magnitude of future impacts may exceed that of the events reported so far. This emphasises the substantial challenge cities face in managing future climate risks, as further shown by Alfieri et al. (2018): "A considerable increase in flood risk is predicted in Europe even under the most optimistic scenario of 1.5 °C warming as compared to pre-industrial levels, urging national governments to prepare effective adaptation plans to compensate for the foreseen increasing risks".

Short- and long-term land-use and urbanisation effects must be evaluated in a historical perspective (see, e.g., Rosso and Rulli 2002). In addition, human vulnerability from natural disasters is mostly linked to a country's development level and environmental quality. Some social groups display higher vulnerability than others. Low education levels in Italy, ranked at the bottom in any OECD countries' assessment during the last decade (OECD 2019), are not a promising feature in this respect. Reconciling climate change, land use and social issues is a hard challenge.

In principle, the impact of climate change is scarcely related to the size of the drainage basin. One cannot predict whether large basins will pay the highest toll or small basins will be those affected most, because understanding the spatial scales of the impact still remains an open scientific issue (see, e.g., Blöschl et al. 2019). Conversely, the increasing role of urbanisation along with a decreasing basin is a well-assessed issue. Although extended engineering works – such as levees and walls that increase river conveyance but reduce the room for a river to spread in its plain – can affect large rivers as well, flood-prone urban areas are the most sensitive to decisions involving the management of rivers and creeks. To this effect, urban storm drainage will play an increasing role in risk assessment, and sustainability of storm water management should be a future focus of urban planning. Social awareness of flood risk helps reduce land consumption, urbanisation of flood-prone areas, and ignorance about safe building practices in these areas, i.e. all factors that increase the toll of a flood disaster.

"Wisdom is the daughter of experience", Leonardo da Vinci said, and these words perfectly apply to discussions about water issues. Therefore, if one aims at understanding the Italian approach to flood risk management, he/she must start from experience. History can teach something, although it frequently occurred that decision-makers underestimated or missed the earnest lessons of history, because the memory of catastrophes, and of floods in particular, rapidly fades in most cases (see, e.g., Withington 2013). However, two further issues negatively affect the capability of public and private institutions of coping with floods: limited availability, unification and sharing of observational data, and cumbersome and conflicting decision-making processes.[1]

The former problem arises out of the fragmentation of monitoring systems in Italy, i.e., the country that first introduced these systems in the form of a systematic observation network, from the pioneering experimental installations in the early eighteenth century to the birth of the National Hydrological Service in 1917. This latter institution was dismantled in the 1970s and 1980s after a long agony, which resulted in more than 20 Regional institutions being created in the early twenty-first century, and their starting to collect data systematically and continuously, with a few exceptions. However, the loss of hydrological data for the last 25 years of the twentieth century cannot be recovered. Therefore, it often occurs that scientists, engineers, decision-makers and attorneys resort to fancy instead of data to support an unaware land-planning policy or dodge personal liability. In the end, several different Regional services working unevenly with assorted criteria, standards, methods and instrumentations, provide a jigsaw puzzle that one can hardly put together.

The latter issue consists in the fact that most decisions on water management are made by Regional governments, born 50 years ago but still operating on the background of a continuous conflict with the central Government for the allocations of competences. Italian Regions are very different in size, population and, what is of interest here, responsiveness to hydrological issues. This yields an uneven capability of approaching scientific innovation, developing technology, operating advanced monitoring, and hiring effective expertise in public institutions. The outcome is a Babel of hydrological practices, uneven regulations that detail national laws and European Union directives, and tricky planning directions resulting in an inadequate capability of land planning.

2.3 The Heritage of Late Nineteenth Century Flood Disasters

In the second half of the nineteenth century, Italy faced a tremendous sequence of floods and landslides. The first wound was the symbol of the newly unified nation. According to the Pope, the 1870 flood in Rome was the punishment of God, because Our Lord had reacted to the injury inflicted by the Savoy dynasty (the former royal family of Italy) that had broken down the papal throne in September 1870. This, of course, was not a scientific explanation shared by the most educated liberals. However, the description of the event as a product of God's will was made by the leading expert in divine matters, i.e., Pope Pius IX, who made the statement *ex cathedra*. Historical evidence certifies as many as 49 floods of the city before that

[1] Both aspects are touched upon, also with reference to floods, by Martinengo et al. in Chap. 16 of this volume. For a description of conflicts over the allocation of decision-making powers, see also, in this volume, Chap. 15 by Alberton.

event, starting from that of 241 BC; therefore, the 1870 episode was not an absolute novelty, since Pliny the Elder had already written in Book III of his *Naturalis Historia* that even if the Tiber is subject to frequent and sudden floods, these would not be in any location greater than in Rome (Pliny the Elder 1942). Nevertheless, the 1870 inundation was much more serious than the previous ones of which people could have memory, causing victims and damages to such a large extent that it caused a strong feeling in the whole Country. Currently, we estimate this event as being the most severe inundation of the second millennium, with an impact similar to that occurred in 1598.

After some years spent disputing about various solutions to be adopted, including a project to divert the Tiber proposed by General Giuseppe Garibaldi, the proposal to regularise the course of the river was finally approved. This led to demolish whole rows of buildings, and even ancient ruins, to accommodate high embankment walls (called *muraglioni*). The *muraglioni* project began in 1876 and was completed in 1900, the Holy Year. After the construction of these embankments and of a modern storm sewerage system, the historic centre of Rome is now sheltered from floods like the 1870 one, but the exposure and vulnerability of the riparian zones, in case of floods somewhat more serious than that one, have increased dramatically. The embankment walls have certainly mitigated the risk of flooding. At the same time, these hard engineering works have interrupted any dialogue between the city and the water, depriving Rome of some very important architectural landmarks, above all the marvellous system of fronts along Via Giulia and the port of Ripetta. In the late nineteenth century, embankment walls were built in many cities, for instance in Verona and Florence, as well as in the former capital city, Turin (where such walls are known as *murazzi*), under the influence of a similar approach taken in Paris.

Two years after the Rome disaster, the levees of the Po River were broken twice in a year. The first time it occurred at the end of May 1872, in the lower course and the delta. The second disaster hit the riparian areas along the middle course of the river, in October 1872. For the people living in the riparian areas, it was an expected occurrence, because they had experienced frequent levees breakdown from the beginning of the seventeenth century, and similar events had occurred in 1801 and 1839, let alone some minor disasters in 1846, 1857 and 1868. In addition, other levee breaches would have occurred again after a few years, in 1879. Indeed, the Po and its tributaries have always modified the river landscape, as evidenced by the name of a small town in the Alessandria area, called Alluvioni Cambiò (i.e., “Changed by Floods”) at the confluence of the Tanaro and Po rivers.

The great floods of May and October 1872 revealed the latent conflicts arisen from the decline of the old rules of hydraulic-agrarian management. All the uncertainties caused by the rules introduced by the new centralist State also emerged. Indeed, the transition to a unitary State had changed the ancient rules of riverbanks management. The economic, social and health conditions of the lower Po valley had plunged into an abyss of poverty and desolation, as floods leave deep and slow-to-heal wounds on the field: upset fields, soils buried by mud, gravel or sand deposits that also alter the chemical equilibrium of agricultural lands, uprooted trees, destroyed buildings, drowned animals. In many cases, lands reclaimed from the marshes required long-term hard work to be recovered, especially in Veneto, Romagna, and eastern Emilia, before they could reach levels of productivity compared with those of the lands that had not been flooded. Moreover, private individuals were not able to provide adequate financial resources to fulfil the reclamation works, which could only be accomplished by the direct or indirect intervention of the central State under a long-term approach (Rosso 2017).

The Brioschi Commission, established in 1873 and chaired by Francesco Brioschi, rector of the Polytechnic University of Milan and a professor of hydraulics, worked for 7 years, until 1880, to produce the first complete survey of the Po, the major Italian river, under a scientifically-based approach. The study examined the river's entire course throughout the floodplain, from Moncalieri (upstream of Turin) to the delta. This was the core document that provided the basic knowledge on river processes, which for many years revealed to be useful to develop further hydrological studies and design engineering works. The systematic approach taken by the Brioschi Commission showed the way to develop hydraulic works that over the course of a century have greatly enhanced the capacity of the lower course of the Po to convey high flows. The Commission covered the entire scientific and technical spectrum necessary to significantly improve river conveyance, after the state-of-the-art approach adopted by distinguished and worldwide-respected experts (Mignosa 2007).

In the time-lapse from 1801 to 1876, 214 embankment break incidents were counted along the Po floodplain, while from 1918 to the present day only six breaches have occurred, three of which during the catastrophic 1951 flood. If the engineering works carried out under a river regulation approach have greatly improved the resistance of the system, one cannot forget that these works – aimed at expanding river conveyance – have notably increased the flood peaks in the terminal part of the river, an increase that can be estimated to range between 15 and 30% of nineteenth century figures (Rosso 2017).

2.4 Four Key Events in the Twentieth Century

After World War II, three major events raised the social and political issue of the widespread fragility of the Country in coping with floods: the 1951 Polesine flood, the 1963 Vajont reservoir catastrophe, and the 1966 Florence flood, which drew worldwide attention. The Sarno disaster that occurred in Campania in 1998 finally emphasised the expensive bill due to neglecting land and river management, let alone channel network maintenance.

The Polesine flood occurred in a major river system (the lower Po River), still poorly shielded against the flood hazard increase after the Little Ice Age in Europe, with mostly rural settlements located in the riparian areas. The engineering works that were carried out later, according to a rough-and-ready civil engineering approach, were often unresponsive to landscape, agricultural practices and environmental issues. These works yielded a (false) sense of safety that encouraged, during the following economic boom in the 1960s, land use practices that soon proved to be unsafe.

The Vajont catastrophe that occurred in a valley between Veneto and Friuli-Venezia Giulia – one of the major dam disasters in the world, causing about 2000 victims, an impact comparable to that of the 2001 Twin Towers attack in New York – was attributable to inefficiency and omissions by national institutions. The massacre was the result of various human errors: (1) keeping on building the dam in a valley featuring inappropriate geology; (2) impounding river flows during the test phase beyond safety margins, thus raising the lake up to an unbearable level; and (3) emptying the reservoir too quickly, thus triggering the landslide. Finally, (4) the cause of such a huge death toll was the missed set-up of a warning system and the lack of an evacuation plan to move people living in areas at risk when the basin was approaching no-return conditions.

The Florence disaster revealed the high vulnerability of urban areas. It can also be read as an unprecedented warning about the effects of hydrological changes that some scholars were beginning to associate with climate evolution,[2] an awareness that people started to achieve few years later, after the MIT Report to the Club of Rome (Meadows et al. 1972). Instead of endorsing a novel scientific approach to the physical process generating flood disasters, and a modern institutional approach to land and river management practice, this warning only engendered the justification for the extraordinary occurrence of these disasters, and for the abovementioned unpredictability axiom concerning such events. The alibi served as a shield against the need to overcome institutional weaknesses, which were also due to the methods of traditional hydraulic-engineering practice and to the pressure of business, increasingly bound to the financial soundness of large, expensive infrastructures (Veltri 2004).

In May 1998 the foothills of the Sarno range in Campania were left bare by heavy rainfall that caused an impressive sequence of mudslides. In about 16 hours more than 140 shallow landslides mobilised that triggered 40 mudslides. Overall, over two million m^3 of soil destroyed 178 houses and damaged more than 450, with a death toll of 159. Sarno and Quindici were the Municipalities that suffered the greatest impact. Each mudflow had quite peculiar characteristics, with volumes up to 180 thousand m^3, mobilised as clusters through several successive castings. Precipitation rates were not extreme, but prolonged. Rainfall produced a number of soil detachments at the top, where the slope of the *impluvium* exceeds 30°, and structural discontinuities, such as morphological concavities and occult watersheds, played an essential role. Anthropogenic discontinuities were the dominant factor, such as the artificial cuts produced to build mountain roads. Previous forest fires also played a considerable role. In addition, shallow landslides were triggered by abrupt changes in vegetation cover. In most cases, the cradles of shallow landslides

[2] It should be noted that in the 1960s the concept of climate change was far from mainstream in science, including engineering, but in those years some scholars were suggesting that long-term climate fluctuations were capable of modifying basic hydrological statistics usually assumed to be time-invariant (see, e.g., Yevjevich 1963).

were in the soils laid over the pumiceous horizon, the one created by ash fallout during the Avellino volcanic eruption of 3800 BC. In the area, the natural channel network was almost lost, completely obliterated by the anthropogenic settlements. The drainage had been reduced, in many cases, to a narrow river talweg, sometimes covered by roads and houses, or confined to manholes of inadequate size. In addition, the ancient artificial drains built in the seventeenth century were altogether clogged.[3]

The Polesine tragedy, which forced almost half of the residents to migrate towards other Italian Regions, prompted the first law (Law no. 184/1952)[4] to have introduced a national policy to accomplish flood protection measures, mainly engineering works, under a 30-year planning horizon, starting from 1953. In practice, this horizon soon became 10 years, and most of the expected investments were not made.

The response to the Vajont disaster, and to the 1966 inundations of Florence and Venice, was provided by the National Commission chaired by Giulio De Marchi (of the Polytechnic University of Milan) with the mandate of testing the state of implementation of the previous "Guidance plan for defence works in natural watercourses" established by Law no. 184/1952. Because of the poor results of the test, the Commission adopted comprehensive guidelines to address flood and landslide mitigation in Italy under a more comprehensive approach than the previous one. This result was produced by 90 scholars after a 3-year commitment.[5]

The Final Report[6] of the Commission suggested extending countrywide the model of the Water Magistrates – ancient authorities already operating in the Po River and Veneto drainage basins. The Commission identified the basin scale as the basic spatial scale to plan actions for soil conservation and water management, regardless of geopolitical or administrative boundaries. After the further 1968 flood disaster in Piedmont and the 1970 great flood in Genoa, the Commission provided the scientific foundations of a more modern institutional approach to this policy area. The Commission also recommended coordinating basin management plans with other land planning actions, since the increased environmental fragility of the Country was mainly the result of fast urban growth. Finally, one must notice that the Final Report played a pioneering role in issues such as environmental sustainability and adaptation through never-ending enforcement: "among the various concerns of

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[3] The Regi Lagni are a set of rectilinear and mostly man-made channels covering 1095 km^2 in 99 towns of Campania. They were built as part of canalisation, land reclamation and flood prevention works on the Clanio River between 1610 and 1616 by viceroy Pedro Fernández de Castro during the Spanish rule of southern Italy.

[4] Law no. 184 of 19 March 1952 ("*Lotta contro l'erosione e la difesa del territorio dalle esondazioni*").

[5] Law no. 632 of 27 July 1967 ("*Autorizzazioni di spesa per l'esecuzione di opere di sistemazione e difesa del suolo*").

[6] See Commissione Interministeriale per lo Studio della Sistemazione Idraulica e della Difesa del Suolo (1970). The Report is also available at <www.censu.it/attivita/atti-della-commissione-de-marchi-1970/>

the Commission in carrying out its work, that future generations are destined to remain inactive in the context of the same problems is not included".[7] This statement predates the birth of the concept of intergenerational equity associated with the idea of sustainable development that people and decision-makers started to consider only in the new millennium.

Finally, the Sarno disaster initiated the modern approach to Civil Protection, established in 1992 after the Seveso and Valtellina disasters of the 1980s. A capillary presence was established in Sarno, jointly with monitoring systems, early-warning models, assessment of residual risk, and effective post-emergency management initiatives. The disaster also showed the essential role of memory in coping with floods. These events occur with high frequency in Campania, mainly in the Salerno Province where Sarno is located. These phenomena are associated with the instability of the pyroclastic layers that periodically Vesuvian eruptions deposit on the hill slopes. However, local memory played an important role. In Quindici, not far from Sarno, a similar event had occurred 2 years before and, therefore, people were cognizant of the potential effects of such calamities. Accordingly, peoples' response to mudflows was more effective in Quindici than in Sarno. While the remembrance was fresh in Quindici, memoryless decision-makers of Sarno were not as aware, so that they chose fake emergency options, for instance by assuming the house is a safe shelter.

2.5 The Planning Chimera

The "Basin Planning" law issued in 1989 (Law no. 183/1989)[8] generated the widespread, comfortable illusion that a coherent, sound framework could face the long-standing Italian issue represented as a "debris hanging over the sea" by Giustino Fortunato in an outstanding, popular pamphlet (Fortunato 1920). This law closely followed the De Marchi Commission guidelines, 19 years after their adoption. Further laws[9] stressed the role of the Civil Protection. These laws were issued after the occurrence of a flood disaster with a large impact on public opinion. All these laws – often cumbersome and too complex to be understood – resulted in

[7] *Ibidem*, Vol. 1, p. 48 (the original sentence reads "Fra le varie preoccupazioni che hanno accompagnato la Commissione nello svolgimento del proprio lavoro, non è compresa quella che le generazioni future siano destinate a restare inoperose nell'ambito degli stessi problemi").

[8] Law no. 183 of 18 May 1989 ("*Norme per il riassetto organizzativo e funzionale della difesa del suolo*").

[9] Among others: Law no. 267 of 3 August 1998 ("*Conversione in legge, con modificazioni, del decreto-legge 11 giugno 1998, n. 180, recante misure urgenti per la prevenzione del rischio idrogeologico ed a favore delle zone colpite da disastri franosi nella regione Campania*"); and Law no. 365 of 11 December 2000 ("*Conversione in legge, con modificazioni, del decreto-legge 12 ottobre 2000, n. 279, recante interventi urgenti per le aree a rischio idrogeologico molto elevato ed in materia di protezione civile, nonché a favore delle zone della regione Calabria danneggiate dalle calamità idrogeologiche di settembre ed ottobre 2000*").

a chimera, a set of goodwill declarations without any effective political strength to turn the intent into action beyond strong declarations through the media.

A floodplain definition and flood hazard assessments, mitigation measures, and emergency management are the pillars to build effective flood adaptation policies. In principle, Laws nos. 267/1998 (Sarno) and 365/2000 (Soverato[10]), together with some other laws originating from the reforms re-arranging the Italian system according to the European Union directives, follow this approach. In practice, however, one must face multifaceted interpretations, methods, evaluations, tabulations, and cartography; different from one Region to another, one district to another; and application sometimes differs at the Provincial and Municipal levels: a paperwork worthy to be included in the library of Babel.

In 1972, the share of national Gross Domestic Product devoted to flood-risk-related measures – including projects of soil conservation, and those to mitigate flood and landslide risk – had fallen to 1.6% from 3.8 in 1962 (Botta 1977). In 2006, I tried to make another assessment, an unsuccessful journey throughout the labyrinth of national and Regional budgets. Anyway, the decaying trend was apparently going on. Of course, the approach had changed over time. In the 1970s and 1980s of the twentieth century, the agenda included a long list of (almost never realised) large hydraulic works, such as a number of Arno dams for flood routing: only one out of ten is now in operation. In the 1990s, after the 1987 Valtellina catastrophe, Civil Protection actions became the major expenditure chapter. This also strengthens the attitude of assuming any disaster is a fair opportunity of public fundraising.

The Sarno disaster reflects better than other events the two historical steps that have marked the recent policies to cope with floods, namely the post-De Marchi planning introduced by Law no. 183/1989 and the need to tackle events with efficient Civil Protection actions. The Sarno event took place before the planning activity envisaged by Law no. 183/1989 was carried out in Campania, as it happened for almost all Regional Basin Authorities. So much so that Law no. 267/1998 (the "Sarno Law") placed its emphasis on the obligation to draft a plan for hazard and risk assessment. In any case, the Civil Protection in Sarno provided proof of efficiency with an unexpected mobilisation of volunteers, also involving the expertise of the scientific community.

What has been done in the first 10 years of this century is practically nothing, despite frequent, repeated and widespread disasters put the flood risk at the top of people's agenda. The plea to introduce a rational approach made again a brief appearance in the middle of the 2010s through a special institution, called *#italiassicura* in step with an inflated media cue, claiming for a national response to the augmented flood threat.[11] In Italian "*sicura*" means "safe". Flood safety, however, does not exist, because flood risk can be faced by smart adaptation policies only, and one cannot forget the residual risk. The birth of this institution was thus affected by

[10] On 10 September 2000, a flood in Soverato killed 14 people, including some handicapped ones.

[11] On *Italia Sicura*, see also, in this volume, Chap. 16 by Martinengo et al.

the original sin associated with a promise that will never be fulfilled, nor could it be, by whatever future administrative body. In practice, *Italia Sicura* (as it was also spelled) was a national agency aimed at managing the bulky complexity of decision-making under the pressure of manifold stakeholders, thus setting the agenda of project funding, mainly engineering works. Not a bad idea, if supported by adequate expertise.

At any rate, the approach by *Italia Sicura* was consistent with expectations, given that the flood damage produced in 1 year (from 2013 to 2014) had topped 8.3 billion euros, but the Government had allocated only 565 million euros, and only 380 were actually made available to those addressing the major emergency issues. *Italia Sicura* started from the assumption that one can cope with floods by adopting adequate management policies, rather than by disseminating all over the river systems some engineering works aimed at reducing the hazard. Although expertise was not always excellent for all the project screening and ranking, some steps forward were made in funding long-expected hydraulic works, such as the Bisagno bypass in Genoa, first suggested after the catastrophic 1970 flood, and further planned in the late 1990s: this facility would have prevented major flood disasters in 1992, 2011 and 2014. Conversely, funding of the engineering works to prevent flooding in Milan was limited to some small but expensive detention basins in the upstream Seveso River. This might reduce frequent, nuisance floods in the area, but it will not effectively reduce the historical incapability of the canalised course of Seveso in the urban area to convey hazardous floods. Because of its short lifetime, one cannot come to the conclusion that *Italia Sicura* was really effective, but one cannot deny that it was the only substantial, rational approach after the failure of the 1989 basin planning initiative.

Following a well-established political practice, the subsequent Government deleted *Italia Sicura*, also erasing its major mission: providing the community with transparent information on expenditure, for the first time in 150 years. The heritage of "the Nation of troubadours" was restored. Since 1870, the troubadour's syndrome[12] drives the Country's flood-coping commitment. Italy is a country where 15% of schools and 21% of cultural assets are at risk, and more than 4% of the former and almost 7% of the latter could face highly dangerous events (Ispra 2018). However, context-aware, systematic, assiduous policies to tackle this risk are still lacking. General Garibaldi, who wanted to divert the Tiber after the "God punishment", the December 1870 flood in Rome, was the first troubadour with no expertise but a huge audience composed of common people. A troubadour appears after each disaster – although catastrophes occur with increasing frequency, troubadours are a never-ending descent – with a strong impact on media and common people, but no appreciable results in reducing the risk for the disaster that will follow.

Because the troubadour's approach is to solve the problem once and for all, the troubadours have usually followed the current engineering fashion. Originally, the

[12] See *Il trovatore*, music by G. Verdi, lyrics by S. Cammarano and L.E. Bardare, after A.G. Gutiérrez's *El Trovador*. The first show was held on 19 January 1853 in Rome, at the Apollo Theatre, further destroyed after the 1870 flood.

panacea was walls and levees. In the late nineteenth century and at the beginning of the twentieth century, floodwalls were built everywhere, as the exclusive approach to coping with floods. After the effectiveness and the efficiency of these works were challenged by floods exceeding the designed one, other approaches were introduced. Diversions, dams, forestation, target shooting against the clouds, deforestation, soil and water bioengineering, detention and retarding basins were therefore added to the list. Since each of these measures was considered the ultimate solution throughout one or two decades, dating Italian flood-mitigation policies is a straightforward exercise.

2.6 Designing Adaptation Strategies

Urged by media and politicians, public opinion often invokes the final solution, the one that can provide hydrologic safety once and for all. Mission impossible, but some decision-makers cheat people claiming that such a solution exists and that it is even feasible, and that someone is actually working hard to achieve it. Unfortunately, there is no panacea capable of removing the risk. In order to mitigate or adapt to these events, there is only a series of things we already do, some things that we can do better, and other things that we can start to do. Moreover, one cannot neglect the medium- and long-term vision.

In addition to the intensive occupation of the riparian areas, what is making floods particularly burdensome in this century are the concatenation, repetitiveness and geographical spread of events. A chain that in synthesis is expressed in the saying "it rains but it pours", as introduced by Giovanni Pascoli in his *Prose*: "It rains but it pours: tears on blood, blood on tears".[13] It is a concept expressed in many languages: "When it rains, it pours" is the title of a rap song by 50cent: when it rains, it pours. It was also the title of a 1955 Elvis Presley top-ten hit, when climate change and land use were still unknown forces of flood-risk increase.

One of the many recent examples is the November 2014 flood in Genoa, a meteorological event that hit also other areas in central-northern Italy, from the Tyrrhenian coast of Tuscany up to the upper Adriatic coast. Complexity is not an Italian issue: in Great Britain, for instance, the Desmond storm in December 2015 was not an isolated episode, since in Cumbria a series of events had already taken place in clusters, and then culminated in the perfect storm. The management of the great floods, therefore, requires a better understanding of the sequence of events that occurs during a period of severe precipitation, and how this sequence could evolve. Moreover, we must learn to deal with floods under a reasonable and sustainable approach, in all respects: social, economic, and environmental.

How can we face future floods, even though the future will certainly be different from what it used to be?

[13] The original sentence reads: "Piove sul bagnato: lagrime su sangue, sangue su lagrime".

2.6.1 Awareness of Climate Change

The first step is the awareness of climate change. Whenever an extreme weather event occurs, people wonder: "was it caused by climate change?" A useless question, because the real question is instead: "How much more likely is this happening in a changing climate?". So, if such an event had an annual probability of 1% and now this probability became 2%, one can say that the likelihood of this occurrence has increased considerably (it doubled) due to climate change. This awareness is essential to prepare for the extreme weather events of the future. Improving statistical predictability, or the measure of the likelihood that a flood will occur, is an important step because it reduces the uncertainty with which we evaluate the probability that a flood can hit the territory and consolidates the collective consciousness that these events can really happen.

2.6.2 Smart Forecasting

Making smarter forecasts is the second need. All over the world, administrations are working on smart cities. Cities become smarter in everything, from traffic flows and telephony to energy consumption; all this can take place because of the massive use of big data, collected in time and space with high resolution, and further processed in real-time. In the event of floods, sensor networks (from weather radars to gauges throughout the river network) can help improve the currently poor predictions of extreme weather conditions, thus giving the community more time to prepare. Improving deterministic or quasi-deterministic predictability is, therefore, a step as important as the previous one, because it reduces the uncertainty with which we evaluate not only if, but also when a flood can hit our territory; at the same time, such forecasts can increase the time horizon for us to prepare for this occurrence. In addition, the targeted use of the same big data that serve telephony or energy can better guide our preparation and Civil Protection procedures.

2.6.3 River Basin Management

Improving river-basin-management practices is the third requirement. The management of rural areas alone, once guaranteed by irrigation consortia, is no longer sufficient. Floods are often so severe that the multifaceted systems for draining, impounding, distributing and routing surface waters are soon saturated. However, these structures have a key role in mitigating the impact of floods of small and medium severity and should certainly not be left to themselves but carefully maintained. Furthermore, green spaces and green roofs, rain gardens, forests, permeable ponds, and surface run-off storage can play an effective role in mitigating flooding risk, but only if these facilities are properly allocated. Smart rural solutions are useful as urban ones. Land reclamation programmes were very popular during the Fascist era, but their design was aimed at draining storm-water from agricultural lands as quickly as possible, conveying it to the outflow water bodies. This can prevent these areas from being flooded, but the downstream risk is highly augmented. However, the storage of water in agricultural areas – upstream of urban areas, where there are no sensitive infrastructures – offers a significant opportunity to reduce the hydrologic hazard. Some countries – for instance, those regularly hit by the monsoon floods – sometimes sacrifice agricultural land for several weeks in order to curb the outflows. This is not a universal solution, since Italy displays a very particular physical and settlement geography, but it could be successfully used in some areas, where deliberately flooding agricultural areas can provide a useful routing effect. Accordingly, the co-operation by peasants and landowners becomes a key factor, and the associated costs must be accounted for in designing the flood management plan.

2.6.4 Improving Design Standards of Engineering Works

There is a crucial need for improving structural measures, both in terms of design figures and in terms of management. Many cities, such as Rome, Turin, and Florence, are walled against flood flows. Hydraulic spillways and river by-pass facilities provide structural mitigation measures in other cities, such as Pisa, Padua or (in the next future) Genoa. Milan has no structural measure to mitigate the inundation of large northern and western urban areas that occurs with high frequency. Embankments walls have been built throughout the last three centuries. These defences have been designed based on an unrealistic appraisal of major flood peaks as estimated using contemporary knowledge and techniques, as further demonstrated by several events in recent years. Furthermore, the project standard plays a crucial role in defending inhabited areas, but only up to a certain safety level; above the standard, a residual risk remains uncovered, associated with the possible exceeding of this level. In many cases, the standard is completely inadequate, because it was defined a long time ago and incorrectly, as in the case of the Bisagno River in Genoa, let alone several dams. In other cases, the standard has been evaluated based on the probability of rainfall, which does not provide the correct probability of flooding: this has been known for 40 years, but even current design practice often misses this point, underestimating flood figures, peaks and volumes. Climate change, jointly with updated historical data series, would need upgrading the estimates of these standards, with a consequent adjustment of the structures. However, one needs to evaluate feasibility and costs to adapt these defences and build new ones; and whether these costs, together with physical, environmental and urban planning limits, is really consistent with the structural approach or other, alternative measures must be taken instead of engineering works.

2.6.5 Maintenance

The budget for maintenance is usually the first to be cut off public expenditure when some restriction is needed at the national, Regional and Municipal scales. Many events have shown that the lack of maintenance is the major cause of the increased impact of a flood disaster. Embankment walls and levees, spillways and canals, dams and barrages are all facilities that claim for assiduous control and constant care. Volatile financing of this chapter of expenditure causes, in the medium and long term, an unquestionable waste of economic resources, let alone the fact that it can even endanger people's lives. The future of maintenance is, on the one hand, a coordinated set of new observation, monitoring, and control technologies; and on the other hand, the holistic reconstruction of ancient processes capable of providing widespread activities in a territory, by integrating engineering, forestry, geological, agronomic, architectural, and urban planning skills.

2.6.6 Dam Operation Strategies

Another issue is the strategy of water impounding in large reservoirs. Most large Italian dams were built in the first half of the twentieth century with objectives that were completely different from flood routing. In most cases, their capability to provide an effective routing of flood flows upstream urban areas is poor, because their location throughout the river network was not optimised under this perspective. However, some of these dams can effectively route extreme floods in order to smooth the hydrograph at downstream locations, thus attenuating flood peaks. Therefore, protocols must be implemented to keep some storage to face major floods under a multi-objective approach, pursuing a better balance among energy generation, irrigation supply, downstream eco-sustainability, and flood management. Such a balance requires that smart hydrological forecasts be produced in real-time, thus providing enough time ahead for operating effective flow-control operations.

2.6.7 Reducing Exposure

A cornerstone of effective adaptation strategies is the adoption of policies capable of reducing exposure. A good flood-management policy will delocalise the objects at risk where defending them by means of both structural measures and non-structural actions is neither feasible, nor economical, nor even reasonable. This requires a comprehensive approach to governance, but it sets a hard goal for Italy, a country where buildings and building rights are sacred, eternal, unquestionable gifts. However, one cannot agree with the community if it declines any suitable and fair mechanisms for practicing delocalisation, even after memorable and striking disasters. Moreover, the mastiffs who deny any reallocation plans claim, at the same time, for awkward, expensive, and unrealistic safety measures at the expense of the Municipality. Let alone the fact that it has often occurred that those who got the money to relocate actually moved, but at the same time they also continued to abuse the same riparian area just as before.

2.6.8 Discontinuing Land Consumption

Another planning cornerstone is the need to reduce land consumption. One hectare of agricultural land provides food to six people a year. It preserves 30% of the Earth's biodiversity, helping our immune system and generating active ingredients for our care. Soil is an effective sponge that can store water up to 3.8 million litres per hectare, thus limiting runoff. It holds between three and four times the carbon in the atmosphere. Although soil is a thin layer of the Earth's crust, it is the basis and substance of landscape, because it is the medium for plant growth, the major water storage, supply, and purification facility, a modifier of Earth's atmosphere, and the key habitat for organisms (Pileri 2015). In short, without the hard work by the soil, I would not be here to write nor would you be reading me. Yet every day we offend, consume and pollute the soil. In Europe, more than 250 hectares are paved every day: a city larger than Milan replaces agricultural land every year. In Italy, eight square meters are paved every second, but nature takes 2000 years to generate ten centimetres of soil. In the world, the damage caused by erosion and desertification has an annual average cost of 70 US dollars per capita, including babies; in Italy, this cost doubles, with long-term deleterious effects that cannot be predicted. Let alone the fact that one urbanised hectare requires 6500 euros per year of public expenditure to keep sewers, canals and drains clean. It is likely that blocking land consumption is not enough, but one could approach soil reconstruction as a remediation measure. The development of new technologies might be useful to speed up natural processes that need a very long time.

2.6.9 Breaking Down Vulnerability

Flood proofing measures are an essential tool to reduce vulnerability. "Flood proofing" (often spelled "floodproofing") is an expression indicating a large number of different measures, tools, and procedures, which can be implemented to reduce the flood risk by decreasing the exposure and/or the vulnerability of people, buildings, infrastructures, and goods during a flood event (Bignami et al. 2019). It includes both structural and non-structural measures against flood damage before or during flooding. Essentially, floodproofing covers two purposes of flood management: flood resistance and flood resilience. Flood resistance keeps out floodwater to prevent damages, while flood resilience minimises the impacts of floodwater once a flood has occurred. These passive measures, both permanent and temporary, to be activated under emergency, can reduce flood damage by up to 75%. The facets of the different solutions are manifold, but the role of architecture and urban planning to this effect should be emphasised. Territorial governance plans and building regulations can facilitate the integration of floodproofing facilities into the blocks and buildings. Furthermore, self-protection and floodproofing policies guarantee the awareness and involvement of the private sector in the context of public policies aimed at mitigating damage and preventing risk. These measures are not always useful in principle, because each specific flood-prone area requires a proper approach. However, for instance, had they been applied to the Milan metro worksites, the damage caused by the 2010 flooding would have been reduced drastically. Only a gradual, balanced and integrated use of the various types of measures can effectively mitigate the impact of new catastrophes. The only guarantee is continuity over time.

2.6.10 The Urban Context

Urban resilience is a key focus of current approaches to flood management (see, e.g., Lamond and Proverbs 2009). The notion of resilience encompasses pre-disaster planning and warning systems, emergency handling procedures and post-disaster reconstruction. Both human and physical systems are involved at all stages. This would include the concept of sustainable flood memory as a critical and agentic form of social and cultural remembering of learning to live with floods (Garde-Hansen et al. 2017). The success of resilience programmes lies in the cooperation of floodplain populations together with private and public actors (see, e.g., Loucks et al. 2008). For example, floodproofing can provide an effective approach, but increasing the installation of structural flood-resistant and flood-resilient features requires a substantial commitment from property-owners and the whole local community (see, e.g., Egli 2002; Bignami et al. 2019). Therefore, knowledge of common features on part of floodplain populations may enhance the chance of achieving such cooperation, because resilience requires an adequate and harmonious commitment that includes de-localisation to reduce exposure, hydraulic works to reduce hazard, and land reclamation and floodproofing measures to reduce vulnerability. The role of land planning, as well as that of architectural and building practices, are not marginal in designing and implementing successful adaption strategies.

Following the *Encyclopedia Britannica*, “architecture” is both the process and the product of planning, designing, and constructing buildings or any other structures. More generally, its mission deals with organising the space where humans live. According to Morris (1881), “it embraces the consideration of the whole external surroundings of the life of man; we cannot escape from it if we would so long as we are part of civilisation, for it means the moulding and altering to human needs of the very face of the earth itself, except in the outermost desert”.

Improving human ability to cope with floods will require, therefore, not only better physical knowledge and an extended toolbox of engineering practices, but a definitive enhancement of land planning policies, of sustainable architectural approaches under a multifaceted perspective, and of social awareness.

2.6.11 Risk Consciousness

Finally, people must learn to live together with floods. It is not possible for all settlements and all infrastructures to be placed in a situation of acceptable risk, leaving aside the fact that such a concept requires a deeper insight. There is always a residual risk, which cannot be eliminated. This risk is not negligible compared with other environmental and industrial risks to which people are exposed. Developing risk-consciousness in the public sphere involves:

- Small-scale management capability of rivers.
- Collective awareness that the risk is real, so that alerts and alarms are an essential tool, and not an annoying buzz produced by some idle academic owl.
- The implementation of local defensive facilities.
- The organisation of the community to respond quickly and orderly in case of emergency.

This can help build and consolidate resilient communities, capable of adapting to climate change by preventing extreme events to turn into disasters with a long-term impact on society and the economy. In this context, ascertaining responsibilities in judicial proceedings – an action practiced today in an episodic manner and with results that are often nullified by statutes of limitations – is a significant issue to increase awareness and resilience. Research, now completely deserted in Italy, can help avoid errors and waste resources. The preparation of the master plan is an indispensable basis. The lack of expertise in national and Regional governmental bodies, because of utterly inappropriate policies that have ignored any physical issue in building water-management institutions after the central bureaucracy was split into Regional ones, is the major drawback to be addressed. Reconstructing technical structures in the public domain is an emergency action that cannot be deferred.

Flood risk is the product of three components: hazard, exposure and vulnerability. One must notice that the proper, risk-conscious approach should combine measures aimed at balancing these three factors. Conversely, the traditional approach in Italy has been to reduce the hazard, mainly through engineering works, without paying any attention to the reduction of exposure and to the enhancement of resilience, a goal that can be achieved only by reducing the vulnerability of flood-prone areas. In many cases, hazard reduction has been the source of increased exposure, that is, its ultimate effect has been increasing flood risk instead of mitigating its impact. In most cases, hazard-reduction facilities achieved through engineering works also contributed to increasing downstream risk, designing poor river landscapes, and reducing ecological diversity.

Another fundamental, conceptual issue deals with social and ethic acceptability. The concept of acceptable risk is hard to be accepted in both natural and man-made catastrophes. Its estimate depends on many factors: cultural level and type of social organisation, individual and collective psychology, income and wealth. Humanity can approach flood risk only by mitigating its impact on riparian areas, after human life, an unevaluable asset, has been safeguarded. The most effective solution for safeguarding human life is the Civil Protection, this including not just emergency measures but also prevention. This was the basic approach of the Italian Civil Protection, born in the 1980s and then established as a Department under the Presidency of the Council of Ministers by Law no. 225/1992, thanks to the commitment of Minister Giuseppe Zamberletti.

In the end, adaptation is the major commitment to cope with floods, given that flood disasters in modern urban areas call for the heaviest natural damage bill (Committee on Urban Flooding in the United States 2019). During the nineteenth and twentieth centuries, urban developments forced the rivers underground into small concrete channels, this resulting in serial disasters (Rosso 2014). From London to Vienna, Hartford to New York, Milan to Genoa, these rivers were buried by urban planners, thus permanently changing the landscape. Re-exposing and restoring buried rivers is the necessary worldwide commitment to increase man's capability to cope with floods and provide sustainable urban landscapes (see, e.g., Bernhardt et al. 2005).

2.7 Conclusion

Rarely has Italy had recourse to the best available expertise and appropriate skills to tackle flood risk. That occurred in two circumstances only. The first after the twin 1882 Po floods, when the Brioschi Commission gathered the greatest scientists, who produced effective guidelines. These allowed for reducing the frequent flooding episodes that had stricken the lower Po riparian areas throughout the eighteenth and nineteenth centuries, also mitigating the impact of the 1951 flood. Experts were resorted to again from 1966 to 1970, when the De Marchi Commission showed how to deal effectively with flood mitigation under a rational, relentless commitment, spread over a long-term horizon of 30 years, but never to be called off thereafter. Both commissions gathered the best available scholars. Otherwise, Italy has continuously assembled, dismantled and reassembled the flood-mitigation toy, entrusted to renowned experts by devout dwarves and intriguing dancers,[14] simultaneously

[14] The Italian idiomatic expression "*nani e ballerine*" ("dwarves and dancers"), crafted in the 1980s, was used to refer to the assorted group of sycophants that surrounded the Italian political establishment of that time.

carrying on the practices of indulging in the mediatic fiction and appeasing people's anger and anxiety after a disaster, that is, very often.

Can Italy approach flood risk under a novel rational approach, given that that past solutions were not capable of achieving a satisfactory degree of preparedness, prevention and equity? This door will only open if all stakeholders achieve an effective awareness of climate change, share smart forecasting initiatives with a multidisciplinary attitude, and look for ameliorated river basin management. Design standards of engineering works should be revised and improved, hillslope and river maintenance should be appropriately addressed on a regular and systematic basis, and dam operation strategies should be revised. One should also put efforts in discontinuing land consumption, reducing exposure and minimise the current, unacceptably-high vulnerability to floods. Because of increasing urbanisation, urban resilience is also a key factor to improve flood management. An interdisciplinary effort to renovate and refurbish Italian cities must rely on risk consciousness about natural disasters, mainly hydrological and seismic one.

Novel strategies only can tackle the above issues. After more than 150 years from the birth of the Country, Italians should have learnt that coping with floods is a never-ending challenge. The strategies to deal with it require the fundamental awareness that the key factors are not money, loans and financial fluxes, but consciousness, knowledge, expertise, sharing, equity.

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Chapter 3
The Uses and Value of Water in Italy: Evidence from Selected Case Studies in Italy, with a Particular Focus on Irrigation, Industry and Hydropower

Giulia Vaglietti, Federico Pontoni, Alessandro de Carli, and Antonio Massarutto

Abstract This chapter analyses the most relevant economic literature on water uses in Italy. In particular, the economic value of water is investigated in four main sectors: urban water services, agriculture, recreational industry and energy. As far as the urban water sector is concerned, most studies analyse the consequences of the introduction of the so-called *Legge Galli*, a complex reform in water governance started in 1994. The studies on water use in the agricultural sector are divided mainly in two branches: the use values of water (which was found to range from 0.3 to 1.2 €/m^3) and the total economic costs and benefits of certain measures, such as for drought management or pollution reduction. For what concerns industry and energy, the economic value of water is rarely evaluated, especially in the former sector, while the majority of studies seem to focus on the environmental impact of production by considering water use and consumption (water footprint). In the chapter, instead, the point of view of the consumer is primarily analysed in relation to the recreational sector, where the willingness to pay for better environmental and

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recreational services connected to water was estimated between €3 and €1056 per year. Nevertheless, the literature review points out the lack of cross-sectional studies of sectors. This lacuna is probably connected to the limited integration among the actors that manage water resources and a too fragmented governance. Solving these issues will guarantee a better allocation of water resources both among users and over time, thus targeting the challenges of adaptation and resilience in the water-energy-food nexus.

Keywords Water uses · Economic value · Irrigation · Hydropower · Urban water services

3.1 Introduction

Italy has one of the highest water consumption rates of Europe: for this reason and in the view of a future more resilient economy, the value attached to water has to be further investigated. Indeed, understanding the economic value attached to the resource would allow to better evaluate the pressure of an economic system on the environment and better address the water-food-energy nexus challenge. After a brief overview of water uses in Italy, this chapter investigates the existing economic literature on water monetary values for different sectors,[1] focusing on the urban water service, industry, energy and recreational uses – the last one being a proxy for the value of water ecosystems.

3.2 Water Uses in Italy

Every year, on the occasion of the world water day, the Italian Institute of Statistics (*Istituto Nazionale di Statistica* – ISTAT) publishes a report on the status of waters in Italy, focusing in particular on productive and civil uses of the resource.[2]

The most recent of these documents illustrate that in 2018 – the last year for which official data are available – the total volume of water withdrawn for civil use on Italian territory was equal to 9.2 billion m^3. This volume accounts only for drinking water and was managed by more than 1800 different providers (ISTAT 2019). According to ISTAT (2020), such a large supply is made possible thanks to a daily

[1] For another overview of the uses of water in Italy, albeit carried out from a different and mainly non-economic perspective, see also, in this volume, Chap. 1 by Benedini and Rossi.

[2] Following the guidelines suggested by ISTAT (2019), the civil use of water is to be understood not only as the domestic consumption of families, but as the totality of all its “non-productive uses”: including its application in public buildings and offices, in services, in activities related to industrial or agricultural businesses insistent on urban areas, and other public necessities such as for washing roads.

production of 25 million m^3 of water, which is equivalent to a withdrawal of 419 litres per capita per day (or approximately 153 m^3 per year per capita).

In 2019, a slight drop in drinkable water abstraction was registered for the first time in Italy; compared to 2015 levels, the volume dropped by 2.7%. However, the high level of extraction in the country was found to be the highest among Member States of the European Union (ISTAT 2019, 2020). The level of withdrawal highly depends on the Regions; Lombardy accounted for 15.4% of the total, followed by Lazio (12.5%) and Campania (10.1%). When looking at different available sources of water, the one most exploited for civil use are wells (48.9%), followed by withdrawals from springs (35.9%) and from artificial basins (9.8%). These are followed, in less significant proportions, by withdrawals from superficial watercourses or natural water basins (5.3%) and, finally, from marine or brackish waters (0.1%) (ISTAT 2020). Measurements of water flows are taken in two ways: through instrumental measurements or through estimates. In Italy, in 2015, only 76.3% of these measurements took place through instruments while the remaining 26.3% had to be estimated. Such a high approximation rate is related to the availability of meters, which is itself strictly dependent on type of source, location and providers' management strategy. Indeed, the probability of a precise measurement increases with the ease of access to the resource and the specialisation of the utilities.

Similar complexities – mainly connected to the accessibility of the resource and the management strategy, such as the age of facilities, the length of pipelines and maintenance levels – are also the main determinants of water losses (ISTAT 2020). Indeed, it is impossible to talk about the distribution system without taking into account the leaks that are generated along the system itself; in 2015, in Italy, total losses – defined as the difference between the amount of water run into the system and the amount delivered to the consumer – amounted to 3.45 billion m^3, corresponding to a daily dispersion of 9.4 million m^3. The most effective indicator to express loss in distribution systems is the percentage ratio between the total volume lost and the total amount of input water. In 2015, this percentage ratio was estimated to be 41.4% (value that has been increasing over time). To this value has to be added a supplementary loss – around 11.6% – of water which is withdrawn from the environment but is not injected into the pipelines. Although this indicator is extremely practical to compare different performances, again it should be noted that measurement quality and calculation methodology may differ between facilities and the different entities processing the data. Moreover, it does not express the share of apparent loss – corresponding to the volumes stolen without authorisation and the amount delivered but not actually measured due to inaccuracy or instrument malfunction – which may vary with time and location (ISTAT 2019).

It is also extremely complex to define the share of the delivered wastewater which is discharged and treated. Indeed, following the standard procedure, the polluting capacity of the vector that has been treated – expressed in population equivalent[3] – rather than the total volume delivered to the treatment implant is generally measured.

In terms of population equivalent only 75 million inhabitants, out of more than 98 million, have access to sewage and depuration services. After treatment, the pollution removal of the biggest plants reaches efficiency levels ranging from 60 to 90%. The treated water is then discharged into superficial flows (80.3%) or into the sea (16.7%), whereas only a negligible part is reinvested in other uses (such as cooling). The remaining sewage sludge – estimated to be around 1.9 million tons – is mostly delivered to composting sites (37.4%), dumping grounds (15.4%) or incinerators (12.9%). Only 17.3% can be used for agriculture.

Considering the productive applications of non-drinking water, agriculture together with industrial processes and energy production, play a decisive role in water consumption. At the European level, Italy is an interesting case study for water-use in agriculture since the Country shows an extremely high propensity for irrigation in agricultural areas. In 2016, the Utilised Agricultural Area (UAA) equipped with irrigation was around 20.2% of the total UAA (2.55 million ha); such a value is among the highest in the Mediterranean region, surpassed only by Malta, Greece and Cyprus. It should be emphasised that the above shares represent the whole potentially irrigable area, but only 61.9% of it was actually watered during the agricultural season (2015–2016). Unfortunately, no recent data are available regarding the volumes distributed: between 2009 and 2010, 11.6 billion m^3 of water were used to irrigate 2.49 million ha belonging to 708,000 farms. It follows that the average quantity of water used to irrigate one hectare was about 5000 m^3, although with obvious variability depending on location and crop type. For example, flooding of rice fields used 10% of the total water employed in irrigation despite only being cultivated on 240,000 ha. Obviously, animal husbandry also requires a significant amount of water, both for watering the livestock and for cleaning equipment. In 2016, Italian farms used 317.5 million m^3 of water, of which the majority was devoted to cattle breeding. As there is limited availability of punctual data on private and industrial water withdrawal, the volumes have been estimated on the basis of specific water requests for livestock weighed by its typology, stabling, diet plus other external factors such as temperature and humidity.

A similar estimation procedure has been applied to define the resource requirements of the manufacturing sector: despite the fact that small companies (less than five employees) tend to use civil water for their production (approximately 195 thousand m^3 in 2016), the majority rely on self-provision or specific industrial withdrawal infrastructure. It is therefore necessary to estimate the total volume of water used starting by the expected water requirements for each unit of output. ISTAT (2019) estimated that in 2015, 3.79 billion m^3 of water were used by the manufacturing sector. From this number, it is possible to calculate the Water Use Intensity (WUI), which provides a measure of the volume of water necessary to generate a

[3] According to Directive 91/271/EEC of 21 May 1991 concerning urban waste-water treatment, a unit of population equivalent corresponds to the organic biodegradable load having a five-day biochemical oxygen demand (BOD5) of 60 g of oxygen per day.

Table 3.1 Water uses and stocks in Italy

Water uses and stocks	Reference year	Source	Billion of m^3
Withdrawn for civil use	2018	ISTAT (2020)	9.2
Annual total dispersion, civil use	2015	ISTAT (2019)	3.4
Irrigation	2010	ISTAT (2019)	11.6
Livestock	2016	ISTAT (2019)	0.317
Manufacturing	2015	ISTAT (2019)	3.8
Storage on dams	2011	Lehner et al. (2011)	2.9
Energy production	2012	ISTAT (2019)	18.5

unit of production in each sector. The WUI – which is calculated as a ratio between the amount of water used and the value of the production sold during the year – is a particularly valuable measure as it represents an environmental pressure factor, describing the impact of an economic system on water resources. In Italy, in 2015, an average 5.9 litres of water were required for each euro of production, with variation in this value depending on the sector. For instance, mineral extraction activities required 21.7 litres per euro of production, while the publishing sector required less than one.

Lastly, it is necessary to consider water use both for the production of energy and for the cooling process of power plants. The Italian Transmission System Operator reports that there are more than four thousand operational hydroelectric power plants today.[4] Despite hydropower technology's wide but uneven distribution, only 45 main dams were inventoried in 2011 in the global reservoir and dam database (GRanD)[5]: those basins can retain a maximum total capacity of 2.88 km^3 of water (Lehner et al. 2011). Obviously, thermal power plants are also major withdrawers and consumers of water: in 2012, 18.5 billion m^3 of water were used by 2275 plants for operating and cooling processes. Out of that total volume, 90% was taken from the sea (ISTAT 2019) (Table 3.1).

3.3 The Economic Value of Urban Water Services

Water services, especially those that are serving urban areas, must face the challenges of sustainability, resilience and adaptation on multiple levels: institutional, political and social. In the early 1990s, Italy introduced a major reform of its urban water sector, through the adoption of the so-called Galli Law (*Legge Galli* – Law no. 36/1994); among the many transformative changes for the sector, for the first time,

[4] Data are downloadable from the website of TERNA, a large energy transmission system operator: <www.terna.it/it/sistema-elettrico/dispacciamento/fonti-rinnovabili>

[5] The data were compiled by Lehner et al. (2011) and are distributed by the Global Water System Project (GWSP) and by the Columbia University Center for International Earth Science Information Network (CIESIN).

the concept of water safeguarding was introduced throughout the promotion of services' efficiency improvements.

In particular, the aims of the decree were to ensure an adequate quality of service throughout the whole Country and to develop economies of scale and of scope by fostering the merger of small local facilities into bigger providers. These objectives – which were reached mainly through the identification of new organisational strategies, the definition of so-called optimal-size areas (*Ambiti territoriali ottimali* – ATOs) and the introduction of a full-recovery tariff – made the new regulation particularly interesting for socio-economic studies. Since then, many scholars have studied the main consequences of this law, both directly and indirectly. The authors who addressed the reform directly tended to compare the general changes *ex post*, that is, after the reform. Despite the conceptual simplicity, this type of exercise is far from easy. Availability of comparable data is extremely limited, especially in the period before the 1990s when management was particularly fragmented. Moreover, there are multiple indexes that a researcher should compare to display a complete overview of the sector.

For example, Danesi et al. (2007) compiled a comprehensive analysis of the very first period of the reform, comparing 1993–1996 data to that of 2001–2004. They found that the number of employees in the water service sector increased by 15% – going from 55,107 to 63,374 employees while investments decreased (−37% in 2001 compared to 1993 levels). On the other hand, the tariff increased with every utility that entered the new management system imposed by the reform, with a gap of +20%. To the reader, this information may appear misleading: a simple explanation is that there was a new and more stringent need for utilities to respect their budget constraint and, at the same time, cover previous debt. Nevertheless, the average Italian tariff was still below the average tariff of the other OECD countries (−60%).

One of the most complete overviews of medium-term changes in the sector was compiled by Massarutto in 2012. They highlighted both qualitative and quantitative variations between the years before the reform and 2011 (depending on data availability). For simplicity, the interests of the authors may be divided in state of the service (infrastructures, users connected to the system, trust and satisfaction of the consumers)[6] and economic/financial indicators (productivity indexes, tariffs, investments). The results were quite interesting. Regarding service quality, they found new utilities able to reach a higher number of final users who were also more satisfied (both in terms of the number of disruptions they perceived and their trust in the drinkability of the resource). Despite an increased number of connections, an intensification of loss/leakages was also highlighted (+2.6% in the decade 1998–2008). This is mainly due to the ageing and deterioration of the previously existing infrastructure. However, there was also an increase in investment – about €10 per capita (1970/90–2011) – which may indicate an attempt by the new utilities to renovate the

[6] Some of those indicators were not calculated before the reform; in those cases, the earliest available data were generally compared to the newest one in order to evaluate the reform effect.

network. Major investments were coupled with increased employment (+17%) and value added (+27%) in the years between 1997 and 2009. As expected – and previously discussed – tariffs also have been increasing: the total gains of the sector, grew from €3.37 billion (actualised) in 1993 to 7.61 in 2011. Nevertheless, this escalation (+119%) should not be overestimated as an increase in tariffs would likely have happened even without the reform. The implementation of the new reform, and the following tariff increase, allowed a reduction also in the expenses for the water services sustained through general taxation, of about €2.53 billion, corresponding to about €42 per capita. Again, with respect to other comparable countries, the authors underlined the need for further improvements. Nevertheless, "only" 10 years after the first implementation of the reform may not be a sufficient time to fully evaluate the transformation of the sector, which is still evolving today. Therefore, the previous data should not be interpreted as a clear proof of efficiency. As it was proven from these two examples, results may also differ with respect to the time span considered. It is therefore necessary to wait a little longer to provide more concrete results: in the future, as a consequence of the reform, the expected harmonisation of the system – under specific control authorities – is likely to provide more reliable data. Only then will it truly be possible to control for long-term effects. Lastly, it should be emphasised that the "comparison methodology" can only state the direction of the evolution of a market without providing detailed information about the drivers of the change.

Instead of studying its direct effects, other scholars addressed the reform's indirect effects by evaluating the actual efficiency of the sector. One of the key points of discussion, both for organisational and socio-political reasons, has been the new aggregation of the (previously fragmentated) sector under the ATOs.

A few years after the implementation of the new policies, Fraquelli and Moiso (2004) evaluated the initial performance of the 18 most representative ATOs. It should be noted that the establishment of the new actors was still in progress and only 84 out of the current 86 administrations were precisely defined.[7] Even fewer had compiled their management plan (*Piano d'ambito*) containing all the necessary information to perform an assessment of economies of scale or scope.[8] Thanks to the information contained in the action plans, the authors defined a cost function (considering water volumes, the consistency of the network and users, prices of productive inputs and other operational details) through which it was possible to define the optimal frontier of operation. Therefore, it was possible to observe each ATO's level of inefficiency by comparing the performances of each observation to the optimal frontier. The results pointed to the existence of significant economies of scale in areas distributing between 50 and 150 million m^3 of water (or serving

[7] The total number of ATOs currently established has been retrieved from the website of the Italian Ministry of the Environment (*Ministero dell'ambiente e della tutela del territorio e del mare*): <www.minambiente.it/direttive/ambiti-territoriali-ottimali>

[8] Economies of scale are positive economic performances which arise when a unit increases in input results in a more than proportional increase in input. Economies of scope, instead, are savings that an industry may obtain by producing jointly two or more output/services.

0.5–1.5 million of users) suggesting that an optimal level of aggregation would be an area distributing between 100 and 200 million m^3 of water. Aside from the dimensions, which is a topic still highly debated today, the analysis proved there was a general level of inefficiency of about 5%: which means that the average management costs were overshooting the optimal one by 5%. It remains interesting to note that the worst performers (generally characterised by small dimensions and located in the Centre or South of the peninsula) improved with time with respect to the year of installation.

A precise review of frontier analysis and economies of scale, concerning any level of the water system, is provided by Guerrini et al. (2018). Quite a few years after Fraquelli and Moiso (2004), they also addressed the issue of inefficiency but focused on utilities instead of ATOs. In particular, through a stochastic frontier analysis, the authors evaluated two types of economies: scale and density. The first is given by the size of the service, which is given by the quantity of customer served. The second is evaluated on the basis of customer density, measured as the reduction in cost with respect to the level of aggregation of users, keeping network endowment constant. Results showed that economies of scale did affect utilities operating along the full water-service chain: utilities serving less than 50,000 customers benefitted the most, followed by those serving 50,000 to 150,000 customers. But, as the authors correctly underlined, there was no general agreement in the literature concerning economies of scale. On the other hand, results were more intuitive for economies of density: the research highlighted the fact that firms operating in densely populated areas achieved the lowest cost per unit of water delivered. In particular, for a 1% increase in the volume of water delivered, the utility's total cost would increase only by 0.16–0.34% while if the network length increased by 1%, the total cost could rise significantly, by about 0.53–1.07%. Lastly, the authors also discussed efficiency scores with respect to the ownership structure of the utility: the ones owned by Municipalities scored the greatest inefficiency levels. As widely argued by Guerrini et al. (2018), the analysis on efficiency is not without limitations. In fact, there are a significant number of variables that do play an important role in the provision and management of the service and may be difficult to include. At the same time, these investigations may be a starting point for decision-makers, managers and stakeholders to implement better and more uniform tools to collect information.

The importance of applying research outputs to improve policy was particularly stressed by Bonacina et al. (2014) who, after having compiled a multi-year Data Envelopment Analysis to define efficiency scores, proposed some guidance on how to improve the tariff method on the basis of their results. Few scholars applied such a valuable approach, despite a vast branch of research being interested in factors such as the role of "europeanization" (Asquer 2009) or, more generally, policies and the effect of monetary instruments (*ça va sans dire*, tariffs). For example, Miniaci et al. (2008) examined in depth the effect of the utilities[9] reform on the consequent tariff dynamics evaluating, in particular, the subsequent effects on family budgets. Concerning water, they found that the ongoing reforms (1998–2005) were not exacerbating affordability issues.[10] Massarutto (2007) also addressed the issue of affordability of public water services, though marginally. In particular, the author discussed water price structure and the full-cost recovery approach and underlined that sustainability was not always a direct consequence of this last approach. In fact, sustainability could assume different shades with respect to the target. Massarutto (2007) further underlined that, when addressing ethical and social issues, volumetric tariffs and equalisation may be more effective.

Other authors, such as Romano et al. (2015), preferred to address the effects of tariff reform by studying specific cases. Though extremely valuable, similar approaches have been excluded from this study. Indeed, case studies allow for a higher inclusion of more detailed information and deeper analysis of specific topics. But, on the other hand, the choice of the case study may be directly influenced by the author's expectations. This is known as "cherry-picking", that is, the propensity to select only elements which tend to confirm the author's beliefs rather than to provide a "general truth" applicable to all contexts (Massarutto 2012). Indeed, in the case of water for civil use too many global variables play a significant role – including socio-political ones – so case studies would distance the results from the main framework too much to evaluate the effect of a policy.

Instead, it is very useful to examine specific segments of the sector (such as distribution, collection or treatment) or to focus on particular characteristics (such as water safety, energy efficiency, etc.).

A very useful example is provided by Fraquelli and Giandrone (2003), who addressed the issue of the efficiency of the wastewater treatment system. Their results indicated that the aggregation strategy undertaken until then by the sector seemed to be positive for improving efficiency: findings highlighted that the most efficient plant size was above 15 million m^3 of water per year, equivalent to 100,000 inhabitants. This threshold is far larger than the average size of a utility in 2003 but also smaller than that of the ATO, allowing a fair competition in the areas. As shown, measuring the performances of the water system, from an economic point of view, is an extremely challenging exercise. One of the main reasons is the significant number of variables and actors that determine the functioning of the system. The next section will show that other sectors which use water face similar limitations.

[9] Including not only water but also electricity and natural gas.

[10] The authors (Miniaci et al. 2008) set the threshold of water poverty whenever the budget for the water services was higher than 1.44% of the family potential budget.

3.4 The Economic Value of Irrigation

Italian agriculture has a high rate of water use. Indeed, the sector represents more than one half of total water withdrawals in the Country (Massarutto 2015), placing Italy among the countries with the highest per capita water usage rates in the world. However, it should be specified that not all the water withdrawn reaches the irrigated agricultural surfaces. Part of it is lost due to leakage during distribution – which anyway return to the aquifer through percolation – and part of it is withdrawn to feed channels or other artificial water bodies – which may serve different functions than irrigation. ISTAT (2014) estimated that, in 2014, only 58% of the total withdrawals of water for agricultural use was actually employed for irrigation. This is, obviously, an indicative estimate which changes from year to year, because irrigation depends on several variables including rainfall, water availability, crop types and cultivated surfaces. The climatic condition of Italy, which enjoys a Mediterranean climate, as well as the large (even if uneven) availability of water due to the presence of lakes and mountains throughout its territory are factors that encourage the use of this technique. Indeed, Italy is the country that has the second most irrigated agricultural surface in Europe, following Spain. These conditions have bolstered the adoption of irrigation over the years, even for crops that until recently have not required it, such as wheat and grapevines.

To estimate the cost of irrigation the concepts of "scarcity and opportunity cost", as described by Brouwer (2004), have been a common applied methodology. Those concepts are based on the idea that for any cubic meter of water, there are multiple competing utilisations which cannot be simultaneously satisfied. This means that the use of a unit of resource in one sector prevents its use in a second one, therefore making the choice exclusive. If the natural availability of the resource exceeds the total of potential applications, the cost of scarcity is zero: each user will be able to dispose of the quantity he wishes to use and there is a quantity that will remain unused. On the other hand, whenever resource availability is not sufficient to satisfy the total demand, something (i.e., one of the applications) will be traded off defining, then, the cost of the resource. Translating this economic theory to Italian agriculture, it is possible to affirm that the "exit price" of irrigation in intensive production, considering the European and national regulations in force in 2001, could vary from 0.10 to 0.40 €/m^3 when the water is distributed on arable land (Massarutto 2003). Higher values may be reached when considering more valuable crops: as much as 0.50 €/m^3 for vegetable or fruit crops and up to 1–1.4 €/m^3 for greenhouse crops. Surprisingly, the authors found that a possible variation in water prices (i.e., following a reduction of European and national support) would not necessarily determine a switch in culture or resource consumption. In fact, high-value crop producers tend to show a lower elasticity to price and, as a consequence, the farmer may prefer to improve water productivity rather than give up production. At the opposite, wherever productive agriculture remains in place (i.e., maize), but full cost recovery is then required, the 'exit price' becomes lower: it follows that, if possible, the farmer may choose to switch to more profitable crops. Being price elasticity quite limited anyway, when such a switch in cultivated crop could not take place, low-income crops such as maize will continue to be irrigated (Massarutto 2003). Similarly, Galioto et al. (2017) proved that irrigation water is characterised by an inelastic demand. They demonstrated through an economic optimisation model that the change in pricing criteria would not cause substantial variations in water use. However, the authors also shown that an increase in water prices could incentivise water saving irrigation solutions even for arable crops. A second but no less important challenge to agriculture and irrigation systems are droughts. Musolino et al. (2017) and Massarutto and de Carli (2009) demonstrated that the greatest impacts of water scarcity are absorbed by the agricultural sector: however, these are in large part transferred downstream in the form of price increases. The consequence of this is that the greatest impact ultimately falls on consumers. Massarutto and de Carli (2009) used the costs incurred in the lost agricultural production and their repercussion on the prices of agricultural products (which have increased in the face of a scarcity of supply) in order to analyse the costs caused by the strong drought of 2003 in the Po river basin. Specifically, the costs attributable to the lack of production due to that event were equal to €749 million, which translated into an effect of higher prices equal to €1377 million. Considering also that the consumption of agricultural products was equal to €1468 million, this resulted in a loss of consumer welfare equal to €91 million (Massarutto and de Carli 2009). Also, speaking of water used for agricultural irrigation, in 2012 Verlicchi et al. conducted a study on the recycling of purified wastewater both for the business-as-usual irrigation of the fields as well as to deal with extreme shortages. Specifically, the analysis was carried out on a purification plant located in Ferrara, in the Po river basin: an area, as already discusses, particularly prone to severe weather shocks. The economic approach used in this case was that of a cost benefit analysis. The results obtained have demonstrated that for a treatment plant with a purification flow capacity of 250 l/s, it is possible to irrigate up to 540 ha of orchard. This translates into a benefit of around €1.11 million per year for local farmers. It follows that in the event of a drought, a condition increasingly frequent in the Po river basin, this benefit could turn into minor losses of production for farmers, due to the availability of water guaranteed by the treatment plant.

Recently, Pérez-Blanco et al. (2018) focused instead on the impacts of irrigation restrictions in the lower Po river basin. Through the application of both a Revealed Preference Model and a Multi-Regional Impact Assessment, which are respectively micro and macro-economic tools, the authors firstly estimated the impact of water constraints on farmers' incomes and then calculated the resulting repercussions across sectors and regions. They found that a hypothetical restriction of 6.5% of water withdrawals (25 Mm^3) would cost about 0.26 €/m^3 while, in a more restrictive scenario, a reduction of 39% of water withdrawal (150 Mm^3) would cost about 0.41 €/m^3. It should be highlighted that the consequent losses in gross value added are not confined only to the agricultural sector but are also found in the whole food, chemical and refinery industries. It follows that the total loss may vary from €0.95 million (1% constraints) to €4.47 million (50% constraints) with respect to the severity of the reduction considered.

A second strong theme linked to the use of water in agriculture concerns pollution of the aquifers, in particular the percolation of nitrates from cultivated areas. An economic methodology applicable to estimate the cost of nitrate pollution is the concept of benefit transfers, as suggested by Raggi and Viaggi (2009). The benefit transfer methodology evaluates the value of an asset or a policy considering the externalities it produces in a certain context and adjusting those to the context of interest, for which it is not possible to carry out a primary study (Boatto et al. 2008). Raggi and Viaggi (2009) evaluated the external cost of the use of fertilisers, which also has an impact on water resources, in Emilia-Romagna and found it to be equal to 53.6 €/ton of nitrogen.

Focusing on the same area, Galioto et al. (2013) estimated the economic cost and benefit of abating pollutants and respecting the Water Framework Directive by reducing the pressure on hydrological resources. The duty to respect the ecological status of water is, anyway, not only up to agriculture but also to all of its users: this is why industry, utilities and other sectors were included in the analysis. The research combined the Cost-Effectiveness Analysis (CEA) with the Cost-Benefit Analysis (CBA). The first methodology evaluates the level of success of a hypothetical strategy by comparing monetary benefits to physical ones (expenditure to remove the pollutant versus pollutants removed) while the second fully monetises all the benefits without reporting physical indicators.

Concerning agriculture, the various measures that have been implemented – such as pesticide prohibition or substitution, extensivisation for livestock and crops, buffer strips, manure treatment plants, etc. – have meant the cost of giving up pesticides to be equal to 30% of the gross income that would have been derived from the treated crop. If the polluting agents were substituted with alternative products rather than banned, then the loss would be minimised to “only” 5%. In conclusion, comparing the total benefit of protecting waterbodies[11] to the total cost, including the one borne by agriculture, industry and utilities, the authors find a ratio benefit-to-cost equal to 0.15: where benefits are estimated to be about €53 million per year and costs about €349 million per year. When considering the results from the article by Galioto and colleagues, it should be noted that the level of aggregation may influence the cost assessment. A further remark is that those who benefit from the positive outcomes are not always the ones bearing the costs. In fact, the higher benefits are derived both from the use value of the resource, either cost saving for drinking water treatment (0.80 €/m^3) or emergency interventions in case of droughts (0.79 €/m^3), and non-use value. The latter in particular is evaluated based on households’ willingness to pay to ensure a proper recreational and ecological status of the water bodies (evaluated between 6.89 and 10.14 €/household). It is thus clear that it is extremely problematic to determine the economic value of certain activities when only one sector is investigated as water has multiple potentially exclusive uses which affect and involve multiple stakeholders, complicating this analysis (Table 3.2).

[11] Both surface and groundwater ones.

Table 3.2 Economic values connected to water use in agriculture

What	Values	Unit of measure	Source
"Exit price" of irrigation in intensive production	0.1–0.5	€/m³	Massarutto (2003)
Vegetable/fruits irrigation	0.5	€/m³	Massarutto (2003)
Greenhouse crops irrigations	1.2	€/m³	Massarutto (2003)
Loss in consumer welfare due to droughts in the Po river basin	91	Million euro	Massarutto and de Carli (2009)
Impact of water constraints (restriction of 22.75% on withdrawals) on farmers' incomes	0.33	€/m³	Pérez-Blanco et al. (2018)
Impacts of water restrictions reflected in the whole food, chemical and refinery industries (−25% restrictions)	7.42	Million euro	Pérez-Blanco et al. (2018)
Use of purified wastewater in the Po river basin	1.11	Million euro per year for local farmers	Verlicchi et al. (2012)
External cost of the use of fertilisers	53.6	€/ton of nitrogen	Raggi and Viaggi (2009)
Economic benefit of abating pollutants and respecting the Water Framework Directive by reducing the pressure on hydrological resources by banning or substituting pollutants	53	Million euro per year	Galioto et al. (2013)
Economic cost of abating pollutants and respecting the Water Framework Directive by reducing the pressure on hydrological resources by banning or substituting pollutants	349	Million euro per year	Galioto et al. (2013)
Use value of the resource – cost saving for drinking water treatment	0.8	€/m³	Galioto et al. (2013)
Use value of the resource – emergency interventions in case of droughts	0.79	€/m³	Galioto et al. (2013)
WTP to ensure a proper recreational and ecological status of the water bodies	8.51	€/household	Galioto et al. (2013)

3.5 Industry and Energy: A Focus on Hydropower

To the authors' knowledge, there are no comprehensive studies on the economic value of water in the industrial sector. Instead, in line with today's most pressing environmental challenges, many industries have tried to address the water-energy-nexus through environmental assessments. Indeed, improving environmental performance may determine several advantages: financially, enhancing efficiency (more output with less input) may lead to significative savings; moreover, if properly communicated, high environmental performance may lead to an increase in the industry's competitive advantage by gaining consumers' loyalty (Proto and Supino 1999). It should therefore not be a surprise that many private firms are producing studies about the impact of their product from cradle-to-grave. Obviously, most of the time, these studies also include water use.

For example, the input-output methodology may be applied by firms as a planning tool to support their strategic choices. Indeed, this process makes it possible to measure the variation in environmental impact following changes in input flows. This approach was used by Albino and Kühtz (2004), who analysed an Italian company producing tiles sold internationally. The authors found that for each ton of packaged a minimum of 0.73 m^3 of water was necessary. The result was then the starting point to monitor the following firm's performance. Anyway, the most diffuse indicator of water use is the water footprint (WF), defined as the cumulative amount of water consumed or polluted in the entire lifecycle of a product (Ruini et al. 2013; Bonamente et al. 2016).[12] The power of the WF approach is its comprehensiveness. It includes the source and quality of the water used (blue – groundwater or surface; green – infiltrated; grey – polluted water) and the location and time of its use, not only for the final product (direct WF) but also for its supply chain (indirect WF).

The detailed level of information provided by a WF assessment, allows managers to set measurable targets for their environmental and business strategies. For example, Bonamente et al. (2016) found that a typical bottle of red wine produced in the centre of Italy, has a water footprint of 578.1 litres. Of those, 77.95% is due to the use of green water in the production of grapes, 7.4% is due to the use of grey water in the production of the packaging (the glass bottle mainly) and 8.72% is due to distribution processes. Similarly, Ruini et al. (2013) investigated the water footprint of one kilo of durum wheat pasta produced by Barilla either in Greece, Italy, Turkey or the United States. They found that, in Italy, from field to distribution, the product requires 1336 litres of water, 200 litres less than in Greece and 1511 less than in Turkey. These differences are mainly due to the climatic conditions or the efficiency of cultivation techniques in the area of growth, but also to the water requirements of other processes such as milling. In general, cultivation is the most water-intensive activity followed by production, packaging and milling.[13] The fact that a product, for which production water has been used, may be displaced and traded implies that its "virtual content of water" has also moved with it. This concept is commonly described as virtual water trade. In the case of pasta production, considering Barilla's trade only, Italy in 2009 was a net virtual water importer (53 million m^3) for which mainly wheat trade was responsible for. Barilla's management changes, such as the relocation of its input provision, allowed Italy to become a net virtual water exporter in 2011 (17 million m^3).

The concept of virtual water trade was widely addressed for a vast variety of topics and products. However, the attention was mainly focused on agricultural commodities, livestock, food and beverages or other industrial items. Unfortunately,

[12] On the notion of water footprint and its application to Italy's trade in agricultural goods see also, in this volume, Chap. 10 by Tamea, Antonelli and Vallino.

[13] Cooking was not taken into account in the previous figures.

despite the significant water footprint of the energy sector there are no recent studies focusing only on the water virtual trade embedded in energy at the national level for Italy. Ali et al. (2018) analysed the national virtual water use and trade between 2000 and 2009 finding that the electricity, gas and water supply sector required almost 10 km^3 of water per year. Despite this, the virtual water trade balance (exports minus imports) was still negative and variable by about 4 to 5 km^3 per year. It is plausible to expect these numbers to have changed over the last few years as a consequence of higher efficiency and environmental awareness.

Miglietta et al. (2018) calculated the energy water footprint of Italy from 2007 to 2016, accounting for everything from the construction of power plant facilities to fuel supply and operation.[14] The authors noticed that fossil fuel power plants accounted only for 4.4% of the total water consumption in the period of interest, the remaining water footprint was instead due to renewable resource exploitation. Nevertheless, when excluding hydropower[15] from the calculation, fossil fuels were responsible for 85% of total water consumption. Interestingly, the authors also computed the economic water productivity index (that is, the value of electricity derived for one unit of water consumed, measured in euro per cubic meter) distinguishing between consumers (industrial versus domestic), sources of electricity (fossil fuels, renewables with/without hydropower) and consumption class (thresholds of kilowatt-hours). Results showed that the greatest value was provided by fossil fuels in the <20MWh consumption class of industrial consumers with 106.71 €/m^3 while the lowest was provided by renewables plus hydropower in the 70–150 GWh consumption class of industrial consumers with 0.73 €/m^3. However, the average value of renewables excluding hydropower proved to be competitive with fossil fuels: the average value derived from fossil fuel power plants for domestic consumers corresponded to 66.17 €/m^3, while it was 60.03 €/m^3 for renewables. On the other hand, the average value derived from fossil fuel power plants for industrial consumers corresponded to 89.08 €/m^3, while it was 80.78 €/m^3 for renewables. Those are extremely high if compared to the average value derived by renewables plus hydropower which are respectively equal to 1.60 €/m^3 per domestic consumers and 1.19 €/m^3 per industrial consumers. It is important to consider, however, that the value of water consumption by technology on which the previous study was built were not specific to Italy but referred to a wider European region.[16]

Massarutto and Pontoni (2014) instead assessed the economic scarcity rent, that is, the "surplus value accruing to the owner of a resource on top of the long-run marginal costs of supplying it", derived by hydroelectricity generation. This study is of particular importance as it is the only one assessing the value of water resources in the Italian energy context and discusses how this could be redistributed between

[14] Biomass sources, concentrated solar power, nuclear and hydropower pumping stations were excluded from the study.

[15] Which, back to 2015, was providing around 16% of total production against the 76.9% of fossil fuels.

[16] The authors based their work on the data on water footprint produced by Mekonnen et al. (2015); therefore, such data have not been reported as not specific for the Italian case study.

the producers and the owner, that is, the local authorities or the central Government. The authors suggest that – on the occasion of hydroelectric concessions' renewal as well as with the new environmental and market regulations – local authorities could extract part of the rent now gained by producers or push producers to reinvest it in more stringent environmental protection measures. In the study the rent generated by hydropower is estimated to range between €0.94 and 1.57 billion per year at national level: with the rent extraction methodology proposed, such as a proportional fee on revenues, local authorities would be able to retain on the territory up to 90% of this value.

The water use and the relative environmental impact produced during electricity generation, by any source, was instead assessed by ExternE – Externalities of Energy (CIEMAT 2000), a project supported by the European Commission on the externalities connected to electricity production. For what it concerns Hydropower, the project evaluated the externalities of a power plant in Northern Italy, looking especially at its impacts on ecology, landscape and society. Impacts on ecology include all the externalities that derive from changes in the hydrology of the river: from changes to water quality (valued at 0.069 mECU/kWh) to changes in the river's ecosystem (2.478 mECU/kWh). Negative effects on river morphology and hydrology due to changes in the quantity or pattern of water flow, were instead estimated to be around 0.181 mECU/kWh. Impacts on society included mainly changes in recreational activities and occupational health due to the variation in water flows (0.077 mECU/kWh). Lastly, the aesthetic impact due to changes in landscape was assessed to be around 0.067 mECU/kWh. Concerning externalities caused by stages other than production – such as construction and transmission – they were found to be unquantifiable or negligible. However, in 2020, the actualised value of their impact is equal to 4.67 €/MWh.

At the same time, hydropower is one of the most important renewable and low carbon technologies that Italy has on its own territory. Its presence has also had a redistributive effect on wealth in the areas where it exists, which are generally rural and depopulated. For this reason, Pontoni et al. (2014) proposed a new environmental tax[17] to internalise the environmental costs induced by hydropower installations and their operation. Implementing an environmental tax as proposed by the authors would increase the marginal cost of damaging river ecosystems therefore nudging producers to change their environmentally impactful behaviours. The performance-based environmental fee proposed by Pontoni et al. (2014) was applied by Pontoni et al. (2016)

[17] The authors proposed the innovative fee for reforming the methodology in use to charge water abstractions for hydropower in Italy to implement the polluter-pay principle (PPP) required by the new European regulations (namely the Water Framework Directive). The directive requires water abstraction charges to reflect both the value of the resource and the environmental impact caused by water users. For this reason, the proposed fee is based on the simple assumption that "any form of environmental tax should be at least proportional to the environmental damage that it is caused" (de Carli et al. 2014, p. 144). The particularity of the methodology described by the authors is the capacity to take in account not only the "intensive" component of the impact (i.e., the magnitude and gravity) but also the "extensive" one (i.e., the grade of dispersion of the impact from the cause or, simply, the length of the river affected).

Table 3.3 Economic values connected to hydroelectric production

	Source	Value	Unit of measure	Reference year
Hydropower rent in the Sondrio Province (Lombardy)	Massarutto and Pontoni (2014)	1.25	Billion euro	2014
Impacts on ecology, landscape and society of hydropower	Our elaboration based on CIEMAT (2000)	4.67	€/MWh	2020
WTP for improving the ecological status of a river connected to hydropower production	Pontoni et al. (2016)	160	€/households	2016

to estimate the effect of its implementation in the Italian Province of Sondrio. First, the authors estimated the value of the fluvial ecosystem and evaluated stakeholders' willingness to pay for improving the ecological status of a river. The WTP was estimated through a discrete choice experiment to assess attitudes towards the integrity of the fluvial ecosystem, hydro-peaking (i.e., sudden variation of flows), water-related recreational activities (e.g., canoeing) and bill increases. Results pointed to a high WTP, up to €160 per year per each household of the region to improve the ecological status of regulated rivers. The cumulated WTP was then transformed into a measure of the unitary cost of impact to be applied in the calculation of the tax discussed previously. The authors found that, despite the fact that the tax could partially erode the rent obtained by hydropower producers, the business would still be profitable and capable of internalising its social costs.

From these studies, it is thus clear that water use is not neutral and requires efficient technical, political and economic planning to be sustainable. Unfortunately, especially when considering studies on virtual water and energy, the need for a better understanding of the Italian context emerges (Table 3.3).

3.6 Recreational and Existence Values: The Value of Water to Communities and Individuals

As mentioned above, measuring the economic value embedded in the water system is an extremely challenging exercise due to the significant number of variables and actors involved. Until now, studies mainly concerned with the productive uses of water have been considered. In this section, the same topic will be addressed from a different point of view: the one of individuals.

There are several indicators to estimate the economic value that consumers assign to water services. One of the most common is willingness to pay (WTP). Indeed, according to Guerrini et al. (2017), "WTP can be considered a form of stakeholder engagement for improving water services, for example, by supporting investments". In their study, given the need of the water system operator (Acque Veronesi) for urgent investments in the infrastructure, a sample of consumers was tested through the contingence valuation method to examine their WTP for the improvement of three services: quality of water sources, renewal of the water network and construction of new wastewater treatment plants. Results showed that consumers were willing to accept an average tariff increase around €12 per year for general improvement. The highest WTP was given for investments meant to prevent the risk of water source contamination (€12.6 per year), followed by investments in networks (€12.3 per year) and last those in wastewater treatment plants (€11.5 per year). The study explained the existence of a strong correlation between WTP, water quality, and consumer experience at utility offices. Indeed, it estimated that reductions in water and helpdesk quality also reduced the WTP of the consumer for the realisation of investments. On the other hand, education, attitudes towards the environment, preference towards privatisation, income and young age were associated with a higher WTP. Concerning age, a similar study by Masserini et al. (2018) investigated the relationship between pro-environmental behaviour, water conservation policies and willingness to pay of a sample of students from the University of Pisa for the implementation of sustainable harnesses and improvement of the water system. The authors found that family values also affected students' WTP. Moreover, the results of the study show that water saving behaviour improved significantly as a response to a possible introduction of higher tariffs to reduce water consumption. It remains useful to increase water saving awareness in order to reduce consumption.

The role of gender, instead, is still highly debated: while Guerrini et al. (2017) did not find any statistically significant difference in the WTP of male and female respondents, Masserini et al. (2018) concluded that women were more inclined to implement water saving behaviours. Contrary to this, while investigating the willingness to pay for agricultural and environmental safety, Travisi and Nijkamp (2004) found that willingness was dependent on the goal: female consumers had a higher WTP to achieve human public health objectives, while the male ones had a higher WTP to protect the biodiversity of agricultural systems. This paper is of particular interest as it investigates willingness to pay to improve water quality with a very specific focus: groundwater protection from pesticides in the area of Milan. The study applied the contingent valuation techniques (as in the case of Guerrini et al. 2017) combined with a choice experiment technique. The combination of these two economic models, in addition to a trade-off between money, health or environmental benefits, has also allowed respondents to differentiate the value they assign to each environmental aspect. The results highlight that if a food's production process increases groundwater pollution levels, then the willingness to buy that food decreases. The study, in line with previously reported results, also shows that a greater level of ecological awareness and knowledge of environmental issues increases consumers' WTP. Furthermore, the result of the interviews proved that the inhabitants of Milan were willing to pay on average €15 per month per household to avoid a 1% increase in the contamination of water and agricultural soil and €3 per household per year to prevent a case of human health-related diseases.

It should be noted that other non-productive uses of water may also have a value for certain stakeholders. An Italian case study by Paccagnan (2007) aimed to analyse the recreational value of Lake Idro, located in Lombardy. Over the course of the twentieth century, the basin has seen a depletion of the quantity and quality of its waters due to various uses, including agricultural and hydroelectric. Indeed, significant withdrawals had greatly reduced its depth, bolstering problems of water pollution. Nevertheless, in recent years, recreational and environmental use has also been increasing. As the author put it, “people’s welfare can increase not only through direct consumption of goods and services, but also from the fruition of a clean environment”. For this reason, the author investigated the value assigned to the lake by users for practicing recreational activities such as beaching, swimming, fishing and windsurfing. Consumer surplus (CS), also according to Willig (1976) in Paccagna (2007), is considered a good proxy for WTP: as such, the study focused on determining the consumer surplus both at the time of the study and in an alternative scenario that accounts for an improvement in the quality of the water body. Considering, among other things, the travel cost model and comparing it to the travel costs for alternatives to Lake Idro, the result was that the CS of the current scenario was €134 per individual, while in the scenario with better water quality, the CS would have increased up to €173 per individual. Similarly, Albertini et al. (2007), estimated consumer surplus through the travel method to the lagoon of Venice, another environmentally endangered Italian body of water. In this case, the authors chose to concentrate on a particular section of users: anglers. Under the “state of the art”, both in terms of water and environmental quality (which are connected to catchment rates), the average consumer surplus corresponded to €1774. An eventual improvement in the characteristics of the body of water would have increased the surplus by almost 60% with obvious significant differences between angler residents in the area of the lagoon and those living outside the area.

From these last paragraphs it is thus clear that environmental evaluation is fundamental both to economists and policymakers in order to assess certain benefits derived from hydric resources that are rarely accounted for in the market. Moreover, specifically in the case of the Lagoon of Venice and Lake Idro, similar studies are fundamental “to tackle with the public good nature of the benefits of preservation, which entails an under provision of this good as a consequence of the free-riding problem” (Paccagnan 2007).

3.7 Conclusions

The focus of this chapter was on the economic analysis and the economic value of different water uses in Italy. Given the breadth of the reform introduced in 1994, most of the existing literature and, consequently, most of the chapter was devoted to the urban water service. The literature review shows that water uses are often analysed in “isolation”: no comparative studies among uses have been carried out so far in the Italian context. Fragmented water governance dominated by an excessive number of entities and a dramatic lack of data can partially be blamed for this important gap in the literature.

As a consequence, many of the studies here illustrated focus on one specific sector. Given the possibility of using the same water for different uses, the lack of comprehensive cross-sectoral studies is a limitation for the development of a resilient water economy in the Country. Nevertheless, data availability is a limitation to the development of more comprehensive analyses: as it has been made clear since the introductory part on water uses in Italy, data sources are not homogeneous in time, space and collection method; hence, comparisons must be made with caution. Similar issues are obviously highlighted in the analysis concerning urban water management, where precise data would be necessary for a better estimation of the success of the new regulation implemented in the sector in 1994 (*Legge Galli*). Despite this, the implementation of the law seems to have driven the local managements towards more integrated systems even if further studies are necessary to define their level of efficiency. Indeed, the complete overhaul of a public service and its alignment to European regulations take a lot of time, especially as this requires significant investments. It is then clear that further studies are necessary to evaluate the actual efficiency of the new system.

The studies on water in the agricultural sector are divided mainly in two branches: the use values of water (which was found to range from 0.3 to 1.2 €/m^3) and the total economic costs and benefits of certain measures, such as for drought management or pollution reduction. As far as industry and energy are concerned, the economic value of water is rarely evaluated, especially in the manufacturing sector, while most studies seem to address the environmental impacts of production, by estimating the water footprint.

The last section of the chapter explored the value of water for ecosystem resilience, environmental protection and recreational use. In the studies here analysed, the willingness to pay ranged from €3 to €180 per year per household for environmental and health protection in the agricultural sector; from €11.5 to €12.6 for improvements in the water urban services; and from €163 to €1056.32 in the recreational sector. As to the energy sector, only one study was reporting the willingness to pay for improving the ecological status of a river connected to hydropower production (equal to €160 per household per year).

In the end, institutional and research fragmentation do not allow for a comprehensive and updated picture of water uses, water consumption and the value of water in Italy for all the possible different uses. As a consequence, this gap makes the assessment of whether water tariffs and water charges are able to internalise all costs of the provision of the resource impossible. The guiding principle of the European Water Framework Directive is that of full cost recovery, which includes scarcity value and the internalisation of environmental externalities. The current Italian institutional framework, including the different tariff design mechanisms for the different sectors, and the current scientific literature analysed in this chapter show that Italy is far from being correctly implementing this principle.

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Chapter 4
Testing the Waters: A Sociological Analysis of Domestic Water Use and Consumption

Filippo Oncini and Francesca Forno

Abstract By looking at water as a sociological object of analysis, the chapter outlines how the insights obtained from sociology can help to a great extent when framing both water as a commodity and water use as a practice. Building on the existing literature, the chapter discusses the specificity of Italy as a meaningful case study and focuses on water saving behaviour and bottled water consumption as two facets of water sustainability. After a preliminary account on the sociology of water and on the characteristics of the Italian context, we make use of the 2014 Multipurpose Survey of Daily Life and the 2014 Survey on Household Consumption by ISTAT to analyse whether water saving behaviour and bottled water consumption are stratified by economic and cultural resources. We provide evidence that while water saving behaviour is almost evenly distributed across the population, the probability of purchasing bottled water is highly dependent on the economic resources of the household. In the conclusion, we discuss our findings and their major limitations, and provide some additional research questions that sociologists could help address.

Keywords Water consumption · Bottled water · Tap water · Sustainable use

4.1 Introduction

Over the past decades, water consumption has become a theme of utmost importance for social scientists at large. The impact of climate change and the demand of people for water resources are dramatically increasing (UN 2015). Since the 1990s, the United Nations have been urging Member States to include water policies in their political agenda, stressing the importance of public interventions at all levels,

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from water and sanitary systems to household consumption choices, as water uses and misuses have an important impact on sustainable development.

Research on domestic water consumption has shown how water demand and uses can potentially be affected by a variety of factors. As a consequence, the search for determinants has attracted scholarly attention across numerous disciplines. Beside research works on the relation between water consumption and utilities tariffs, ownership structure, water conditions, household characteristics, climate and geographical features – mostly in the domain of economists and political scientists – a bulk of studies have also analysed how water consumption and uses may be related to people's environmental knowledge and values. Within this body of works it is often discussed how water saving behaviour and water bottled consumption are associated with several socio-psychological factors such as values, beliefs, attitudes, and environmental concerns (e.g. Leiserowitz 2006; Russell and Fielding 2010; Price et al. 2014; Van Der Linden 2015; Aprile and Fiorillo 2017). Over the last years, sociological interest has been growing and new frameworks for the analysis of water use *as a social practice* and drinking water *as a commodity* have made their appearance on the scene. Nevertheless, sociological attention towards the social stratification of water uses has been so far scarce, despite this issue could widen the debate and provide alternative interpretations and policy advice.

Using Italy as a case study, this contribution makes use of two large samples of the Italian population to explore the social stratification of water waste behaviour and bottled water purchase. The study of these two water-related behaviours in the Italian context is particularly interesting for two main reasons: first, water use seems a particularly salient issue for Italian citizens, as demonstrated by the great turnout at the 2011 referendum aimed at the abrogation of the rules approved by the Parliament in support of the privatisation of local public services, including water management (Carrozza and Fantini 2016).[1] Second, the consumption of bottled water per capita is the highest in Europe and third worldwide only after Mexico and Thailand (Beverage Marketing Corporation 2018), despite tap water being drinkable practically all over the country.

For this twofold reason, in the next section we introduce the sociological perspectives that have been used to study domestic water use and bottled water consumption, highlighting the nascent state of the field within sociology. Secondly, we discuss in depth why Italy represents a meaningful case study in comparison to other countries, by focussing on the referendum of 2011 and on the comparatively high consumption of bottled water (Sect. 4.3). We then move to the empirical part (Sects. 4.4 and 4.5), where we use the Multipurpose Survey of Daily Life (MDL) and the Survey on Household Consumption (SHC) by ISTAT to explore whether and how bottled water consumption and water saving behaviour are socially patterned. In the conclusion, we discuss our findings and their major limitations, while providing some additional research questions that sociologists could help address.

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[1] On this see also, in addition to Sect. 4.3.1 of this chapter, Chap. 11 by Turrini and Pertile in this volume.

4.2 Water as a Sociological Object of Analysis

When looking at sociological debates, one may be struck by the ability of scholars to gaze out at every possible facet of social life. A "sociology of" indeed exists for every aspect (e.g. social stratification of labour or gender inequalities), process (e.g. social and cultural reproduction), life stage (e.g. childhood or adulthood), or good (e.g. food or music), which in turn can be combined to produce quasi-infinite lines of investigation (e.g. social class differences in the transmission of gendered food preferences from parents to children). In this light, it is rather surprising to notice that a "sociology of water consumption" is still in its infancy. Despite water being the most important natural resource, and in Maussian terminology a "total social fact" (Orlove and Caton 2010), sociologists' efforts have thus far not cumulated to produce a clearly identifiable field of research that looks at water dynamics at the micro, meso or macro level. Yet water has become an urgent theme, as its depletion, privatisation, contamination, scarcity and unequal distribution are – or at least should be – more and more in the political agenda, especially in times of global warming and increasing world population growth (FAO 2015; WWAP 2015; 2019; WWF 2019).

Among scholars interested in the sociology of (water) consumption two main lines of research have recently emerged. Despite a common interest in sustainability, these two can be roughly distinguished by their focus on water use as a social practice and drinking water as a commodity. The former has been looking at the use of water in the course of routinised social practices, namely those everyday acts of consumption, which despite being almost invisible and inconspicuous, can consistently impinge on the use of natural resources. Starting from the arguments put forth by Schatzki (1996) and Reckwitz (2002), scholars within this tradition recognise practices as the main unit of social analysis, which exists simultaneously as (1) organised entities comprising many interconnected elements – "forms of bodily activities, forms of mental activities, 'things and their use', a background knowledge in the form of understanding, know-how, states of emotion and motivational knowledge" (Reckwitz 2002, p. 249) – and as (2) performances, namely the actual 'doing' of them by their carriers. Since practices follow norms and shared understandings, practitioners generally tend to perform them consistently and similarly across space and time, though the possibility to "adapt, improvise, and experiment" leave room to modification and change (Warde 2005; Shove 2010; Evans et al. 2012). Within this framework, many ordinary, but water-intensive activities have been reconsidered and particular attention has been paid to showering and laundry routines (Hand et al. 2005; Jack 2013; Pullinger et al. 2013a; Mylan and Southerton 2018). These practices are usually examined by looking at the arrangements that result from:

(i) Technologies and materials (materiality), to disentangle all the physical elements involved in the practice. For instance, Mylan and Southerton (2018) single out the function of dirty laundry baskets as "barometers to regulate the laundry flow", and the many ways in which household infrastructure and spaces are used to dry clothes.

(ii) The ordering or fragmentation of shared social rhythms (temporality), to understand how laundry or showering routines are scheduled and become socially patterned. For instance, laundry still signals the gendered division of domestic labour, while time-use surveys highlight that people shower more often than in the past decades (Hand et al. 2005; Mylan and Southerton 2018).
(iii) The frames of meaning that constitute conventions and social norms (conventionality), to comprehend how the practice has acquired a relatively fixed and shared understanding. For instance, Jack (2013) engaged a group of participants to wear the same pair of jeans without washing them for 3 months to bring to surface the hidden conventions regarding the "visibility" of cleanliness.

As water is not reducible to its molecular properties, the investigation of its social (ab)use cannot overlook the configuration of these three elements, which continuously interlace to reproduce or modify a practice. Thus, in their exemplification, Hand et al. (2005) illustrate how accounts for showering could consider at once the (i) innovation in plumbing, heating or power jet (materiality), (ii) the cultural history of the body and the changing significance of cleanliness (conventions), and (iii) shifts in the temporal ordering of showering, from collective Sunday bathing to privatised arrangements that allow for more fragmented moments of washing (temporality).

This framework has been rather successful in the past 15 years for its twofold contribution to the study of sustainable consumption. A methodological one, because besides being able to conjugate quantitative and qualitative techniques (Pullinger et al. 2013b), it sets out clear indications on how to identify and define a consumption practice, what social levels can be observed, and an analytic rationale to decompose the practice in its sequential activities (Mylan and Southerton 2018). But also a theoretical one, as it departs from approaches rooted in neo-utilitarian and cognitive-based theories which consider consumers' attitudes and choices as the main units of analysis (Shove 2010). Contrarily, practice theorists propose interventions that are not based on individuals' behaviours, but rather on the complex arrangement of the practice itself. As an example, one may imagine an intervention aiming at reducing households' water waste that leverages on both the water efficiency requirements of buildings or devices (shifts in materiality) and on the promotion of a "contest" that awards families with lower yearly water consumption rates per capita (shifts in conventionality).

A second, more scattered, area of sociological investigation has delved deeper into the rise of bottled water consumption. As noticed by Jaffee and Newman (2013a, p. 2), "despite bottled water's dramatic growth over the past quarter century, its present ubiquity, and the not insignificant local contestation it has generated, scholarly attention to this phenomenon has been surprisingly sparse". The analysis has thus far looked at tap water provision and bottled water consumption as two sides of the same coin, in order to shed light on a seeming paradox: which processes led to the growth and success of an industry selling a good almost freely available and readily accessible by most people? Taking only the poles of the spectrum, two major explanations have been proposed (for a more thorough review, Hawkins 2017). One the one hand, research has looked at change in consumers' perceptions and practices, stressing the active role of individuals in choosing according to their own beliefs and preferences. For instance, medical studies on the benefits of frequent hydration for athletes' muscles in the 1970s have subsequently reached the wider public, thus broadening the idea that everyone would take advantage from the possibility of sipping "at disposal" (Race 2012). Similarly, lack of confidence in the quality of tap water provision, especially after environmental disasters and health hazards (e.g. Stein 2000), has been pointed at to explain why consumers may decide to opt for plastic. In this light, beverage companies started selling bottled water to respond to consumers' need for potable water, as in some areas their products came to be seen as more reliable than other sources (Hawkins 2017).

On the other hand, critics focused on the pernicious role played by corporations in fuelling the bottled water market, both by commodifying former public water sources – namely transforming non-marketed natural resources into marketed goods – and by operating through marketing strategies. Although global movements against bottled water consumption and local actions against groundwater dispossession have appeared on the scene, the ascension of bottled water has been incessant everywhere (Swyngedouw 2005; Rodwan 2017). Jaffee and colleagues, building on the concept of "accumulation by dispossession" (Harvey 2003), elucidate how corporations invested more in the creation of a bottled water market than in the privatisation of tap water provision, as the former is more convenient, profitable and controllable ("a more perfect commodity"), whilst the latter presents high maintenance costs and can meet several resistances (Jaffee and Newman 2013a, b; Jaffee and Case 2018). Nonetheless, as bottled water consumption does not exist in a vacuum, companies' capital flows have leveraged on the rich semantic network elicited by water – a symbolism where romantic aspects of nature, health precepts, body purity and safety intertwine – to both undermine trust in tap water and transform mundane and abundant things into the exotic (Wilk 2006).

Few studies, instead, consider how water use and bottled water may be stratified. The available evidence that analyses representative datasets of large populations generally neglects how individuals' resources may contribute to the social patterning of water (un)sustainable use, despite social stratification can be useful for understanding un-sustainable consumption. Before going further in this direction, some thoughts will be put forward in discussing why Italy represents a meaningful case study in comparison with other countries.

4.3 Italy as a Meaningful Case Study

4.3.1 The Struggle over Water Management

Over the past two decades, water has been a highly salient and debated issue in Italy, especially with regard of its management structure. Historically, water ownership in Italy had been kept public and local authorities had the power to establish public water operators responsible for managing water service. Starting from the 1990s, however, the public management of water started to be put in question with a series of reforms. For some organisations such as the Organisation for Economic Cooperation and Development (OECD), water in Italy has been under-priced for a long time (2011). The relatively low water tariffs had been made possible by government subsidies for investments. However, because of the high public debt levels, the government has proved unable to sustain these subsidies and this, in turn, has impeded necessary improvements of the water infrastructure (Marotta 2014).

The idea that guided the Italian Government to embark on a reform process of the water sector was the increase in both the efficiency and the size of water utilities through an incremental adoption of a market-oriented mode of governance, based on competition. The so-called "Galli Law" (Law no. 36/1994) aimed at consolidating municipal service providers into regional utilities, separating service provision from regulation, achieving cost recovery from tariffs, and improving efficiency. Accordingly, this law devised a new administrative body called *Ambito territoriale ottimale* (Optimal Territorial Area, ATO).

Although aiming to improve the quality of the service, the water management reform stimulated a number of conflicts between jurisdictions operating at different scales, with recurrent judicial actions from 2000 onwards. As argued by Carrozza and Fantini (2016), "at the heart of these conflicts there was either the wish of local governments to preserve their previous autonomous control of the sector or their effort to create new spaces for action in the water sector" (p. 102).

The conflicts generated at the institutional level have not been the only ones. The process was also challenged at the national level by a grassroots mobilisation that opposed the privatisation of water services. While a movement of opinion around water had already started to emerge in Italy in the late 1990s (Carrozza and Fantini 2016), citizens' dissent became stronger and more organised at the turn of the new century.

Citizens' mobilisation drove to the establishment in 2006 of the *Forum italiano dei movimenti per l'acqua* (Italian Water Movements Forum), a coalition of civil society actors encompassing a wide spectrum of organisations: alterglobalist NGOs, environmental groups, trade unions, civic committees, local authorities, consumers associations, missionaries and parishes (Carrozza and Fantini 2016). The Forum's first activity was to promote a bill providing for the re-publicisation of water services. The initiative was able to collect wide public attention and the bill, later presented in Parliament, was signed by over 400,000 citizens. In 2010, however, the Constitutional Court established that the Italian legislature could legitimately opt for free market principles in matter of water resources management (Judgment No. 325/2010). As a consequence, the Forum's second national action was to call for three referendums aimed at the abrogation of the rules approved by Parliament in support of the privatisation of local public services, including water management.

As in the case of the bill, also the referendum initiative enjoyed strong levels of citizens' support. In a very short period of time the Forum was able to collect 1,400,000 signatures, almost three times the required amount (Carozza and Fantini

2016). During the referendum, which was held in June 2011,[2] citizens voted almost unanimously for the repeal of the existing legislation on the privatisation of water services. However, in spite of such an overwhelming result, 2 months later the Italian Parliament approved a law that strengthened the privatisation of water management. As a response, the Forum, supported by six Italian Regions (Apulia, Lazio, Emilia-Romagna, Marche, Umbria and Sardinia), started a legal fight in order to get the new law recognised as illegitimate by the Constitutional Court.

The Court did so in 2012, by declaring the new legislation in clear conflict with the popular will expressed in the referendum (Judgement No. 199/2012). Consequently, the Forum started a campaign of 'civil obedience' to demand the respect of the popular vote expressed in the referendums of June 2011. This campaign intended to make all actors – central Government, Parliament, regional Governments, municipalities, the corporations that had been managing the water services and all public and private stakeholders – respect the will of the Italian people and keep the management of water services public (Carrozza and Fantini 2016).

In addition to legal actions, during these years activists adopted also a number of other strategies such as exhibitions, performances, conferences, meetings, media campaigns and mail-bombing directed at MPs, cabinet ministers, local administrators and all those involved in decision-making in the water sector. Such a various repertoire of action adopted by the "water movement" was not aimed solely to inform, inspire and sustain the political struggle, but also to transform people's views and practices related to water, re-socialising its symbolic and cultural dimensions (Carrozza and Fantini 2016). While raising awareness on the importance of water for life, and discussing the repercussions of water being treated as a commodity, activists also directly asked citizens to re-think their water consumption habits, stressing the need for a more responsible daily use of water. For instance, the "turn-off-the-faucet" campaigns in different guises ("*Imbrocchiamola*" and "*Acqua del Sindaco*") aimed to reduce the consumption of bottled water.

[2] The original proposal addressed three questions: a first one concerned the repeal of the law that forced local Governments to turn to the market for the provision of all local public services; a second regarded the abolition of the specific rule on the choice of water services management; one last question was related to the method of calculation of the water service fees. In January 2011, the Constitutional Court, the highest court of Italy in matters of constitutional law that also decides on the eligibility of referendum questions, rejected the second question and passed the other two. As underlined by Marotta (2014): "In particular, the Constitutional Court approved the referendum for the repeal of the legislation on water services with specific reference to the criterion of 'adequate return on the invested capital' (Judgement no. 26/2011). The Court made it clear that this referendum aimed at separating water management from the global logic of market profit" (p. 42).

4.3.2 Water Service Provision and Quality

Despite efforts for improvement, water service provision in Italy still suffers from very high water losses in the distribution networks, with an average dispersion value of 47% (ISTAT 2019). Consequently, this means that almost half of the water withdrawn for municipal supply is not billed to the customers because of leakage, malfunctioning water meters and water theft.

Moreover, although as estimated by ISTAT (2019) families connected to the municipal water supply in Italy are in general satisfied with the service (those who feel “very satisfied” with the service amount to 21.3%, and those “quite satisfied” to 63.3%), the overall level of satisfaction varies significantly across the territory. Families that are at least quite satisfied are nine out of ten in the North, eight in the Centre and South and down to seven in the Islands (Sicily and Sardinia). However, there are geographical areas of the country where the share of poorly satisfied families far exceeds the percentage of those very satisfied. The greatest deviations are recorded in Calabria (26.6% not satisfied against 9.6% very satisfied), Sardinia (24.3% against 8.8%) and Sicily (22.7% against 11.1%). Moreover, although water that comes from the tap must be potable according to the law, families that do not regularly drink water from the tap still represented in 2018 the 29%, amounting to roughly 7.5 million people (ISTAT 2019). The territorial differences are noteworthy: from 17.8% in the North-East to 52.0% in the Islands, with the highest percentage in Sicily (53.3%), followed by Sardinia (48.5%) and Calabria (45.2%).

Interestingly, as pictured in Fig. 4.1, regions where individuals are more satisfied with water service are not necessarily those with the highest percentage of individuals who regularly drink water from the tap. While there are only two regions (Trentino-Alto Adige and Aosta Valley) which score high in both individuals who regularly drink tap water and individuals who are highly satisfied with water service, and three regions (Calabria, Sicily and Sardinia) where both figured are low, in all other Italian regions such relationship is less clear-cut, meaning that there might be other factors, rather than individuals satisfaction with water service, which have a bearing on people’s habit to drink tap water.

In this regard, Fig. 4.2 shows how the percentages of people who regularly drink water from the tap and, conversely, of those who do not, have significantly changed over time following different paths. On the one hand, the percentage of individuals who regularly drink water from the tap has followed a rather fluctuating trend over the years (decreasing from 1993 to 1999, steadily increasing until 2012, and then decreasing again in the most recent years[3]), while the percentage of those who do not drink water from the tap because of lack of trust has steadily decreased. On the

[3]Although it is clearly difficult to speak of a direct effect on people’s water consumption of the campaigns launched by the Italian “water movement” to reduce the consumption of bottled water and, conversely, increase that of tap water, it is nevertheless interesting to note that the percentage of those who declare to usually drink water from the tap seems to have increased during the years immediately after the referendum (2011–2012), only to decrease again in the following years.

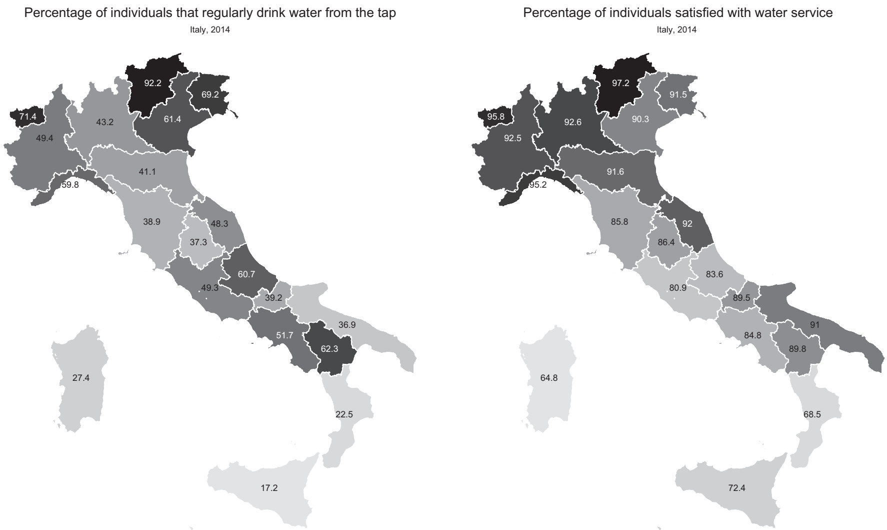

Fig. 4.1 Left panel (**a**): percentage of individuals who regularly drink water from the tap by region. Right panel (**b**): percentage of individuals satisfied with water service by region. (Own analyses based on the Multipurpose Survey of Daily Life by ISTAT (2014))

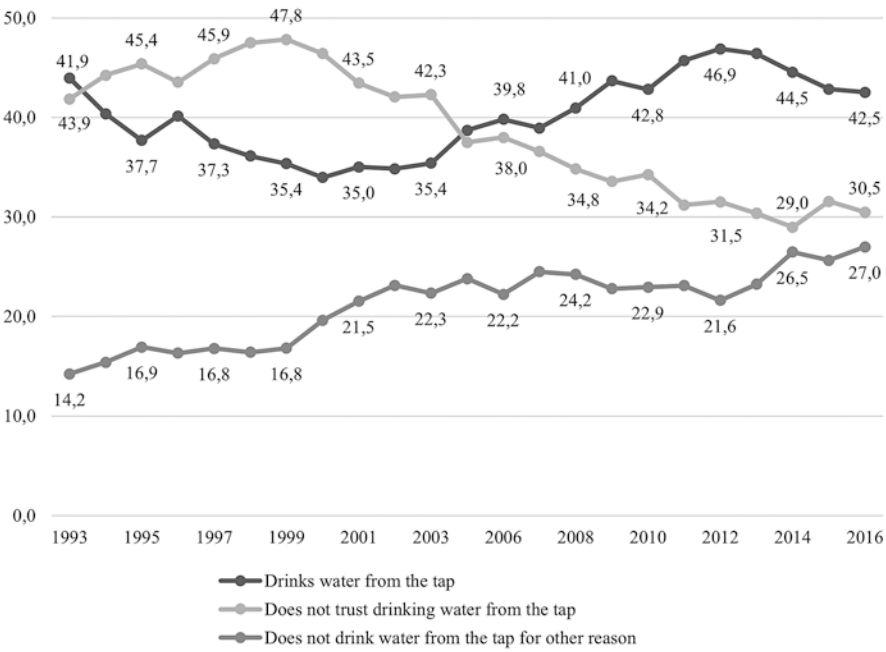

Fig. 4.2 Tap water trends from 1993 to 2016. (Own analyses based on the Multipurpose Survey of Daily Life by ISTAT)

other hand, the percentage of those who do not drink tap water because of other reasons has steadily increased, mirroring the constant increase in bottled water consumption.

As pointed out by several studies, the reasons why people may opt for bottled water rather than tap water are in fact manifold and are not necessarily connected to the lack of trust in the public drinking water system. For example, consumers may turn to bottled water because of their dissatisfaction with the organoleptic quality of tap water, such as taste, odour and sight (Doria 2006). Or alternatively, they may prefer bottled water because it is considered healthier, but not necessarily safer, than tap water (Carlucci et al. 2016).

4.3.3 Bottled Water

As already mentioned, Italy is one of the highest producers and consumers of bottled water in the world. According to the 2018 Beverage Marketing Corporation report, with a production of 13,450 billion litres and a per capita annual consumption of 222 litres in 2017, Italy is Europe's biggest consumer of bottled water (29 litres per capita more than in Germany, +16.4%; 84 litres more than in France, +68.9%) and ranks third at the world level behind Mexico and Thailand (Beverage Marketing Corporation 2018; Legambiente 2018).

In Italy the consumption of bottled water began in the 1970s (Carlucci et al. 2016). From the mid-1980s to 2000, the bottled water industry grew from a niche market filled with special healing waters and elite brands to a market involving more than 250 brands of bottling companies with about 130 factories (Beverage Marketing Corporation 2018). As it is possible to see in Fig. 4.3, the number of

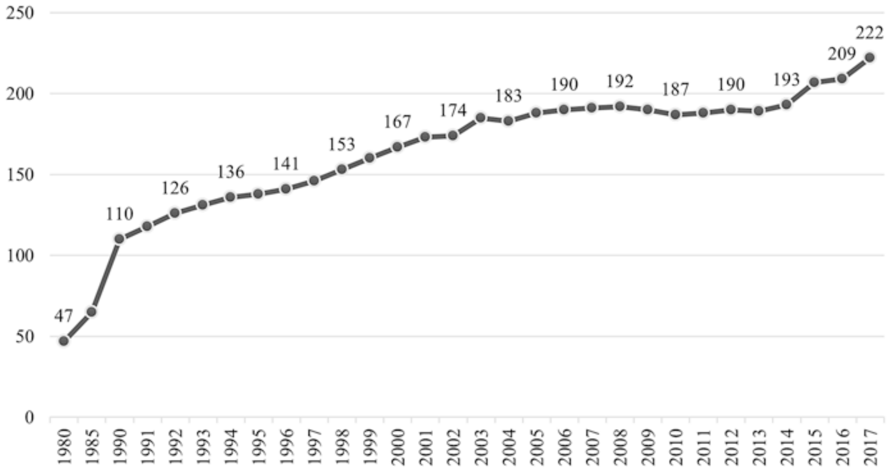

Fig. 4.3 Litres of bottled water per capita in Italy from 1980 to 2017. (Own elaboration based on Bevitalia (2019))

litres of bottled water consumed per capita have constantly increased, growing faster from the beginning of the 1980s to the turn of the new century, to remain stable for about a decade (from 2004 to 2014), to start to grow again towards the peak of 222 litres per capita in 2017.

With a total value between €7 billion and €10 billion a year, the business of bottled water generates revenues for around €2.8 billion for Italian bottling companies. In 2017, the mineral water sector saw a 7.8% growth in volume and 7.7% growth in value. Sparkling water showed a particularly strong performance (+9.2% in volume and +8.4% in value), while still water maintained the positive trend registered in recent years, with +8.3% growth in volume and +8% growth in value (Bevitalia 2019).

The Italian bottled water market is dominated by eight producers (Sanpellegrino Nestlé Waters, San Benedetto, Fonti di Vinadio, Acque Minerali Group of Italy, Lete, Ferrarelle, Cogedi, Spumador) which together make up over 74% of total national production. As emphasised by the 2018 Beverage Marketing Corporation report, the Italian market is the only large market for packaged water that is not dominated by large multinational beverage companies. The only large multinational that has conquered the leadership of the market is Sanpellegrino (owned by Nestlé Waters), while Coca-Cola, although operating on the market for some years, is far from the top positions, and the other two large multinationals of packaged waters, Danone and Pepsico, are almost absent (Beverage Marketing Corporation 2018).

The consumption of bottled water has important implications for the production of plastic waste and consequent pollution. Indeed, besides issues related to water conservation as a fundamental strategy to guarantee a sustainable management of scarce resources, the entire process of extraction, processing, packaging and transportation of bottled water has a considerable environmental impact (Carlucci et al. 2016).

According to Legambiente (2018), the reason for the high production and consumption of bottled water in Italy is to be found in the rather low concession fees applied by the Italian regions to bottling companies. Although in Italy water springs are owned by the State and, therefore, extraction concessions fall within the competences of the Italian regions, the tariffs applied are usually very low, allowing very high profits for the business of bottled water. Such low tariffs clearly have an impact on the final price of bottled water for consumers, which according to Beverfood, an Italian magazine specialised in the beverages sector, is the lowest in the European Community, and with a price of 0.2 euros per litre is one of the cheapest in the world (Bevitalia 2019).[4]

Opponents of bottled water around the world have often accused the industry of doing more than merely advertising a product (Jaffee and Newman 2013a, b). In this regard, activists have often argued that the bottled water industry represents the effort by corporations to commodify a human need in a time of increasing scarcity

[4] These data are from Statista ("Average selling price of mineral water in large retail distribution in Italy in 2018, by type", https://tinyurl.com/y42e2fnk) and Numbeo ("Price Rankings by Country of Water (1.5 liter bottle)", https://tinyurl.com/yxvgfhan).

of such an essential and basic natural resource. The several appeals made by the Italian "water movement" (Martinelli 2011) seem however to have clashed with the convenience (in term of comfort and money) of choosing bottled water, especially for out-of-home consumption (Doria 2006). Over the past decades Italians have grown accustomed to the idea of shopping a bottled water from almost everywhere. As disposable plates, cups and utensils, also bottled water is after all at the heart of the contemporary consumer experience.

4.4 Data and Methods

4.4.1 Data and Dependent Variables

To analyse the stratification of water use and bottled water consumption we rely on the 2014 Multipurpose Survey of Daily Life (MDL) and the 2014 Survey on Household Consumption (SHC) by ISTAT, the Italian National Institute of Statistics. The former collects data on the daily life of a representative sample of Italian families, and all respondents are required to fill out a questionnaire on their habits, including how often one pays attention not to waste water. Original response categories were "regularly", "sometimes", "rarely" and "never", which we then recoded so to have a dummy variable distinguishing people who pay at least some attention (1) from those who rarely or never pay attention (0). To compare the results of the model with the stratification of other practices oriented toward sustainability, we conducted the same analyses also on three other variables collected in the survey, which have the same response categories and were recoded in the same manner. These are "How often do you pay attention not to waste electricity", "How often do you purchase local products" and "How often do you purchase organic products". We restrict the analysis to individuals aged 25 to 64 years old, and after listwise deletion the sample comprises 22,101 cases (91.4% of the original analytical sample).

The SHC survey collects data on household expenditure from a representative sample of Italian families over a period of 12 months to avoid seasonality bias. The reference person in the household is required to fill in the weekly record of purchases of goods and services, which is then converted into a monthly estimate. In the survey, it is possible to distinguish between families that do not spend money for mineral water (0), and families that spend any amount greater than zero (1). In this case, we restricted the analysis to households with a reference person aged 18 to 64 years old, with non-missing values for all the variables considered (N = 10,463). On both samples, we applied logistic regression using survey weights to correct for sampling bias.

4.4.2 Control Variables

In the MDL survey we measured cultural and economic resources distinguishing between the educational level of the respondent (tertiary, upper secondary, lower secondary and primary or less) and social class in five categories (bourgeoisie, white collar, petty-bourgeoisie, working class and inactive). Additional control variables included type of family (single, couple, lone parent), age (35–44, 45–54, 55–59, 60–64), gender (male, female), number of components and macro-area of residence (North, Centre, South and Islands).

In a similar manner, in the SHC survey we differentiated between the educational level of the reference person (tertiary, upper secondary, lower secondary or less) and the total expenditure of the household minus nondurables as a proxy for income. Control variables included marital status (single, couple, separated/divorced, widow), employment status (worker, unemployed, inactive, other), number of people in the household, age, gender of the respondent, macro-region of residence (North, Centre, South, Islands).

4.5 An Exploration into the Social Stratification of Water Waste and Bottled Water Purchase

Table 4.1 presents the frequency distribution of the original response categories of the four dependent variables capturing different practices oriented toward sustainability. As it can be noticed, the distributions are very different. While more than 70% of respondents declare to regularly pay attention not to waste water and electricity, purchasing local or organic products are practices much less commonly taken up. Only 21.6% and 10.6% of individuals, respectively, habitually engage in these types of behaviours. This difference is not surprising: while avoiding water or electricity waste is a cost-free practice, which can help save money, purchasing local and organic products inevitably require an additional cost for consumers.

Moving to the results of the logistic regressions, Fig. 4.4 illustrates the marginal effects of engaging in the four practices by educational level of the respondents. Tables 4.2 and 4.3 present instead the marginal effects for all the control variables used in the models. Although all four practices are to some extent stratified by educational level, the magnitude of the difference is much more marked for purchasing

Table 4.1 Descriptive statistics for the original response categories of the dependent variables. Own elaboration based on ISTAT MDL survey (2014)

	Water	Electricity	Local products	Organic products
Regularly	71.1	75.9	21.6	10.6
Sometimes	18.6	17.1	39.9	35.9
Rarely	6.7	4.6	18.5	24.2
Never	3.6	2.5	20.1	29.4

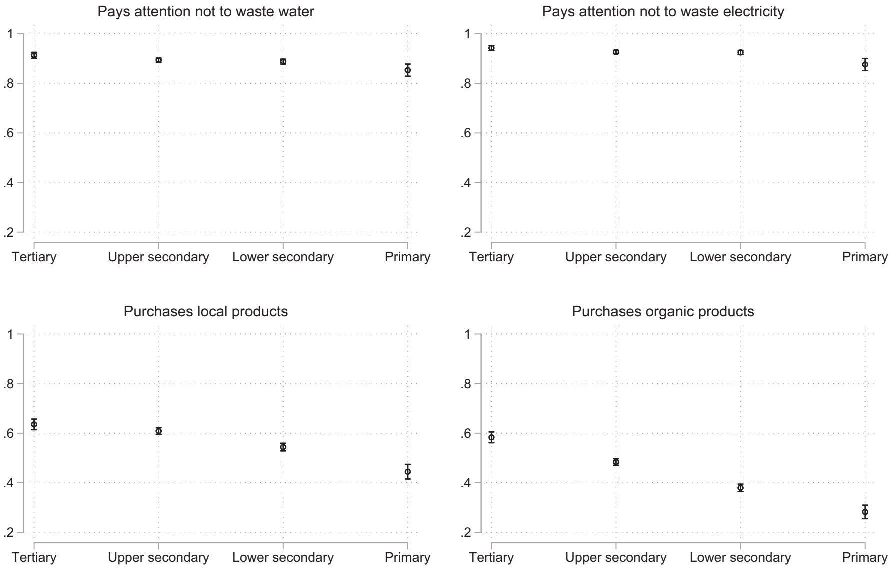

Fig. 4.4 Marginal effects of education level on the probability of paying attention to water consumption and electricity, and purchasing local products and organic products. (Own elaboration based on ISTAT MDL survey (2014))

local and organic products.[5] In the case of water and electricity consumption, respectively 6.0 and 6.7 percentage points separate tertiary and primary educated individuals, while there is not a substantial difference with individuals holding an upper or lower secondary title; conversely, the educational level has a strong monotonic association with the probability of purchasing local and organic products. For the former, the probability moves from 63.6% for tertiary educated respondents, to 60.9% for upper secondary educated ones, and then drops to 54.4% and to 44.5% for individuals with, respectively, a lower secondary and primary education. For the latter, the magnitude of the association is even larger, as it moves from 58.3% for tertiary-educated individuals, to 28.3% for primary-educated ones, decreasing of 10 percentage points along each educational level. Similarly, economic resources (proxied by social class) are not associated with the probability of saving water or electricity, but they play a significant role in the purchase of local and organic products: compared to the bourgeoisie, all the other classes are significantly less likely to acquire at least sometimes these products. In particular, working class individuals are respectively 10.5 and 11.9 percentage points less likely to acquire local and organic products.

In the case of bottled water consumption, 66.2% of the families declare that they have spent any amount more than 0 for mineral water in the previous month, whereas

[5] Results do not change substantially if we apply an ordered logistic regression on the original response categories or if we recode the variables distinguishing between "regularly" and all the others.

Table 4.2 Marginal effects on the probability of paying attention to water and electricity. Own elaboration based on ISTAT MDL survey (2014)

	Pays attention to water					Pays attention to electricity				
	AMEs	*Std. Err.*	*p-value*	*[95% Conf. Interval]*		*AMEs*	*Std. Err.*	*p-value*	*[95% Conf. Interval]*	
Education level										
Upper secondary [ref. Tertiary]	−0.019	0.007	0.005	−0.033	−0.006	−0.016	0.006	0.005	−0.028	−0.005
Lower secondary	−0.026	0.008	0.002	−0.042	−0.009	−0.018	0.007	0.011	−0.032	−0.004
Primary	−0.060	0.015	0.000	−0.089	−0.031	−0.067	0.014	0.000	−0.094	−0.039
Social class										
White collar [ref. Bourgeoisie]	0.023	0.010	0.029	0.002	0.043	0.013	0.009	0.142	−0.004	0.029
Petty-Bourgeoisie	0.007	0.012	0.589	−0.017	0.030	0.006	0.010	0.540	−0.013	0.026
Working class	0.021	0.011	0.058	−0.001	0.043	0.014	0.009	0.133	−0.004	0.032
Inactive	−0.008	0.014	0.580	−0.036	0.020	−0.018	0.013	0.144	−0.043	0.006
Type of family										
Couples [ref. Single]	0.002	0.009	0.799	−0.016	0.021	0.009	0.008	0.298	−0.008	0.025
Lone parents	−0.027	0.012	0.022	−0.051	−0.004	−0.017	0.010	0.097	−0.038	0.003
Age										
35–44	0.036	0.009	0.000	0.019	0.054	0.034	0.008	0.000	0.018	0.050
45–54	0.057	0.009	0.000	0.039	0.074	0.048	0.008	0.000	0.032	0.063
55–59	0.059	0.010	0.000	0.040	0.079	0.057	0.009	0.000	0.040	0.074
60–64	0.075	0.010	0.000	0.056	0.095	0.066	0.009	0.000	0.049	0.082
Gender										
Female [ref. Male]	0.036	0.005	0.000	0.027	0.046	0.029	0.004	0.000	0.021	0.038
Number of components	−0.005	0.003	0.107	−0.010	0.001	−0.003	0.002	0.210	−0.008	0.002
Macro-area of residence										
Centre [ref. North]	0.016	0.008	0.038	0.001	0.031	0.004	0.007	0.522	−0.009	0.017
South and Islands	0.020	0.006	0.001	0.008	0.032	0.011	0.005	0.039	0.001	0.021
N = 20.011										

Table 4.3 Marginal effects on the probability of purchasing local and organic food. Own elaboration based on ISTAT MDL survey (2014)

	Purchases local food					Purchases organic food				
	AMEs	*Std. Err.*	*p-value*	*[95% Conf. Interval]*		*AMEs*	*Std. Err.*	*p-value*	*[95% Conf. Interval]*	
Education level										
Upper secondary [ref. Tertiary]	−0.027	0.012	0.026	−0.050	−0.003	−0.099	0.012	0.000	−0.123	−0.075
Lower secondary	−0.091	0.014	0.000	−0.119	−0.063	−0.203	0.014	0.000	−0.231	−0.176
Primary	−0.191	0.020	0.000	−0.229	−0.152	−0.301	0.019	0.000	−0.337	−0.264
Social class										
White collar [ref. Bourgeoisie]	−0.043	0.015	0.004	−0.073	−0.013	−0.014	0.015	0.357	−0.043	0.016
Petty-Bourgeoisie	−0.048	0.017	0.006	−0.082	−0.014	−0.047	0.017	0.006	−0.080	−0.013
Working class	−0.105	0.016	0.000	−0.137	−0.073	−0.119	0.016	0.000	−0.151	−0.088
Inactive	−0.138	0.020	0.000	−0.177	−0.100	−0.103	0.019	0.000	−0.140	−0.066
Type of family										
Couples [ref. Single]	0.090	0.015	0.000	0.060	0.120	0.056	0.014	0.000	0.028	0.085
Lone parents	0.004	0.018	0.843	−0.031	0.038	−0.013	0.017	0.444	−0.046	0.020
Age										
35–44	0.062	0.013	0.000	0.037	0.086	0.053	0.012	0.000	0.030	0.077
45–54	0.094	0.012	0.000	0.070	0.118	0.055	0.012	0.000	0.032	0.079
55–59	0.106	0.015	0.000	0.078	0.135	0.064	0.014	0.000	0.036	0.091
60–64	0.141	0.016	0.000	0.111	0.172	0.066	0.015	0.000	0.036	0.095
Gender										
Female [ref. Male]	0.083	0.007	0.000	0.069	0.096	0.112	0.007	0.000	0.098	0.125
Number of components	−0.022	0.005	0.000	−0.032	−0.012	−0.018	0.005	0.000	−0.028	−0.009
Macro-area of residence										
Centre [ref. North]	0.007	0.012	0.583	−0.017	0.031	−0.012	0.012	0.306	−0.035	0.011
South and Islands	0.119	0.010	0.000	0.100	0.139	−0.017	0.010	0.090	−0.036	0.003
N = 20.011										

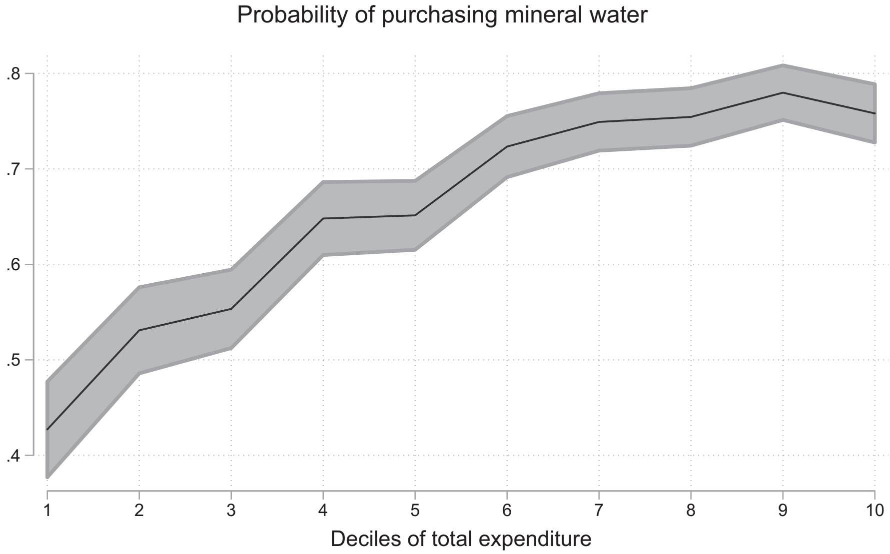

Fig. 4.5 Marginal effects of deciles of total expenditure on the probability of purchasing mineral water

33.8% are likely to exclusive rely on tap water. Figure 4.5 illustrates the marginal effects of the deciles of total expenditures – our proxy for household income – on the probability of purchasing mineral water. Table 4.4 displays instead the marginal effects for all control variables.

In line with similar studies (Johnstone and Serret 2012), the probability of purchasing bottled water increases with higher economic resources. The probability moves from 42.7% in the first decile to more than 75% in the last three deciles, with an increase of more than 30 percentage points across income layers. Conversely, the educational level seems to be negatively associated to bottled water purchases, as lower secondary (or less) educated respondents are 4.9 percentage points more likely than tertiary educated ones (see Table 4.4) to buy bottled water. This result points to the importance of distinguishing between cultural and economic resources as two different components of social position, which instead are too often captured by the loose concept of socioeconomic status.[6]

[6] Bottled water consumption could be also driven by the perceived quality of tap water in the area of residence. Despite water being drinkable almost everywhere in Italy, families may opt for bottled water because they do not appreciate the organoleptic quality of tap water or because they do not trust the service provider. This could explain why there appears to be a regional gradient, with households in the South and Islands almost 12 percentage points more likely to purchase bottled water net of several control variables (see Table 4.4). Additional research using regional, and possibly council data on water uses and quality could help disentangle how individuals' bottled water purchases, their resistance to tap water, and its perceived quality are imbricated.

Table 4.4 Marginal effects on the probability of purchasing bottled water. Own elaboration based on ISTAT *SHC survey (2014)*

	AMEs	*Std. Err.*	*p-value*	*[95% Conf. Interval]*	
Education level					
Upper secondary [ref. Tertiary]	0.027	0.016	0.106	−0.006	0.059
Lower secondary	0.049	0.018	0.006	0.014	0.083
Total expenditure (deciles)					
2° [ref. 1°]	0.104	0.032	0.001	0.040	0.167
3°	0.126	0.032	0.000	0.063	0.188
4°	0.220	0.031	0.000	0.158	0.281
5°	0.223	0.031	0.000	0.162	0.284
6°	0.295	0.030	0.000	0.235	0.354
7°	0.321	0.030	0.000	0.261	0.380
8°	0.326	0.031	0.000	0.266	0.386
9°	0.351	0.030	0.000	0.292	0.411
10°	0.330	0.031	0.000	0.268	0.391
Gender					
Female [ref. Male]	0.009	0.014	0.530	−0.019	0.037
Age					
35–64 [ref. 18–34]	−0.037	0.017	0.034	−0.071	−0.003
Marital status					
Married/cohabiting [ref. Single]	0.024	0.018	0.182	−0.011	0.059
Divorced	−0.009	0.020	0.658	−0.048	0.030
Widow	0.023	0.033	0.489	−0.042	0.087
Region of residence					
Centre [ref. North]	0.064	0.016	0.000	0.033	0.095
South and islands	0.112	0.013	0.000	0.087	0.137
Number of components	−0.004	0.006	0.521	−0.016	0.008
Working condition					
Unemployed [ref. Employed]	0.009	0.020	0.629	−0.029	0.048
Inactive	−0.005	0.018	0.795	−0.039	0.030
Other	0.043	0.041	0.295	−0.037	0.122
N = 10,463					

4.6 Discussion and Conclusions

By focussing on water use and bottled water purchase, this contribution aimed to introduce some possible connections between the sociological scholarship on consumption and the study of water use in Italy.

As discussed above, Italy represents an interesting case study for various reasons. Over the past two decades, water has been a highly salient and debated issue and this especially with regard to its management structure. The attempts made by the Italian Government to reform water governance through an incremental adoption of a market-oriented approach gave rise to a vast popular movement opposing the privatisation of water services, which was a key element marking the water policy-making over the last years.[7] But Italy also presents one of the highest rate of bottled water consumption, with important implications for the production of plastic waste and consequent pollution.

By building on the existing studies, in this chapter we tried to deepen our understanding of water saving behaviour and bottled water consumption, by discussing how domestic water use and consumption are socially patterned.

Without any claim of completeness, we distinguished two major approaches, outlining how recent efforts in the broader sociological literature on consumption have focused the attention on water intensive practices at home (such as laundry, gardening, or showering) and critical reflections on the success of the bottled water market. In line with this twofold distinction, we used two representative surveys of Italian families to study the social stratification of water domestic use and bottled water consumption, a theme which has seldom captured the attention of scholars. Obviously, these are but two of the manifold water domains capable of attracting sociological attention: the study of water supply politics in cities (Anand 2011), the organisation of social movements against water privatisation (Bakker 2007; Jaffee and Newman 2013a, b) or the functioning of irrigation systems and related practices in rural settings (Ternes 2018; Miao et al. 2018) are just a few examples of the extent of the subject.

The analyses suggest that, in general, the great majority of individuals pay attention to water wastage at home, and when compared with other sustainable practices that require greater economic efforts and that are considered markers of distinction of the middle upper classes (e.g. Oncini 2019), differences across educational levels are negligible. While purchase of organic and local food is considerably stratified by cultural and economic resources, water (and energy) saving practices seem instead almost evenly distributed across the population. The vast diffusion of the practice and the absence of a strong gradient are comprehensible, as paying attention not to waste water requires little additional effort (e.g. turning off the tap when brushing teeth or decrease showering time) and can indeed be economically convenient.

On the other hand, the probability of purchasing bottled water increases with the available economic resources of the household: in other words, wealthier families are less likely to exclusively rely on tap water. This result, in line with the evidence gathered in other countries (Johnstone and Serret 2012), deserves attention as it brings into question the simple idea that sustainable behaviours are more widespread among the middle classes. It may be so in the case of organic food purchase, or when deciding to participate in Alternative Food Networks (Graziano and Forno 2012), but in many other circumstances, the higher economic availability of more privileged strata of the population is likely to be associated with un-sustainable practices, if only for the lack of economic constraints.

[7] Additional analyses, available upon request, show indeed the existence of a significant relationship between regularly keeping oneself informed about politics and paying attention not to waste water. This correlation might suggest that water use is a salient, politically connoted issue for people who are interested in politics, and resonate with the wave of activism that surrounded the 2011 referendum.

These results, coupled with the fact that the main cause of water wastage in Italy is to be found in poor hydraulic infrastructures causing the loss of almost 50% of drinkable water (ISTAT 2019), may suggest that policy efforts should address the reduction of plastic-bottled-water consumption rather than raise awareness on water saving practices. A few encouraging signs might be found in the spreading of water kiosks and domestic purification devices that improve the palatability of tap water, as well as in the growing consumers' awareness regarding the environmental impact of plastic (Torretta 2013; Carlucci et al. 2016). Nevertheless, as already discussed above, the bottled water sector has been growing unremittingly since 1980s and per-capita consumption reached its maximum in 2017.

Despite its explorative objective, some limitations of this study are worth mentioning. First, the dependent variable in the MDL survey measures a rather generic attitude towards water saving and does not tell us anything regarding more specific water-intensive practices such as bathing or gardening, which would allow a much-refined understanding of sustainability practices (e.g. Pullinger et al. 2013a) and their social stratification. Second, in the SHC survey we are only able to distinguish families that purchase mineral water from those that do not, with no information regarding the material of the bottles. Nonetheless, although some families could also rely exclusively on glass bottles, the sector is still predominantly driven by plastic containers, which take up 82% of the water-packaging market (Bevitalia 2019).

On a final note, how could the sociological imagination help and widen the study of water use in the Italian context? In this chapter, we relied on survey data to explore two facets of the phenomenon, but many other research questions are open to investigation. What are the factors that push individuals to rely on bottled water despite tap water being cheaper and safe practically everywhere? What are the social and historical reasons that favoured the success of the mineral water industry (e.g. Black 2009)? What is the role of drinkable water in the meal routines of families? Why in some regions tap water is consumed more than in others regardless of its inherent quality and flavour? Is trust in public institutions linked to the avoidance of tap water? How do bottled water companies use marketing leverages to mark symbolic boundaries and distinguish almost identical goods? Sociological research, especially in the Italian context, could help provide additional keys to interpret water uses and misuses, and possibly inspire more effective responses to environmental concerns.

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Chapter 5
Water Resources Management in Italy: Institutions, Laws and Approaches

Emanuele Boscolo

Abstract Starting with Law no. 36/1994, later expanded on by the Italian Environmental Code of 2006, waters in Italy are no longer regarded as a production asset to be exploited, in a perspective of economic efficiency; they are finally seen as an environmental asset to be protected. All waters are public, so that the State may take care of them and preserve them for future generations. The State does not therefore act as the owner but, rather, as the custodian of waters. Water displays all the features of common pool resources (provision of non-excludable ecological services, scarcity, and vulnerability), and community self-governance instruments – such as river contracts – are increasingly widespread. District-scale planning has become standard practice, leading to a re-sizing of the role of concessions, which are being revised more and more often in the increasingly frequent water shortage situations. The integrated water service is regulated by the Italian Regulatory Authority for Energy, Networks and the Environment, which, mostly through the approval of pricing policies, drives operators towards efficiency improvements and infrastructural investments. Pricing has also taken on a social function, in that it must fund both water bill reductions for low-income households and measures designed to limit disconnections for payment default.

Keywords State-owned waters · Commons · Water service concessions · Water panning and regulation · Italian Regulatory Authority for Energy, Networks and the Environment

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5.1 Introduction: The "New" Water Law as the Point of Intersection of Key Issues

Over the last three decades, through a reform that started with Law no. 36/1994 and continued, in the wake of Directive no. 2000/60/EC (Water Framework Directive – WFD), with Legislative Decree no. 152/2006 (hereinafter also referred to as the "Environmental Code" or simply the "Code"), Italian water law has been radically redesigned by dismantling a legal structure that had stood strong for centuries (Lugaresi 1995). The most evident novelty is expressed in the statement according to which all waters, none excluded, are public, thus abandoning, once and for all, the traditional distinction between public and private waters that had been the backbone of the system since Roman times: "All surface waters and groundwaters, including where they have not been abstracted from the ground, are publicly-owned" (Article 144, Paragraph 1, of the Code). It must be immediately made clear that the extension of the condition of being publicly-owned to include all waters is based on a completely different rationale than in the past. Indeed, the change does not stem from a perspective of mere exploitation, but it is a prelude for the implementation of a rigorous environmental policy. This changed value system forms the backdrop against which the entire reform programme is based, also providing the framework for the preference now given to planning instruments that operate on a district-level macro scale over the traditional management model that relied on individual water withdrawal and water abstraction concessions. At a distribution network level, this scenario has resulted into a shift from a municipally-based public service, in which the feeding, distribution and water treatment systems were separate and fragmented, to an innovative organisational model, known as "integrated water service", characterised by vertical integration in the supply chain and organised on an "optimal-size" area (*Ambito territoriale ottimale* – ATO) scale, under the responsibility of optimal-size-area governments (*Enti di governo d'ambito* – EGAs) (which do not coincide with Municipal governments).

"Waters constitute a resource that must be protected and utilised according to principles of solidarity; all uses must be made in a manner that allows to safeguard the expectations and right of future generations to benefit from an intact environmental heritage" (Article 144, Paragraph 2, of the Code). Italian water law sits at the intersection between two key issues: the protection of water as an environmental asset and the need to ensure an efficient distribution of adequate quantities of water that are sufficient to meet the basic needs of each individual (Boscolo 2012; Casalini 2014; Pioggia 2015; Caporale 2017; Iannello 2013; Massarutto 2003; Massarutto and De Carli 2009; Alberton 2012; Alberton and Domorenok 2011; Pototschnig 1969). These two functions highlight the priority given to environmental values and the fundamental importance assigned to the right of each individual to rely on this vital non-replaceable asset. They cannot be hierarchised and, ultimately, require the harmonisation of water withdrawals (and the pressures that they generate) with the timescale and mechanisms for water renewal. They are two needs that must always prevail over demands for productive exploitation.

Indeed, unlike in the past, waters are no longer considered as a mere production asset that must be exploited to its full potential, in a perspective of economic efficiency. We have become aware that the water system is, first and foremost, a multifunctional environmental matrix, which must be protected as a fundamental part of our ecosystem (that is, despite its cyclical renewability, a particularly vulnerable component/container of an extraordinary biodiversity, as well as an irreplaceable element of all biotic processes), and that water itself is an essential and non-replaceable resource for humans, the consumption of which for drinking purposes is a vital necessity and access to which must therefore be guaranteed on a universal basis.

The deepest implications of this cultural and legal evolution hardly come to the surface with the necessary clarity, and the environmental bent seen in the "new" water law does not seem to have as yet translated into a fully-established paradigm. The process for the modernisation of water law is still under way and involves lawmakers as much as the judiciary, which has provided crucial indications to guide the transition.

Traditional water law – that is, the body of law which, after the unification of Italy in 1861, inherited the legacy of the various pre-unification laws and gave form to a systematising piece of legislation, Royal Decree no. 1775/1933 (Astuti 1958) – was based on the assumption that water was endlessly available, a powerful bias which resulted in the allocative function of administrative intervention remaining essentially unused. Water law had thus to be redesigned from a new perspective, consistent with the observation that water, also in consequence of the increasingly-severe effects of climate change, is a scarce resource that is not available in sufficient quantity to meet an inelastic and growing demand, which manifests itself not just in the basic human need for drinking water but also in an agricultural, industrial and energy-related economy that is still largely dependent on water. The Italian Constitutional Court, too, has made reference to the scarcity of water, in order to legitimise the move towards all waters being regarded as publicly-owned[1] undertaken with the above-mentioned Law no. 36/1994 and confirmed with Article 144 of the Environmental Code. The condition of water stress – once unusual in Italy, whereas now some parts of Southern Italy are at serious risk of desertification and even some areas in the Po Valley are exposed to prolonged periods of drought – has exacerbated many issues and has given momentum to the reform process. In the past, no water requirements remained unmet, with the growing rate of water withdrawal (well over the natural renewal rate) being also facilitated by a lack of

[1] Constitutional Court, judgment no. 259 of 19 July 1996. The Court stated that: "the 'public character of waters' regards the use of an asset that has become scarce, as a common pool resource"; this was a fundamental ruling, which was echoed in the more recent judgment no. 273 of 22 July 2010 by the same Court, which highlighted the "aim of lawmakers to regulate the collective use of an indispensable and scarce asset, such as water, in a systematic and planned manner", and the ensuing "resolution of lawmakers to regard all ownership-related aspects of the protection of public waters as subordinate to programming- and management-related aspects, a choice which is better-suited, in the opinion of lawmakers, to the purpose of regulating the correct use, by all citizens, of water resources, which they are entitled to access".

differentiation in terms of applied fees and prices. Today, the idea is beginning to take hold that an inevitable balancing exercise must be undertaken, through which some uses (industrial) must be legitimately sacrificed. In this view, specific allocative rules must be defined, based on a classification of the various types of water withdrawals and according to a pricing structure designed to promote the protection of water ecosystems and biodiversity, which sits at a definitely higher position than general economic demands.

As part of the values that inform the system, a crucial role is also played by solidarity (Article 144, Paragraph 2, of the Code) (Pototschnig 2000), which must be carefully balanced with the qualification of water distribution as a public service of an economic nature[2] and the WFD principle of "full cost recovery" (according to which, as reiterated by the Constitutional Court,[3] the water price must fully reflect both the environmental costs of the resource and the production costs of the service). Such a balancing effort calls for a water distribution system that is disengaged from rigid market-driven patterns (Gambino 2004), which would predictably lead to some groups of citizens being unable to rely on an adequate quantity, thus failing to uphold the right of all to water (Staiano 2011; Violini 2017; Frosini 2010).

In operations management terms, after the 2011 referendum on local public services – which showed how the topic of water can be politicised and used for easy rhetoric, based on the confusion between the public character of water and the call for a public management of the distribution service – the "in-house" operator system has become largely prevailing and the creation of the conditions for public tendering and competition among operators no longer appears to be, unlike in the previous decade, an objective. Having fallen seriously behind against the agenda drafted through Law no. 36/1994, with a consequent prolonged lack of action in infrastructural investment, the situation radically changed in 2012, with the assignment of extensive regulatory powers – comparable to those that allowed for the modernisation of the energy sector – to the Italian Regulatory Authority for Energy, Networks and the Environment (*Autorità di Regolazione Energia Reti Ambiente* – ARERA). The authority is an independent body responsible for regulation in the energy, water and waste collection sectors (Boscolo 2017a), which is entrusted with the task of ensuring efficiency (for example, through pricing models that encourage productivity improvements and higher investments) and fairness (through pricing differentiation and the definition of user contracts and social measures designed to assist users who are struggling to afford their water bills). Regulation is key in a sector that seems to have chosen to do without the natural forces and corrections of competition and needs external intervention to prevent the recurrence of a scenario in which State companies, at a high risk of politicisation, inadequate in size and in constant deficit, are unable to improve the services they provide or even to carry out essential work on both water distribution networks and treatment facilities (Pioggia 2012). In this sector, regulation is not meant to protect competition, as it is in the

[2] Constitutional Court, judgment no. 325 of 17 November 2010.

[3] Constitutional Court, judgment no. 26 of 26 January 2011.

liberalised sectors of telecommunications and energy. Rather, it aims to drive operators towards the pursuit of greater efficiency, with effects on both the quality of the service and the prices charged to users.

Last but not least, it must be noted that water pricing continues to act as "the 'prism' through which the values involved can take on a tangible form" (Travi 2014). ARERA is entrusted with the task of defining the general criteria (the pricing "model") to which all pricing plans prepared by the various optimal-size-area governments must conform. If in the past the whole matter revolved around the determination of the price to be charged to users and the consequent impact on their family budgets, in the current scenario, the pricing function has taken on a variety of different purposes. ARERA has defined a pricing model of incentives and penalties that seeks to direct the choices and behaviours of system players towards its desired results. Through the modulation of pricing criteria, optimal-size-area governments and operators are driven towards the pursuit of infrastructural investment and service quality improvement. Similarly, price differentiation (that is, the assignment to progressive price bands based on consumption and user category) allows to implement a progressive charge system and, most of all, to reward users with lower prices in response to a reduced and more environmentally sustainable consumption. Pricing models are the main operating instrument in the broader water policy defined by the regulatory authority, and the prices charged to users reflect a wider-reaching approach and the harmonised result of competing interests.

5.2 The "Custodial" Role of the State and the Participatory Management of Commons

Viewed from this perspective, traditional approaches and tools – essentially functional to regulating production uses, and based on the idea that water withdrawal requirements must be met as the available water resources exceed water demand – are showing their deep and manifest inadequacy. The critical revision regards, first and foremost, the civil-law-derived ordering scheme that, for centuries, has confined normative thinking in this field into the narrow dichotomy between public and private ownership of waters (Carapezza Figlia 2008). Water law may no longer be constrained within the tight framework of the theory of goods and is now part of the wider scope of environmental law. True, lawmakers keep stressing that waters are publicly-owned, but reference to this categorisation is only made to mark a clear break with the past. The underlying attribution scheme is not aimed at granting the State dominion over the *res*, but rather at entrusting the public authority (that has the necessary powers) with the purpose-driven task of protecting waters. This is an attribution scheme that is devoid of any purely property-centered dimension (Giannini 1963; Cassese 2007) and thus stands apart from both the Roman-law-derived property law model that was championed during the time of legal absolutism (Rodotà 1990) and the traditional interpretation of the notion of being publicly-owned that was developed as part of the Italian administrative legislation. With European Union (EU) law remaining silent on the topic of actual ownership, water law is remodelled based on a new approach to the legal relationship between public authority and the water system, one in which the condition of being publicly-owned, far from responding to an anti-historical call for complete submission to public ownership and control, originates from the need to ensure full implementation of the most rigorous environmental policies (in both quantity and quality terms) for the protection of water resources and the prioritisation of drinking use over any other form of water exploitation. Water – just as the Italian Constitutional Court has explained – “belongs to us all and, as such, must be distributed according to rational and impartial criteria that must be established through specific administrative rules”: from the dual principle of public property and fair allocation “stems the consequence that water use must be regulated and planned by the public authority, in an effort to ensure a balanced consumption for purposes other than domestic ones”.[4] The above translates into a total exclusion (Cassese 1967) of any possibility of private ownership of individual water bodies, which is deemed to be incompatible with the characteristics of unity and indivisibility of the water system, correctly perceived, from the point of view of science, as a complex adaptive system, vulnerable and not very resilient (Cafagno 2007).

The difference is obvious compared to the previous approach, according to which only waters that are capable of being usefully exploited must be regarded as public, as famously worded under Article 1 of the already mentioned Royal Decree no. 1775/1933: “All spring, river and lake waters, including where artificially abstracted from the ground, redesigned or expanded, which, considered either in their individuality, and thus in terms of their flow rate or size of their water catchment area, or as part of their overall waterway system, are or may become capable of being utilised for public interest purposes are to be regarded as public”. The reference to the condition of being publicly-owned, as defined in the Italian Civil Code (Articles 822 and following), needs to be clarified. Behind the newly-developed notion of all waters being publicly-owned lie the traits of an innovative form of shared ownership: the “property of all”, as defined in purposely evocative terms first by the Constitutional Court and then by the Court of Cassation, which spoke, in particular, of a dual ownership of environmental assets, in light of which reference to the “‘condition of being publicly-owned’ expresses both ownership by the general public and ownership by the public authority, the latter (ownership of the asset in the strict sense of the word) operating as a sort of stewardship [*appartenenza di servizio*], stemming from the fact that the public authority is the entity that can, and must, guarantee the conservation of the specific characteristics of the asset and their continuing availability for use”.[5]

In this perspective, the public character of waters calls for a State that acts as the custodian of the water system, as well as for the submission of all forms of

[4] Constitutional Court, judgment no. 273 of 22 July 2010.

[5] Court of Cassation, Joint Sects., judgment no. 3813 of 16 February 2011.

exploitation to prior screening by the public authority and to an assessment of compatibility against the existing environmental and drinking water requirements. It is once again the Constitutional Court that pointed out that "it is the responsibility of the competent public authority to programme, regulate and monitor a correct use of water in a given area, not for the mere protection of a publicly-owned asset, but for the purpose of achieving a balance between the public nature of water and its call to meet the domestic and production-related needs of citizens. These are entitled to use groundwaters, in accordance with the administrative rules that have been established to ensure the conservation of water resources, which may not be indiscriminately depleted through unregulated water withdrawals".[6]

Waters are not "State property" as such: an innovative interpretation of the notion of being publicly-owned has emerged, according to which the public authority acts as a custodian and is "only" called on to exercise the conservation and distribution functions that are strictly required (Caputi Jambrenghi 2004) to implement a value system informed by the indivisible ideas of sustainability and solidarity. As incisively stated by the Court of Cassation, "ownership by the State (as State-community, that is, as the entity that represents the interests of all) is not an end in itself and is not relevant only in terms of expressing title to an asset; rather, it carries with it all the duties of a type of governance that seeks to enable all the various forms of public use and enjoyment that are inherent in the asset".[7]

This profound revision of the notion of being publicly-owned has opened up a space for an even deeper reforming effort, stemming from the ontological features of water resources. Waters provide fundamental and indivisible ecological services and, now more than ever, are exposed to depletion due to over-abstraction and pollution. As such, they can be structurally classified as "commons" or "common pool resources" (Nespor 2013), not to be confused, as it is often the case in an unjustified effort to bring the past into the present, with the category of *res communes omnium*, which in archaic Roman law was used to describe resources that were available in unlimited quantity, individual access to which was to be granted to everyone, as demanded by a subsistence economy (Fiorentini 2010). The Italian debate on common pool resources is still open and has not always followed a straight line (Bombardelli 2016; Gambaro 1995). Two things are clear, though. First, the inadequacy of the traditional categorisation of public goods, as expressed in the Italian Civil Code, is widely recognised (Renna 2004; Renna 2006; Della Cananea 2011; Napolitano 2010, 2015; Palazzotto 2017; Andreis 2015; Castorina and Chiara 2008). Second, there does not seem to be any doubts that viewing environmental assets as common pool resources is a useful line of reasoning (Boscolo 2017b, 2019), resulting also into the possibility of including both publicly-owned assets (such as waters) and privately-owned assets (such as micro-lots of land, woodlands and landscape elements) into a single classification category, carrying specific duties of conservation and transmission to future generations. Recent noteworthy

[6] Constitutional Court, judgment no. 273 of 22 July 2010.

[7] Court of Cassation, Joint Sects., judgment no. 3813 of 16 February 2011.

openings by the judiciary and the ensuing debate (Cortese 2011; Marella 2011; Saitta 2011) call for a verification of the correspondence between the idea of waters being publicly-owned, with the State acting as a custodian, and the notion of common pool resources that has become popular in international socio-economic literature.

A comparison with the theory of the commons highlights remarkable similarities with the Italian case. The condition of massive pollution and systematic depletion from over-abstraction that has been the terrible norm for some decades, is the almost literal transposition of the metaphor that was labelled by Garrett Hardin – towards the end of the 1960s – as the "tragedy of the commons" (Hardin 1968). Exploitation by many, albeit rational at an individual level, eventually causes the depletion of the commons. Therefore, the sum of individual choices leads to "tragedy". The limits of collective decision-making have traditionally been used to support the argument that private management of natural resources is in fact a more efficient option. Faced with the same problems, however, Italy would appear to have responded with the traditionally opposite alternative: the all-public approach, the "institutional" solution, placing the concerned resources under the ownership and centralised control of the State, which is then able to rely on its huge powers. The choice of regarding environmental assets as publicly-owned would seem to be at the polar opposite of both the notion of private property and the communitarian and cooperative-based models identified by Elinor Ostrom in the extensive research she had conducted over the previous decades (Ostrom 2006; Napolitano 2007), and which expresses a sort of counterpoint against the allegedly inevitable dichotomy between public and private and promotes the adoption of local self-governance solutions.

In spite of appearances, however, Italy has to some extent gone past the public-private dichotomy. Indeed, there is no point in continuing to wonder whom the waters belong to. The debate on ownership may sit in the background (Casertano 2008): environmental assets raise, first and foremost, a question of identifying the government body that should be entrusted with the task of preserving them in the long term. We speak of a body that can make decisions that are efficient, but also open and democratic – the latter requirement being the reason why preference is now given, and has been given for some time (in the Italian system, too), to responsible self-governance solutions. In this direction, an exceptional legitimating factor is found in Article 118 of the Italian Constitution, according to which "State, Regions, Metropolitan Cities, Provinces and Municipalities are called on to facilitate the independent initiative of citizens, both as individuals and as associations, in the performance of activities of public interest, based on the principle of subsidiarity". Typical communitarian arrangements, based on the notion of horizontal subsidiarity, are seen across the structure of the Italian water system, with tangible examples including irrigation consortia or the more recent rediscovery of the so-called "civic uses", or public use of land (Grossi 1977; Cerulli Irelli 1983), as redesigned, from an environmental perspective, by Law no. 167/2017.

The most interesting instrument, however, is certainly that of river contracts (the equivalent of the French and Belgian *contrats de rivière*), now regarding more than eighty water bodies all over Italy (Bastiani 2011; Boscolo 2012; Duret 2015).[8] Indeed, in practice, a management model is emerging that, in many respects, goes beyond the legislation in force, and opens up a concrete space for a number of forms of active involvement of river population and water users. River contracts have rapidly taken hold and have allowed to achieve significant results in terms of river restoration, through the convergence of various user categories, the local communities and the public authorities on new value systems and shared agendas (Magnaghi 2006). These results would not have been achieved through authoritative instruments. Even national lawmakers, following in the footsteps of previous regional laws, have acknowledged the significance of river contracts (or lake contracts, landscape contracts and ecological network contracts), leading in 2015 to the introduction in the Environmental Code of Article 68-*bis*, according to which "River contracts are involved in the definition and implementation of river basin and sub-basin district planning instruments, operating as voluntary strategic and negotiated programming instruments for the conservation and correct management of water resources, the promotion of river areas and the prevention of hydraulic risk, contributing to the local development of such areas". In addition to giving these consensus-based instruments formal recognition, the above provision grants them an active role as from the initial stage of goals definition, thus entrusting them with a wider function than a purely complementary one in the implementation of district planning. River contracts have become key instruments for the promotion – including on a financial level – of the relationship between communities and water resources, and have taken on the function of providing a legal and administrative framework for the "spontaneous convergence of participatory resources, technical competences and local decision-making" (Boscolo 2012), finally enabling access of non-institutional entities to water governance and the shift from participation to co-governance (Duret 2015).

A system has appeared in which local stakeholders are attributed a role and responsibility in respect of specific water bodies, a trend which – because it acts on a different level – can co-exist with the notion of waters being publicly-owned in their entirety, as well as with macro-level district planning. In observing these trends, however, we must clearly recognise their complementary value within the multi-scalar dimension of the water system and the related governance instruments, creating a model in which the act of "taking responsibility" by the local communities is referred exclusively to individual water bodies or portions thereof, and is in addition to, rather than in substitution of, the functions of protection and sustainable governance exercised by the public authorities. In this perspective, and having made this essential clarification, it now makes sense to speak of a "third way", finally setting aside the public-private categorisation. That is, it makes sense to speak of waters as common pool resources, in terms that are not in contrast with the idea of waters being publicly-owned, with the State acting as a custodian.

[8] On river contracts, and public participation more generally, see, in this volume, Chap. 19 by Fasoli, Bastiani and Puma.

5.3 The (Difficult) Priority of Planning

Another distinguishing aspect in the evolution of Italian water law is represented by the rebalancing effort in the relationship between concessions and planning, historically characterised by a marked bias in favour of the former (Pototschnig 1969; Boscolo 2012). Water concessions were once the backbone of the entire system, epitomising the overall legal structure of a management model that had become established starting from the second half of the nineteenth century. With decades of delay (Colucci et al. 1974), the process has started for a gradual disengagement from the traditional governance system, heavily dependent on demand and fitting only with a (once unconditionally-prevailing) model of maximum exploitation of all waters capable of being usefully abstracted.[9] In this perspective, planning has become the core of a policy approach designed to pursue the conservation of waters and their programmed sustainable use.

The WFD called for a reorganisation of planning policies on a district-level macro-scale (a matter of "optimal size") (De Benedetto 2017). In Italy, however, the difficult and decades-long transition to a river basin scale, which, after the devastating Florence floods of 1966, had been indicated as the most appropriate scale to control diffuse externalities, finally came to an end with the adoption of the law on the protection of soil (Law no. 183/1989). Now, in view of the need to comply with EU requirements, the Code (hurriedly) provided for the aggregation of the previous river basins into river basin districts, but following lines of reasoning that, at times, seem to make little hydrographic sense. This new administrative (no longer hydrographic) arrangement was then rationalised with Law no. 221/2015, which amended Articles 63 and 64 of the Code. These have now provided for the elimination of the previous river basin authorities and the transferral of their competences to seven river basin district authorities (Eastern Alps, Po, Northern Apennines, Central Apennines, Southern Apennines, Sicily and Sardinia), which have been assigned the task of preparing the river basin district plans and the related operating plans (including the river basin district management plans). District authorities have also been assigned key competences in terms of the hydrogeological protection of soil and are responsible for implementing the WFD, as transposed into Italian law by Legislative Decree no. 49/2010, as relates to the protection from flood risks (first and foremost through the approval of flood risk management plans).

[9] It is perhaps just worth noting that this same value system had provided the basis for the institution, in 1933, of a special water jurisdiction (on the history, functions and current structure of the water jurisdiction system, see Conte (2006), Parisio (2009) and Palazzolo (1999)). The whole water jurisdiction system, consisting of eight Regional Courts of Public Waters and a High Court of Public Waters based in Rome, was provisionally reorganised under Law no. 45/2004, pending a more systematic reform, also addressing the issue of participation in technical boards (on this matter, see the statements and observations made by the Constitutional Court in judgment no. 353 of 17 July 2002). For a summary of the debate currently under way, see Marchetti (2011) and Mastrangelo (2009).

Over the last decade, water planning activities have translated largely into the approval of district management plans, starting from 2010 (Alberton 2011; Boscolo 2012). These instruments have marked the turning point that the river basin plans required under Law no. 183/1989 had been unable to achieve, and represent the most important example of a new process-based and adaptive planning model, which has been made possible also through a series of structured procedures designed to pursue the centrality of knowledge, as well as to promote authentic participation and an analytical evaluation of the effects produced. The need for a greater flexibility and adaptivity than in traditional planning instruments stems mostly from the newly-acquired awareness of the limitations that are inherent in the ability of lawmakers to predict how things will develop when faced with complexity, of which water systems represent one of the most significant examples.

The heart of the planning procedure is the construction, open to participatory contributions, of the knowledge basis that forms the true gravitational core of the plan itself. This activity goes well beyond the mapping of the basin and the compilation of a user register (absurdly still missing in many parts of the country, despite its creation being a requirement under Article 5 of Royal Decree no. 1775/1933). It is, in fact, a much more analytical exercise, including, as expressly required under the WFD, a detailed "characterisation" of district water bodies, which is functional to the assignment of specific quality and quantity objectives for each of them (Maier 2010). In so doing, attention shall be paid to the territorial specificities of the water body, which is seen not just as part of a geographical basin but also as belonging to a differently-designed ecological area: indeed, and although it may seem counterintuitive, the search for the most appropriate model has led to distributing surface water bodies into multiple hydro-ecoregions, each featuring its specific characteristics and criticalities. This methodological approach represents the prerequisite for the development of a finally objective and up-to-date picture of the actual morphology of the surface water network, of groundwaters and of transitional coastal waters, also including a map of uses and mutual interdependencies between quantity- and quality-related availability of waters, determinants and pressure factors. The knowledge basis for each plan is completed with the identification of the carrying capacity for each hydro-ecoregion. In the more strictly programming-related part of the plan, the various hydro-ecosystems are assigned their respective objectives, to be achieved through a series of measures that are also identified in the general management plan, with a requirement for precise indications on policy funding means. Management plans place key importance on economic analysis, as they seek to identify, in line with the most recent developments in environmental economics, the actual value of the natural capital that may be associated with the various water bodies as well as the costs of any purely exploitative models that are still being implemented (Boscolo 2018).

The district plan is structured in a manner that is comparable to a mosaic of frames and is formed bottom-up starting from each individual hydrological unit of significance, while retaining the ability (scalability) to indicate actions and decisions that must necessarily be made at a district level (De Bellis 1984). The opportunity has opened up for the involvement of Regions and Municipalities in the characterisation process, as a key condition for the development of a genuinely scalable and integrated planning model, within which each local authority, remaining within the framework established by the central authority, may describe, in as much detail as necessary, the (secondary) water network that innervates its territory and participate in identifying the necessary governance actions.

Trans-scalar plans are, indeed, the only possible response to the risk, which is always very high, that planning documents formed at a district level (too large: just as an example, the Po River Basin District covers roughly one fourth of the entire Italian territory) lead to an excessively schematic representation of physical and ecological features of vast areas, for which only a more analytical approach may highlight significant differences, clusters, fracture lines and different habitats. An erroneously homogenising approach would end up losing sight of the need for policies to focus on each one of these smaller units separately. The response to such an ungraspable complexity – with its many connections and interdependencies – is now even more difficult following the repositioning of water policies on a much wider scale, based on a purely administrative subdivision into river basin districts. Planning – with huge delay – is finally set to become the essential core of the system and, judging by the first procedures implemented by district authorities for the preparation and approval of management plans and flood risk plans, it shapes up as being based on the priority of knowledge, as well as on the participation of all stakeholders (involved in environmental, industrial and agricultural policies) and institutional authorities (Regional, Provincial, Municipal).

5.4 Water Withdrawal Concessions in a Condition of "Certain Uncertainty"

Not less crucial, as previously mentioned, is the matter of the structure of water withdrawal concessions and the legal regime applicable to them. Just to give an idea, it is estimated that approximately 70% of natural water flows within the Po river basin are withdrawn and intensively exploited. Of course, a clear distinction must be made between dissipative uses and other forms of exploitation, such as surface irrigation, which return much of the water back into the ground. This distinction, however, the need for which has been pointed out by many, goes hand in hand with the observation that all water abstractions cause a deep alteration in the delicate ecological and hydrological balances of the water system and contribute to reducing its self-purification capacity, as well as its biodiversity (Greco 1983). Paradoxically, an exceptional use of the resource – with the ensuing prejudice caused in terms of both damage to the ecological mechanisms and limitations on general uses by the community – does not even translate into an actual return on the investment, as the lack of differentiation in prices, which are kept low by policy, prevents a selection among competing claims and leaves room for decidedly suboptimal (and thus less profitable) uses.

The overhauling of the concession model is therefore another necessary step in the path towards a new water law, as the measures defined in management plans often have to reckon with a reality made of water withdrawal concessions (and discharge authorisations) that are very much in need of extensive and unpostponable revisions. The traditional instrument of the water concession (Costantino 1975), long regarded as some sort of paradigm in the general category of administrative concessions (D'Alberti 1981), needs to adjust to a scenario in which withdrawal rights may no longer be guaranteed in the long term and even quantity continuity has to be subordinated to the imperative call for the conservation of water ecosystems, leading, first and foremost, to a requirement for adaptability.

In the original view of Royal Decree no. 1775/1933, water was a "means" for the achievement of economic and production-related results (irrigation, hydropower, driving power, cooling power, etc.) (Pastori 1996). The concession process came down to a verification of resource availability and use cost-effectiveness, conducted on the basis of hydraulic compatibility assessments made on a local micro-scale level (partly due to the inability of modelling the full effects of withdrawals on the specific balances of the entire basin). One of the most significant consequences of this approach was the particular rigidity of concessions. The only adaptation clauses (revocation and revision) were associated with the extremely rare cases of significant alteration of available quantities due to natural events causing a radical change in the water flow: a condition that was set out, in very stereotypical terms, by both the law and the individual concessions. This was, however, a remote possibility and, in practice, concessions were basically unassailable. Consistently with the values on which the system was based, it is emblematic that, in response to the then-prevailing demands for production efficiency, a compulsory concession transfer instrument was developed with a view to making sure – in a Pareto-efficiency perspective – that preference could always be given to the user with the greatest exploitation capacity (with termination of the existing concession and obligation for the new concessionaire to indemnify the previous concessionaire).

This system has now entered an irreversible crisis. In the current picture, the typical rigidity of traditional concessions is being radically redesigned, in the light of an increasingly pressing need to conserve water ecosystems in an optimal condition – a need that can be met, first and foremost, by ensuring that water flow is maintained at a rate that is compatible with the preservation of biodiversity. With a radically changed hierarchy of values, environmental demands call for a (continuous) verification of the compatibility of withdrawals with parameters that were once unheard of, such as the minimum vital flow (or environmental flow), an important descriptor of the quantity-related values that must be guaranteed in order to ensure the preservation of biocoenosis in the river bed (safe minimum standard). In the increasingly frequent periods of low water, these checks may lead (Article 95, Paragraph 3, of the Code) to the imposition of compulsory releases or withdrawal reductions, which are noticeably not accompanied by the payment of indemnities,[10] not even where the expectations of concessionaires for a profitable exploitation of the waters are affected.

Situations of direct competition among different uses are arising at a worryingly systematic rate, partly following a reduction in the amounts of water that are available at a given time during the various seasons. As these issues are directly linked with the particularly inelastic nature of water demand, they cannot be resolved only through conventional allocation rules. In an effort to incorporate the environmental dimension into the concession procedure (thus working on a different level than the minimum vital flow, which rather operates like an externally-imposed restriction), the demanding obligation has emerged to verify the compatibility of withdrawals against a newly-developed indicator, known as the river basin balance (expressing the ratio between needs and the available/activatable quantity in a given water body, net of the minimum vital flow: Article 145 of the Code). The entire system is moving away from a needs-based approach, which saw technical skill and financial capacity as the only limitations to exploitation. On the same front, we will soon also see the first tangible results of a programming action for dissipative and river-basin-changing uses (at a water body level) that is designed to be respectful of the river basin balance and identify interdependencies (environmental and economic) between multiple uses along the river.

The above changes are all part of a general concession overhaul process that also regards concession duration and fee structure, which is now required to incorporate – as prescribed by both the WFD (user-pays principle) and the Decree of the Italian Ministry for the Environment no. 39 of 24 February 2015 (*Regolamento recante i criteri per la definizione del costo ambientale e del costo della risorsa per i vari settori d'impiego dell'acqua*) – a component aiming to compensate for the uses and environmental functions of water that are no longer possible due to the reduction in available quantities and the externalities produced by withdrawals. Such a revision of the fee determination system, in addition to responding to a pressing need for greater recognition of the full value of public goods, is also part of a wider discourse invoking the use of the economic lever as a means to encourage a more responsible consumption (Cafagno 2015). Such an approach to water law should be largely used, since the current scenario is affected by a significant distortion in the recognition of operator preferences (willingness to pay) due to the fact that fees and prices have long been kept low "by policy" and have been inadequate to ensure the internalisation of environmental costs by those who are permitted to exploit common pool resources for their own purposes.

The legal structure of concessions is changing, with significant consequences not only with regard to the granting of water withdrawal rights, but, first and foremost, with regard to their term. The conditions are arising for environmental interests to finally prevail, including when it comes to historically long-term concessions (Casalini 2010). Such deep transformations are resulting into a new concession model that has a much more differentiated structure than in the past (D'Alberti

[10] The Italian Court of Cassation (judgment no. 28268 of 21 December 2005) confirmed the legitimacy of a reduction in quantities available for withdrawal, with no indemnification to be paid, in two Sardinian basins following calculation of the minimum vital flow.

1986), but is also very different from the models outlined by the general law on administrative procedure (Law no. 241/1990): one may think of the issue of the revocability of concessions, which, in this field, are required to waive any forms of relief for any prejudice suffered by the concessionaire, by reason of the inevitable uncertainty regarding assignable quantities. Indeed, as a derogation to Article 21-*quinquies* of the afore-mentioned Law no. 241/1990, a water concession may be revoked with no indemnification when responding to the need to ensure the priority of environmental and drinking-water demands, in all situations where the maintaining of withdrawal rights (and of the quantity levels granted in the concession) would endanger the fragile balance of the water body.[11] Such a form of revocation option confirms once and for all that water withdrawals for economic purposes are subordinate to environmental and human demands. In this framework – representing the reflection into legislation of the general ontological value attributed to the water system – revocation (which does not have to lead to termination, but could simply involve a temporary limitation on the quantities granted through the concession) is the only instrument that can ensure constant alignment between withdrawals and quantity available for withdrawal (that is, net of any amounts that may not be withdrawn for environmental reasons). This fact gives the revocation-adjustment discretion a key role among the range of active instruments that may be used by the public authority for environmental protection purposes.

From the priority given to environmental care stems the impossibility for the concessionaire to call for "reinforced" protection, both in relation to the preservation/non-adjustability of its water withdrawal rights and in terms of indemnification/compensation, with the additional consequence that the exercising of such discretion upon arising of the relevant environmental conditions takes on the character of necessity that is typical of those measures that are designed to guarantee a "high" level of environmental protection and the priority of drinking water uses – as well as the pre-eminence of agricultural over industrial uses[12] (Tonoletti 2008). The concession relationship is structurally characterised by the possibility of terminating or reducing (adjusting) its subject matter. It therefore seems fair that – where, in the technical opinion of the public authority, the conditions arise for the adoption of specific protection measures – no financial indemnity needs to be paid to re-establish a balance that, by definition, may not be aspired to right from the start.

[11] "With reference to Articles 2, 3, 41, 42 and 43 of the Italian Constitution, this Court deems the question of the constitutional legitimacy of Article 43 of the Consolidated Act on Water (as approved by Royal Decree no. 1775/1933) – in the part where it requires the holder of a water abstraction concession for the production of electricity to release the water, with no right to indemnification, whenever required by the concession grantor in the public interest – to be manifestly unfounded. The particular legal treatment of public waters means that the rights of a private concessionaire can never qualify as ownership rights and are always subordinate to the needs (including extraordinary needs) of the public, whose right to use the waters is always latent and can resurface at any time, with the consequence that the concessionaire, who is fully aware of said limitation, may only request an adjustment of its fee in proportion to its reduced use of water": Civil Court of Cassation, Joint Sects., judgment no. 23196 of 3 November 2009, in *Giustizia civile – Massimario annotato della Cassazione*, 2009, p. 1532.

[12] "In periods of drought and in all cases where water resources become scarce, during which quantities available for withdrawal are adjusted, priority must be given, immediately after human consumption, to agricultural use": Art. 167 of the Code.

To complete the picture, we also need to point out the inflexible approach undertaken by the Constitutional Court in stressing that concession awards (as instances of allocation of a scarce resource) need to always be preceded by a call for tenders. This stance has provided the basis for crucial arguments in support of concession renewal prohibition.[13] Also, it sanctions the principle according to which – given that the water quantity available for withdrawal represent a sort of "essential facility" in relation to the possibility of performing certain economic activities – water must be assigned in a manner that places all aspiring concessionaires on the same level, with "incumbents" no longer being able to rely on their privileged positions. Calls for tenders are the only instrument that is capable of directing awards towards a form of "dual efficiency", favouring applicants who promise to undertake greater efforts in environmental terms (reducing consumption, reconverting production systems, updating irrigation systems, switching to less water-intensive crops, etc.) as they are able to make a more economically-efficient use of the limited amounts available for withdrawal.

To conclude, we can now recognise the existence of two interests – an environmental interest and an interest in the withdrawal of drinking water (really, two sides of the same sustainability/solidarity argument) – that are clearly prevailing, and another interest – linked to the exploitation of waters for irrigation-related purposes – that is subordinate to the first two, but prevails over any interests associated with industrial exploitation. From this hierarchical classification of public interests, radical changes stem in the structure of concession procedures and the content of concession instruments. This, in turn, leads to a scenario in which reflecting on the concession system can provide extremely useful indications for administrative law in general, which is increasingly faced with the task of allocating scarce assets and utilities and awarding concessions in a condition of "certain uncertainty", that is, a situation where the only certainty is uncertainty regarding the quantity of water that will be available in the future (Boscolo 2013). From this the need arises to identify suitable concession models that are able to incorporate a requirement for adaptability as to both term and assignable amounts (Rodolfo Masera 2017).

5.5 Technical Regulation and Water Pricing

The value of solidarity expressly pointed out by Article 144 of the Environmental Code is concretely implemented in the integrated water service[14] (Parisio 2013, 2018; Bruti Liberati 2010; Carbone et al. 2017; Bercelli 2006). It is not sufficient that all waters are public, it is also essential that the daily amount of good-quality water that each person needs is made available to everyone. When it comes to water

[13] Constitutional Court, judgment no. 339 of 12 December 2011, concerning a law issued by the Lombardy Region; Id., judgment no. 114 of 10 May 2012, concerning a law issued by the Autonomous Province of Bolzano.

[14] On the integrated water service see, in this volume, Chap. 13 by Parisio.

distribution, public intervention must take on the form of a structured public service in charge of allocating a vital and non-replaceable asset. In order to effectively answer its call to fulfil the right to water, as recognised by both international law and Italian constitutional law,[15] the distribution service must be able to ensure universal access, both in a geographical sense (water supply must be made continuously available in all parts of the country) and in a financial and social sense (access to water by each person must not be prevented by insurmountable price barriers). At the same time, the water treatment segment must make sure that all wastewater is adequately treated and returned, with a view to improving the quality of water in water bodies, in accordance with the goals set out in the WFD and detailed in the above-mentioned district management plans. The organisational efficiency that is requested from the integrated water service is measured against the following objectives: operational efficiency, that is the ability to organise operations management effectively, and economic efficiency, that is the ability to achieve a sound economic management, with an eye to long-term financial balance indicators and the funding of asset-renewal programmes. The above is always to be balanced against the need for social redistribution initiatives, seeking to respond to cases of water poverty.

More than twenty years after the adoption of the reform law (which was later transposed into the Environmental Code), the system is still far from having met the abovementioned goals and has only just recently shown a possible shift in trend (Massarutto 2011). The system has suffered the consequences of extensive fragmentation (the legacy of the long history of a service that was designed in the nineteenth century on a municipal scale) and a huge lack of investment, which has led to significant plant deterioration (with network losses, poor service quality in some areas and obsolete water treatment services almost everywhere). For a long time, even the ability to design a valid pricing policy had been lacking: in contrast with the principle of full cost recovery, mandatorily introduced by the WFD, the system was based on a sort of distorted balance between low service quality and prices that were kept low by policy. And, most of all, despite the countless legislative interventions, the system was unwilling to reduce public operations management – which was often inefficient and politically-biased – and open up to competition.

The distribution service displays the particular feature of being a local natural monopoly (Ogus 2000), mostly due to the non-duplicability and non-shareability of distribution networks (Polo and Denozza 2001). Just like for other public services, many have suggested that competition could drive the system towards greater efficiency in operations management. In the case of the integrated water service, however, because of the barrier represented by the existence of only one network, the competition model can only be applied in the form of competition *for* the market (and not *in* the market), that is through a tendering process, accompanied by a guarantee by the concessionaire that it will make the service available to users through the network, which remains publicly-owned (Bartolini 2008; Di Porto 2008) and is made neutral in accordance with the essential facilities doctrine (Bastianon 1999;

[15] On the right to water in Italy see, in this volume, Chap. 11 by Turrini and Pertile.

Salonico 2001; Durante et al. 2001). For a long time, the creation of a competitive system was made pretty much impossible also by the lack of a truly independent regulator (Napolitano 2017) – one having the necessary powers to collect the required information and not exposed to the risks of being "captured" or lacking neutrality – that would be somehow comparable to the Ofwat authority in England and Wales.

In 2012, the scenario changed radically with the attribution of a regulatory function to the body that was then the regulatory authority for energy, and is now responsible for regulation also in the water and waste collection sectors and has thus been recently renamed as the Italian Regulatory Authority for Energy, Networks and the Environment (the abovementioned ARERA). Right from the start, regulation in the water sector showed some unusual traits, not fully in line with the economic theories of regulation. This was in consequence of choosing a system that was once again not very much inclined to competition. Indeed, the referendum of June 2011 had been an occasion for lacerating ideological clashes between two irreconcilable views: on the one hand, the supporters of a water service in the hands of private operators, chosen through transparent tendering procedures, and, on the other, the large army of supporters of the (distorted) belief that public ownership necessarily entails public operations management. After the clear victory of the latter position, management through in-house companies became (and still is) the most widespread model all over the country.

In this context, regulation has become a sophisticated technical activity, aimed at guiding – administratively – the behaviour of system players (Boscolo 2017a). Regulation activities are not directed at the creation of the conditions for competition, but rather at emulating its incentives, in an effort to lead the organisation and management of a service in public hands towards a condition of maximum efficiency and protection of user rights (in terms of both contractual performance and availability of social measures). The particular form of regulation in the water sector is called for to prevent operators that have been directly appointed, with no competition involved and no real external supervision, from ending up in charge of a monopoly and acting, through opportunistic behaviours, to the detriment of users. Regulation in the water sector has thus taken on the function of preventing the "all-public" approach, implicitly dominating, from re-proposing, in the medium term, the typical sub-optimal results that can be expected from operators that have not been adequately directed towards maximum efficiency.

The key role entrusted to ARERA is confirmed in the Decree of the President of the Italian Council of Ministers of 20 July 2012, which lists the duties assigned to the regulatory authority. As established under Article 2 of the decree, ARERA must ensure "the provision, availability and quality of the service to users", the "definition of a fair, certain, transparent and non-discriminatory price structure", the "protection of the rights and interests of users", the management of the integrated water system according "to a condition of efficiency, balance and non-discrimination" and, last, the "implementation of the EU principles of 'full recovery of costs', including environmental and resource costs, and 'polluter-pays'". Based on this value system, defined in its normative details, Article 3 lists, again with remarkable accuracy, the regulation and control functions that are entrusted to the regulatory authority. Said list includes, but it is not limited to, the definition of service quality objectives and minimum levels (including through a system of incentives and penalties), the preparation of the model agreement for the regulation of relations between awarding authorities and operators, the definition of cost components ("including the financial costs of investments and operations") for the determination of prices, the definition and regular review of the pricing method. The list goes on to include the review of optimal-size-area plans, with possibility of giving binding prescriptions as required, the approval of prices proposed by the local authorities and the provision of guidelines for accounting transparency. Finally, the list mentions the role of the regulatory authority as the body in charge of protecting user rights, a function which it can exercise also through the examination of complaints, requests and observations. In addition to the above, Italian Law no. 221/2015 has also vested the regulatory authority with the task of introducing appropriate measures in the pricing model to address the matter of payment defaults and the provision of a minimum guaranteed amount of water to low-income users. Regulation is therefore also responsible for taking into account social concerns in the management of the integrated water service.

On a local level, the organisation of the integrated water system is based on the creation of optimal-size-area governments (the abovementioned EGAs), which have taken over the role that was previously assigned to Municipal governments (De Benedetto 2017). The 62 EGAs (whose number is being consistently reduced due to continuous rationalisation and institution-building efforts not as yet concluded) are responsible for the preparation of the optimal-size-area plans, the definition of the optimal-size-area prices and the awarding of the service. The assignment of regulatory functions to ARERA has shifted the organisational model towards a partial centralisation, which has meant that ARERA has taken on a role of verification and re-direction of strategic choices by local authorities. Upon approval of prices (that is, of the draft price structure proposals submitted by each EGA, together with the economic and financial plan and investment programme for the strengthening of infrastructural networks and the organisation of the service at an optimal-size-area level), the regulatory authority is called upon to issue a binding opinion – "under penalty of invalidity" – on technical and economic aspects and on the concession agreement clauses. ARERA thus plays a key role in the planning process by expressing opinions on draft plans that, more than once, have led to radical changes in locally-made decisions. The approval of optimal-size-area plans, which goes well beyond the purely formal checking of draft plans, has made the regulatory authority able to guide the planning process towards a unitary model. Such a model is based on advanced assessments in terms, on the one hand, of consistency with technical knowledge on economic and infrastructural aspects and, on the other, of regular measurement of results aimed to enable adaptive and self-corrective processes. Again, when approving the price structure to be applied in each optimal-size area, the regulatory authority is also called on to express an assessment in relation to the infrastructural intervention programme, the economic and financial plan (for the purpose of verifying sustainability over time for both operations and investment) and the operation agreement. The latter function is exercised by ARERA with a view to ensuring the adoption of a uniform pricing method and the effective economic sustainability of the investments provided for in the infrastructural intervention programmes.

For an idea of just how complex some of the matters dealt with by ARERA are, it is worth taking a quick look at its activities regarding price regulation and the preparation of the model concession agreement.

As to the latter issue, with Resolution no. 656/2015/R/IDR, the regulatory authority has adopted the model for the regulation of the relationship between awarding authorities and operators in the integrated water system. The model indicates the layout and content of the agreement, working on the assumption that said instrument is called on to regulate the contractual relationship between the parties in full, both *ex ante* (that is, during the awarding process) and *ex post* (during the concession period). In addition to providing a clear and up-to-date overview of the key contents of the concession instrument, the model also analyses the problems that may affect a long-term agreement that fails to address all the relevant issues, leaving the public party at risk of finding itself in a condition of bounded rationality, due to serious information asymmetries, which would heavily affect its ability to deal with the various situations that may arise in the course of the concession period (Petretto 2007; Cavallo Perin 1998).

However, the most important activity undertaken by the regulatory authority so far is certainly the approval of the pricing method (Vaccari 2018). Before the regulatory authority took action, the pricing formula, which was not an accurate reflection of costs, was established under the Decree of the Italian Minister for the Environment of 1 August 1996 (*Metodo normalizzato per la definizione delle componenti di costo e la determinazione della tariffa di riferimento del servizio idrico integrato*). ARERA has designed a new system based on the principle of full cost recovery (with only actual costs being recognised in the price) and has transformed the pricing method into a means to pursue strategic system-upgrading objectives, with a particular focus on the promotion of infrastructural investment.[16] Through its pricing policy, the regulatory authority seeks to achieve a range of objectives of an environmental, social and economic/financial nature (ARERA 2018). Pricing "allows to pursue policies for reducing consumption and promoting a rational and efficient use of resources, as well as the protection of their quality and quantity, while directly affecting water use by imposing payment of a price for its consumption; it is crucial for the economic and financial balance of operations and for the planning of investment" (Caporale 2017). Pricing must, first and foremost, guarantee a full recovery of efficient expenditures, ultimately implementing the principle set out under Article 9 of the WFD and confirmed by EU Communication COM/(2000)477.

ARERA has defined a pricing model of incentives and penalties that seeks to direct the choices and behaviours of system players towards its desired results.

[16] On water pricing see also, in this volume, Chap. 17 by Massarutto.

Through the modulation of costs that can be recognised in the price and the guarantee of a fixed level of earnings for operators, pricing criteria drive the system towards unpostponable infrastructural investment, as well as efficiency and quality improvements. Similarly, price differentiation – that is, assignment to progressive price bands based on consumption and user category – allows to implement a progressive charge system and, most of all, to reward users with lower prices in response to a reduced and more environmentally sustainable consumption. Prices must also remain affordable and must not lead to an amplification of the phenomenon of water poverty (Barraqué and Montginoul 2015).

ARERA began working on its pricing model back in 2012, with the approval of a transitional method (MTI-T), which was later followed by the first full-performance method for the 2014–2015 period (MTI-1) (Massarutto 2015). In December 2015, after two consultation documents (Resolutions nos. 406/2015/R/idr and 577/2015/R/idr) which gathered countless qualified contributions, the pricing method was approved for the second period covering 2016–2019 (MTI-2) (Resolution no. 664/2015/R/idr). In the search for an increasingly satisfactory solution, the new method, following in the footsteps of the previous one, further expands the range of modulation options included in the regulatory model, so as to allow for maximum flexibility in response to the differences that characterise the various areas in terms of demographic profile, organisational structure of the integrated water system, willingness to invest, etc. It is an asymmetrical model, designed to prevent generalised price increases that are disconnected from the individual situations in the various EGAs and their respective upgrading programmes. The MTI-2 method is comprised of six different pricing matrixes,[17] based on the incidence of required investment compared to the value of existing facilities, implementation of aggregation processes/quality improvements and the value of operating costs per citizen served compared to the national average, with the possibility of applying higher price increases where investment capacity is greater (through the action of the "theta" price multiplier). Identification of the applicable pricing frame by each EGA reflects its positioning in respect of crucial elements that define the quality of operations (including in terms of investment requirements, ratio of operating costs compared to national average, implementation of river basin aggregation processes and awarding to a single operator) and, mostly, shows the gap between the existing situation and the ideal paradigm of maximum efficiency – which acts as a benchmark – to be pursued by each EGA.

In order to guarantee the sustainability of water prices, ARERA sets a cap to the maximum increase that can be applied through the ϑ (theta) multiplier, which represents the upper limit to the amount of operating costs borne by the operator that can be transferred onto consumers. The theta coefficient varies, penalising operators that are less efficient or are lagging behind in terms of rationalisation processes and investments.

[17] In the MTI-1 method, there were only four pricing matrixes.

The price regulation system also operates as a powerful disincentive in respect of anomalous situations, which each EGA must put right in as short a time as possible. The disincentive measure entails the blocking of all price value adjustments, with major consequences on profitability, where, for example, operators have seen their right to operate the service being held invalid by a court, have not complied with the obligation to hand over the water networks to the single optimal-size-area operator, or have failed to adopt the Service Quality Charter[18] by the relevant deadlines. Finally, the regulatory authority has also set a 10% decrease in prices chargeable to users for operators that have failed to comply with their obligation to provide the data and documentation required for price structure definition (thus confirming once again the crucial value assigned to information by the regulatory authority).

Approval of draft price structure proposals is also an occasion for reviewing the adequacy of initiatives undertaken by each EGA in terms of infrastructural-technical as well as contractual quality improvements. With regard to the first aspect, ARERA (with its Resolution no. 917/2017/R/idr) has defined a series of infrastructural adequacy indicators, aimed at measuring interventions in terms of water loss reduction (a water conservation matter linked to aging pipes), continuity in supply, quality of the water supplied and water purification levels (which are key to avoiding any additional infringement proceedings for breach of EU Directive no. 917/271/EEC). With regard to contractual quality (Resolution no. 665/2015/R/idr), ARERA has defined a set of assessment parameters designed to evaluate aspects such as how long did users have to wait, availability of information, invoicing system, etc. In terms of quality improvement, it is also worth noting that the regulatory authority has envisaged a measure prescribing automatic payment of an indemnity (€ 30 per user) where quality obligations are not fully met.

Undoubtedly, pricing has also social implications. Albeit water prices in Italy are still much lower than in other European countries (the price of one cubic meter of water is € 1.53 in Rome, € 2.04 in Italy on average, € 2.45 in Madrid, € 3.44 in Amsterdam, € 3.59 in Paris and € 4.414 in Berlin), initial adjustments, involving significant increases in water bills, have brought into the limelight the issues of bill reductions for low-income families and payment defaults (Cauduro 2017). As to the matter of universal access to water, Article 60 of Italian Law no. 221/2015 requires ARERA to identify appropriate solutions to ensure the availability of water at a reduced price to low-income households. As to the matter of payment default, Article 61 of the same law requires ARERA to issue guidelines for reducing payment default by users, while ensuring coverage of costs and the supply of the minimum life-sustaining amount.

This issue, which witnesses a tug of war between efficiency and fairness, as well as between cost-effective management and the right of all to water (Zolo 2005; Staiano 2011), may not be addressed through a traditional social intervention scheme funded through taxes. Funding of social measures must take place through

[18] The Service Quality Charter, or simply Service Charter (*Carta della qualità dei servizi* or *Carta dei servizi*) is a document setting out the service quality standards and the duties of the operator toward the users.

pricing, in a perspective of cross-subsidisation. Thus, the abovementioned social actions must be covered through pricing differentiation by consumption band and use, as confirmed by the Decree of the President of the Italian Council of Ministers of 13 October 2016, according to which "*the cost of supplying water to low-income users at reduced prices must be covered through specifically-designed pricing mechanisms*": a typical redistribution measure.

Indeed, as previously mentioned, ARERA has also undertaken an incisive action in terms of price differentiation, in an effort to guarantee progressive pricing and recognition of different uses, as well as to direct users towards reducing unnecessary wastage. The final price is made up of a fixed component and a consumption-based component, which is calculated according to a progressive price band system. Progressive pricing translates into a first reduced price band for domestic uses,[19] ensuring – in a social assistance perspective – the provision of the minimum life-sustaining amount (corresponding to 50 litres per day per citizen, as set out under the Decree of the President of the Italian Council of Ministers of 13 October 2016), followed by one basic price band and three progressive price bands. Greater consumption quantities are penalised through the application of higher prices. When progressive pricing is applied to highly-diverse households, the problem inevitably emerges of linking the price charged with the number of members in each household, as the price increase associated with greater consumption should not hit more numerous households. From this perspective, prices per person introduced in some EGAs are to be looked upon with favour, as they are certainly fairer in reflecting the inelastic and non-voluntary nature of higher consumption levels in larger households, who would otherwise end up subsidising single-person households, making it easy for the latter to maintain their consumption levels within the lowest price bands.

5.6 Conclusions

Since the 1990s, Italian water law has undergone a process of authentic rewriting. For centuries, this field of law had been dominated by the dichotomy between public waters and private waters and, more in general, by attribution issues. Today, however, awareness that water constitutes an environmental matrix able to guarantee essential ecological services prevails. Such a different framing of waters as an

[19] It must not be forgotten, however, that, absent income-related prerequisites (unlike in the *Low-Income Tariff for Eligible Households* operating in Great Britain), users to whom the reduced price band is applied differ significantly in terms of preferences (consumption habit and aptitude for reducing consumption) and income level and always carry a minimum demand that cannot be lowered further. These differences mean that the reduced price produces different results for different users. For some users, the reduced price is a real social measure, while for others the cost reduction has basically no effect. This same reasoning applies to the higher price bands, designed to act as disincentives, which produce different effects depending on user income.

environmental good, rather than a good subject to exploitation, brought about the development of a highly original and innovative legal framework that entails the rethinking of some of the constitutive notions of general administrative law. This process invested the issue of State property: if, in the past, waters were considered public with a view to ensuring their most rational and intense exploitation, today State property has a merely "custodial" function inasmuch as the public administration is in charge of guaranteeing the protection and intergenerational transmission of water resources. Planning has taken on an unprecedented, central role. In the space of a few years, local authorities have approved plans at a wide-area (*area vasta*)[20] level, based on hydrological geography and aiming at a double objective: on the qualitative level, retrieving the chemical-physical quality of single watercourses; on the quantitative level, limiting withdrawals that are harmful to aquatic ecosystems. However, we have also seen how, based on the principle of horizontal subsidiarity, planning has favoured the spread of river contracts. These, thanks to the convergence of local governments and non-State actors, enabled the attainment of water-body rehabilitation objectives that would not have been possible otherwise and, above all, the recovery of the identity value of rivers and lakes for riparian populations, as well as an increased accountability on the users' side. In the past, withdrawal concessions represented the core of public policies in the water sector; today, they belong to the sustainability framework that is provided for through river-basin-district management plans, and have been made "flexible" so as to adapt to the uncertainty of available flows. As a result, concession-holders increasingly face withdrawal restrictions without being entitled to ask for compensation. This situation has been defined as one of concessions under conditions of certain uncertainty: the only certainty being the uncertain availability of water resources, the relationship between the concession-holder and the public administration cannot aspire to any kind of stability, and it is thus flexible since the beginning.

Italian water policies have been redesigned when scarcity problems became evident. Alpine reserves (glaciers) are shrinking and big portions of Southern Italy are by now exposed to the risk of desertification. Such a condition of water stress endangers the agricultural sector but may also potentially impair the drinking water supply. Therefore, all water policy measures are geared towards the rationalisation and reduction of withdrawals by setting a rigid hierarchy that gives primacy to environmental functions and drinking water consumption while sacrificing – in this order – industrial and agricultural exploitation.

In this respect, waters can be categorised as commons, with two consequences: on the one hand, each use must not impact on the reproduction and integrity of the resource; on the other hand, planning and management activities have to open up to the democratic involvement of citizens, through processes that – as we have

[20] The so-called *area vasta* (introduced with Law no. 56/2014) refers to the inter-Municipal or Provincial administrative levels, and to the idea that territorial planning and resource management are best organised at a level between the Regional and the Municipal ones. Wide areas act through wide-area-level plans (*piani di area vasta*).

seen – guarantee a growing level of transparency in administrative procedures, making sure that the latter's technical character does not prevent public participation.

Protection of waters as an environmental resource necessarily goes hand in hand with distribution policies, aimed at making sure that everyone has access to a daily quantity of good-quality water. Such a twofold goal of the administrative action is summarised in Article 144 of the Environment Code. This norm defines the underlying principles of water policies and provides for waters to be protected for environmental reasons and, at the same time, distributed according to a criterion of solidarity – that is, through an efficient public service capable of guaranteeing that the right to water is effective for everyone.

To conclude, the analysis conducted above has confirmed that water law constitutes nowadays a central and innovative sector of environmental law, aimed at sustainability. This marks an important shift vis-à-vis the tradition that, starting in the nineteenth century, had conceived water law as an instrument for the allocation of water resources with a view to the country's economic development. At the same time, water law also constitutes the experimental space of a model that brings together the values of intergenerational responsibility and distributive efficiency, in order to overcome all territorial and social inequalities in the supply of a fundamental good.

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Part II
Water Management and Environmental Concerns

Chapter 6
Water-Dependent Ecosystems in Italy

Riccardo Santolini, Tommaso Pacetti, and Elisa Morri

Abstract Water is a key element of all the ecosystems and creates a complex web of connections between nature and society that need to be properly understood and quantified. Ecosystem services assessment, combining ecology with economic evaluation, can help identify holistic management strategies that preserve the ecosystems multifunctionality while enhancing the benefits produced by water. In the last decades, Italy has moved towards the adoption of an "(eco)systemic approach" in natural resources management, from local pilot experiences (for instance, Regional Law no. 13/1997 in Piedmont) up to the recognition of the importance of Natural Capital and its accounting in the national legislation (the 2015 *Collegato Ambientale*). In between, several experiences of innovative management practices, such as Payments for Ecosystem Services, have been experimented. The overview here presented aims at giving evidence of the work done so far, highlighting the limits and potential of introducing the concept of ecosystem services to support watershed management.

Keywords Ecosystem services · Natural capital · River basin management · Water management

6.1 Water-Ecosystem Dependencies

Water plays a fundamental role in the ecosystems determining habitats and their productivity (Falkenmark 2003; Mekonnen and Hoekstra 2016; Bazilian et al. 2011) and sustaining a large set of services, namely water-related ecosystem services (WES) (Martin-Ortega et al. 2015; Grizzetti et al. 2016). WES are the ecosystem services (ES, i.e., the conditions and processes through which ecosystems, and the species that make them up, sustain and fulfil human life) (MEA 2005) produced by

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water moving through the landscape and interacting with terrestrial ecosystems (Duku et al. 2015). According to Braumann et al. (2007), WES can be categorised into four classes, following the Millennium Ecosystem Assessment approach (MEA 2005):

(i) provisioning WES, which include services associated with the use of water, as water supply or hydropower production;
(ii) regulating WES, such as flood regulation;
(iii) cultural WES, which are related to the provision of religious, educational and touristic values;
(iv) supporting WES, such as the presence of vital estuaries and other habitats.

From this perspective, water can be interpreted as a connecting factor between nature and society. On the one hand, hydrology and hydrogeology characterise the ecosystem structure and its functions, providing WES that determine the livability of a place (e.g., the role of water in semi-arid watersheds, Belnap et al. 2005). On the other, water quantity and quality (thus, WES) are strongly influenced by man-made ecosystem modifications (e.g., climate change and change in land use), which can alter the blue/green water partitioning and the entire hydrological cycle (Falkenmark and Rockström 2006; Metzger et al. 2006; Staponites et al. 2019; Stets et al. 2020).

Focusing on freshwater, the importance of WES appears evident by looking not only at natural systems (e.g., rivers, floodplains, wetlands, lakes and groundwater bodies) (Eamus et al. 2016; Grizzetti et al. 2019) but also at man-made water systems, such as irrigated agricultural fields or urban environments (Gordon et al. 2010; Garcia et al. 2016). All these examples are connected by the permanent or temporary presence of surface water or groundwater determined by the occurring ecohydrological processes and resulting in the potential production of WES (Fig. 6.1, Brauman et al. 2007).

Therefore, it is fundamental to adopt an (eco)systemic approach to watershed management, starting from the holistic recognition of water as the basis of ecosystems multifunctionality to support the preservation of the whole set of produced WES.

6.2 Towards the Assessment of WES

The development of the ES concept (Mooney et al. 1997; Costanza et al. 2017) has led to the systematic integration of economics and ecology, allowing an in-depth investigation of the relationships between economic systems and natural environments (Braat and de Groot 2012). ES are usually represented as a flow from a stock of Natural Capital (NC, i.e., the entire stock of natural assets – living organisms, air, water, soil and geological resources) which provides goods and services of direct or indirect value for human beings and whose functions are necessary for the survival of the ecosystems (Costanza and Daly 1992). We can differentiate between the ES exclusively provided by NC, whose functions provide supporting and regulating services from which other ES derive (Elmqvist et al. 2011; CCN 2019), and those

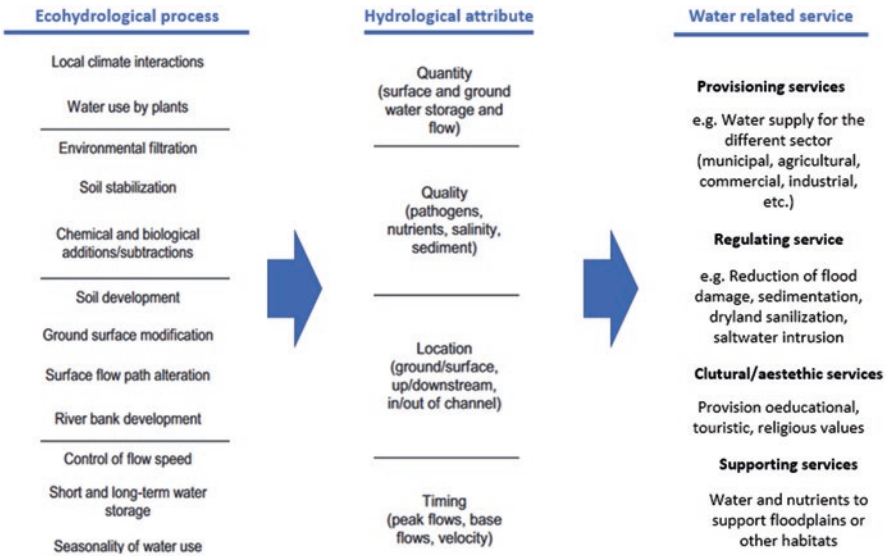

Fig. 6.1 Relationship between ecosystem functioning, its effect on hydrology and the potential ES associated. (Adapted from Brauman et al. 2007)

ES based on the integration of NC with other types of capital (i.e., human, social and financial) and productive factors (e.g., agriculture, and therefore food production, that depends on the soil and climate, but also on the use of agricultural machinery and farmers' skills). While different forms of capital can create complementarities, they can hardly be substitutive without creating problems of sustainability (O'Neil 2013). Currently, the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) considers all the contributions of nature to the quality of life as Nature's Contributions to People (NCP), regardless of the amount of human co-production (IPBES 2019).

The assessment of ES requires the spatial explicit quantification of biophysical functions and the evaluation of associated services (Maes et al. 2013), underlining the necessity to identify a Functional Ecological Unit (FEU), that is, the reference territory within which an ES flow is correctly representable and manageable (Palomo et al. 2013; Santolini et al. 2016; Santolini and Morri 2017a, b). Dealing with WES, the watershed and sub-watershed scale allows the correct representation of supply areas where specific functions are generated and demand areas where the functions are converted into a service, according to society valuation (Fisher et al. 2009). Once defined the FEU, the (W)ES assessment is based on the use of indicators that are information (including datasets and proxy indicators such as land use) which communicates the characteristics and trends of ES and can support decision-making (Maes et al. 2016).

According to the Pilot Analysis of Global Ecosystems by the World Resources Institute, freshwater ecosystems and their dependent species are at greatest risk

(Revenga et al. 2000) resulting in a rapid decrease of WES production. However, WES importance is currently partly ignored because many of these services do not have a quantitative indicator of their value. Introducing a sound evaluation of natural capital and associated WES in the accounting systems becomes essential to support decision-making, as their underestimation may lead to wrong choices with significant direct and indirect costs for the environment, society and the economy. Therefore, the physical quantification of NC obtained through the analysis of the ecosystems and a systematic accounting of ES becomes fundamental, especially when dealing with water resources. WES evaluation must be based on a sound modelling framework (Bagstad et al. 2013; Vigerstol and Aukema 2011) that is also the basis for a monetary valuation to allow their inclusion into economic decisions, such as the evaluation of environmental and resource costs (ERC) within the Water Framework Directive (WFD 2000) of the European Union (Brower et al. 2009; Martin-Ortega et al. 2011).

6.3 Incorporating Ecosystem Values in Watershed Management: The Italian Experiences

Starting from the first experiences of ES assessment made by correlating the land cover classes with ES values derived from literature (Cataldi et al. 2010; Scolozzi et al. 2010, 2012) up to the three reports on the Italian NC released since 2017 (CCN 2017, 2018, 2019), Italy has moved towards the recognition of NC and ES as a useful tool to support development strategies and priorities for action (Santolini et al. 2011). The Italian Natural Capital Committee established in 2015 (pursuant to Article 70 of the so-called *Collegato Ambientale*, that is, Law no. 221/2015) has pointed out the main opportunities and challenges of introducing the NC and ES concepts in the Italian policies:

(i) development of an accounting system for NC, ES flows and associated pressures;
(ii) strengthening the technical evaluation skills of the public administration;
(iii) integration of the NC into existing standard procedures for preliminary assessment of plans, programmes and projects;
(iv) introduction of an environmental tax system (e.g., introducing ES into ERC evaluation) and other economic instruments for the protection of NC and its functions (CCN 2017).

One of the challenges is to interpret the conservation and sustainable use of biodiversity as a viable and sustainable market opportunity through incentives that can drive private investment, production and consumption towards actions and projects of sustainable use and resources conservation objectives. These aspects are becoming increasingly important in the regulation of the water sector, where the WFD (adopted at the Italian level with the Legislative Decree no. 152/2006) has clarified how the economic analysis represents one of the fundamental tools to facilitate sustainable water use. The WFD highlights how the implementation of a water pricing policy which encourages a rational use of water resources and allows an adequate contribution to the recovery of costs, including ERC, represents a fundamental tool for environmental protection (Berardi et al. 2017). The inclusion of the WES concept in the implementation of the WFD fosters a wider policy objective of sustainability through the river basin management plans, moving from the achievement of a good ecological status as a target *per se* to the recognition of the fundamental role of the ecosystem in supporting societal goals (Grizzetti et al. 2016). Incorporating an ecosystem service approach in the existing water legislative framework can lead to innovative solutions in watershed management (Carvalho et al. 2019; Pacetti et al. 2020), as demonstrated by the concept of Payments for Ecosystem Services (PES), which have increasingly gained the interest of scholars and decision-makers. By definition, PES schemes are voluntary transactions based on the systematic measurement of ES, which can be traded between ES suppliers and ES beneficiaries (Wunder and Wertz-Kanounnikoff 2009). Their innovation in the water sector lies in their turning of the "polluter/user pays" principle enshrined in the WFD into the "beneficiary pays" principle, potentially extending the WFD objectives to other watershed management aspects by promoting the enhanced delivery of services that were lacking an adequate recognition (EEAC 2019).

At the global level, the PES for watershed management are the most developed in terms of transaction value and geographical distribution: 24.7 billion dollars in 62 countries in 2015, for a total of 387 programmes (Salzman et al. 2018). The obvious connection between water and land management in a watershed (e.g., the risk of poor water quality and downstream floods due to upstream mismanagement) makes it easier to get support for payments from beneficiaries to suppliers. Moreover, transaction costs can be low, as the benefit is widespread among a multitude of beneficiaries that can pay through water services tariffs or other national taxation.

In Italy, a pioneering application is represented by the experience of Piedmont, whose legislation on water management (conceived more than 20 years ago with Regional Law no. 13/1997) provides the possibility of accounting for a watershed management compensation value when setting the tariffs for drinking water supply. This standard does not refer explicitly to ES but recognise the ecosystem value through a tariff that include the maintenance and restoration costs of the ecosystems providing the resource. Another successful example related to WES is the management strategy of the watershed upstream the Ridracoli dam in Emilia-Romagna to solve the problem of reservoir silting. The local managing utility (i.e., Romagna Acque) activated a PES scheme encouraging farmers to adopt sustainable forest management practices that reduce soil erosion. Monitoring showed a significant decrease in sediment transport and the costs for farmers' incentives to maintain the natural regulating services provided by forests (200 to 100 euro/ha) have been lower than the cost of traditional reservoir dredging (Pettenella et al. 2012). A list of the main PES for watershed management implemented in the Italian territory can be found in Table 6.1.

Table 6.1 Summary of main PES for watershed management implemented in Italy

PES ID	Location	WES supplier	WES Buyer	Scale	WES	Description
Romagna Acque – Ridracoli reservoir	Emilia-Romagna	Farmers	Water utility	Sub-catchment	Regulating	Incentives for agriculture best practice to reduce erosion
Ecopay-connect Oglio Sud	Lombardy	Park authority	Wood company	Park	Regulating/ Supporting	Wood company pays for park functionality maintenance
Agricoltori Custodi	Tuscany	Farmers	Local district	Sub-catchment	Regulating	Supplementary income for farmers that maintain marginal lands
Sasso Simone e Simoncello	Marche	Park authority	Breeders	Park	Regulating/ Supporting	Breeders pay for park functionality maintenance
Piedmont Regional Law no. 13/1997	Piedmont	Water authority	Water users	Region	Regulating	Share of water supply tariff for watershed functionality conservation
BIM	Italy (multiple locations)	Local district	Hydropower company	Sub-catchment	Regulating	Hydropower company pays a withdrawal tax to support watershed conservation

6.4 Conclusion

WES are limited by and strictly dependent on the health of ecosystems and the richness of their biodiversity, whose uniqueness must be preserved to assure the provision of services. The ongoing research on the NC and ES provides a holistic approach for framing socio-ecological issues in watershed management. However, the estimation and valuation of WES remains an open field due to difficulties in determining the relationships between the hydrological functions and the services provided (Brauman 2015). In parallel to the development of sound assessment methodologies, the protection of NC requires the integration of policies. A rapid change of paradigm is needed to promote an operational dialogue among sectors to manage water resources and to deal with multiple challenges in the field of biodiversity protection and climate change mitigation. In this direction goes the inclusion of PES in the WFD toolbox, to encourage a coordinated involvement of the public and private sectors in the sustainable management of water resources. The ongoing experiences (described in Sect. 6.3) represent some pioneering examples of identifying and introducing payment systems for ecosystem and environmental services at different levels, both from a public and a private perspective. The activation of WES remuneration mechanisms can be developed at different scales but must affect the overall quality of the environment while preserving or increasing specific CN functions (Article 70, Paragraph 2, letters (a) and (b) of Law no. 221/2015). Therefore, the evaluation of WES on a wider scale (e.g., the hydrographic district scale) becomes a priority to assess synergies and trade-offs among WES, aiming at determining the critical impact thresholds to safeguard the social utility of the ecosystem functions over time. Moreover, evaluating and managing WES at a larger scale can produce important monetary savings with a progressive investment amortisation and a subsequent commitment related only to maintenance. An alternative path towards the sustainable management of water is traced, now it is time to set up adequate legislation, specific contractual arrangements, and payment methods to develop systemic and non-emergency action programmes.

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Chapter 7
Water Quality Control Policies and the Criminalisation of Pollution

Giovanni De Santis and Matteo Fermeglia

Abstract The present contribution aims to provide a comprehensive account of Italian legislation on water quality and water protection through criminal law. The Italian legal regime on water quality largely builds on the overarching European Union framework, which includes the Water Framework Directive, the Drinking Water Directive and the Nitrates Directive. The path towards full implementation of European water policies in Italy has been, however, all but void of drawbacks and still entails remarkable shortcomings. Hence the Italian implementation of European directives in Italy will be addressed, with a view to highlighting the several nuances with regard to non-compliance and the extensive use of exemptions and derogations. Furthermore, this contribution will provide an overview of the fragmented Italian legal regime for criminalisation of water pollution as interpreted by Italian criminal courts. The upshot of this overview is the ultimate unfitness of the Italian criminal legal regime to adequately ensure water quality protection. Last, the far-reaching 2015 reform of the Criminal Code on environmental crimes is analysed, which arguably paves the way for a more coherent and ecosystem-oriented approach to water quality while strengthening coordination between administrative and criminal responses to water pollution.

Keywords Water quality · Water governance · Drinking water · Nitrates · Environmental crimes

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Although jointly discussed, this article can be attributed as follows: Giovanni De Santis authored Sect. 7.4; Matteo Fermeglia authored Sect 7.3; Sects 7.1, 7.2 and 7.5 were co-authored. The usual disclaimer applies.

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7.1 Introduction

Water is a highly complicated matter. It is a natural resource that is vital for life, social and economic activities as well as the functioning of the ecosystem. To enhance water quality involves dealing with a complex interaction of legal, social, economic and environmental factors. The fight against water pollution and degradation is a long-standing policy objective at the European Union (EU) level, with the first legislation dating back to the 1970s (Aubin and Varone 2002). However, far-reaching ecological goal-setting at the European level is facing several hurdles and resistance when translated into domestic regulations at Member States level (Keessen et al. 2010; European Commission 2019c). This has been particularly the case with the Italian implementation of EU regimes for water quality. Overall, Italy has mostly failed to adopt a wide-ranging set of measures and tools to effectively manage and enhance water quality, while clearly unfolding a scenario of path-dependence (Alberton and Domorenok 2011).

Water quality deterioration does not only result from neglect or mismanagement, as it is also actively caused by harmful human intervention. This is where criminal sanctions come into play by complementing the blind spots of administrative regimes to enhance water quality. Yet importantly, criminal offences have hardly played a prominent role in water protection thus far. Water-related crimes have been recently defined as "any punishable contravention or violation of the limits on human behaviour as imposed by national criminal legislation, which uses surface, and ground water, or water services, as a means for committing other crimes" (Segato et al. 2017). The existing Italian criminal law regime, however, proves fairly fragmented, although it is now evolving toward a more holistic and comprehensive response to water-related crimes.

The aim of this contribution is thus to shed a light on the contours and pitfalls of Italian legislation implementing water quality standards and ensuring water quality protection through criminal law. To this purpose, Sect. 7.2 summarises the evolution of the Italian regime on water quality protection. Section 7.3 skims through the current rules of such regime, with a view to unfolding the main achievements and shortcomings in the implementation of the EU Water Framework Directive, the Drinking Water Directive, and the Nitrates Directive. Section 7.4 turns to the Italian criminal law regime for water-related crimes, and emphasises the remarkable change embedded in the recent reform of the Criminal Code as to environmental protection through criminal law. Section 7.5 concludes.

7.2 The Evolution of the Italian Regime on Water Quality

The first comprehensive piece of legislation dedicated to legislative and administrative harmonisation of water law in Italy was the Royal Decree no. 1775/1933. The Royal Decree was foremost aimed at prompting a more efficient use of water resources. This objective was to be achieved by establishing public ownership of all water bodies with relevance for public uses in order to safeguard efficient use of water sources. Furthermore, the private or public nature of water bodies was to be pinpointed based on their actual suitability to serve human consumption and their geographical characteristics (Cerulli Irelli 1988).

Law no. 319/1976 (so-called "Merli Law", *Legge Merli*) was the first wholly domestic body of law setting specific rules for legislative rationalisation as to the protection of water sources.[1] Moreover, and perhaps more importantly, Law no. 319/1976 was the first one aimed at reconciling environmental protection with economic and social interests by setting standards and uniform thresholds with regard to industrial discharges (Dell'Anno 1999). In sum, Law no. 319/1976 addressed five key issues in water management and protection: a) definition and regulation of water discharges with regard to water bodies from all pollution sources (public and private); b) formulation of general requirements and criteria for water use and water discharges; c) organisation of public services for water supply, as well as water treatment and sewage; d) drafting of general plans for water bodies restoration, based on Regional plans; e) systematic monitoring of both the qualitative and quantitative statuses of water bodies. Furthermore, the *Legge Merli* mainstreamed a political-administrative model for water protection in the Italian legal system. This regime, meant to sanction unauthorised discharge of wastewater, was based on the dichotomy between criminal and administrative sanctions, the former being directed to punish violations of unlawful wastewater discharge from industrial sites, and the latter aimed at sanctioning illegal discharge of domestic wastewater. In line with tradition, criminalisation of water pollution has thus been embraced as a collateral tool alongside the prominent administrative sanctioning regime for water damage and degradation (Hassemer 1984). Consequently, up until the key 2015 reform of the Italian Criminal Code introducing *ad hoc* environmental crimes (see *infra*, Sect. 7.4.3), the balancing of conflicting interests related to the protection of water resources has been widely dealt with by public administrations – and therefore, administrative courts – rather than criminal courts.

Two further relevant developments marked the evolution of the Italian water protection regime. Such developments came about in times of increasing public attention to water management as a result of massive disasters and flood events, such as the 1966 flood in Florence (Alberton and Domorenok 2012, p. 391). First, Law no. 183/1989 for the first time introduced a body of norms providing for integrated protection and management of soil and water, thus encompassing the whole water cycle and setting the stage for an integrated water services management.

[1] Law no. 319/1976 first introduced the definition and regulation of water discharges for monitoring and sanctioning purposes. This element was originally understood in a very broad fashion, thus including all activities resulting in (direct or indirect) water discharges, on a regular or occasional basis, in all surface and groundwater bodies. This definition has been eventually narrowed down by Legislative Decree no. 152/1999, and most recently by Legislative Decree no.152/2006, so that it now comprises only direct and long-lasting wastewater discharges taking place through run-off systems (Art. 74 of Legislative Decree no. 152/2006).

Among other things, Law no. 183/1989 introduced the River Basins as relevant planning tools for managing water bodies in the Italian territory, as supervised by the then newly-established River Basin Authorities. Accordingly, River Basin plans were mandated as territorial planning tools aimed at collecting data on water bodies' quality, as well as at informing actions to adequately improve water uses. Second, the basic framework introduced by the *Legge Merli* was amended by Legislative Decree no. 152/1999, which in turn implemented EU directives on water protection.[2] While the existing discharge limit values and the relating general authorisation regime were left unchanged, this Legislative Decree linked such emission thresholds to overarching water bodies' quality objectives, which in turn were linked to the water bodies' capacity to recover. Moreover, Legislative Decree no. 152/1999 attributed to Regional administrations the task of enhancing the qualitative and quantitative statuses of surface and groundwater bodies through comprehensive Water Protection Plans (WPPs) – importantly anticipating the approach adopted by the Water Framework Directive (see *infra*, Sect. 7.3.1.2). The WPPs thus became the uniform administrative and planning tool to address prevention of water pollution in Italy, while setting overall environmental objectives and specific uses of water bodies, as well as taking preventive and remedial measures necessary to enhance the status of water bodies.

7.3 Water Quality Legislation in Italy: Striving for EU-Compliance

The current Italian legal regime on water quality is largely embedded in Legislative Decree no. 152/2006 (so-called "Environmental Code", *Codice dell'ambiente*). The Environmental Code repealed all previous legislation, thus aiming to establish a comprehensive regime for water protection while implementing several EU regulations, including Directive 2000/60/EC (Water Framework Directive, WFD), Directive 98/83/EC (Drinking Water Directive, DWD) and Directive 91/676/EEC (Nitrates Directive, ND). This approach was arguably directed to foster integration and consistency between different subsets of water law, thus ensuring compliance with the WFD.[3] However, the Italian experience with EU law implementation on water quality shows remarkable gaps with respect to the ambitious underpinnings of the EU legal framework, and remarkable hardships in achieving compliance and effectiveness on the ground (Balzarolo et al. 2011). Implementation of the above-mentioned EU directives on water quality in Italy has in fact been hindered by institutional conflicts, poor environmental objectives, and extensive reliance on derogations and exemptions (Alberton and Domorenok 2012; Rainaldi 2010).

[2] In particular, Directive 91/271/EEC concerning urban wastewater treatment and Directive 91/676/CE (the Nitrates Directive, on which see *infra*, Sect. 7.3.3).

[3] Case C-32/05, *Commission v Luxembourg*, Judgment of 30 November 2006.

7.3.1 Water Framework Directive

The WFD marked a radical shift in the evolutionary policy on water protection in the EU by embracing a holistic approach to the ecological status of waters through specific environmental objectives and a multi-level governance system (Morgera 2012). Fierce oppositions during the political negotiations of the WFD, however, resulted in several ambiguities, which in turn led to its fragmented interpretation and overall poor implementation at EU Member States level (Keessen et al. 2010). Italy makes no exception in this regard. Three main deficiencies characterise the implementation of the WFD in Italy, namely: water management governance fragmentation, inconsistent identification of relevant geographical areas, and poor monitoring of water quality status (Alberton et al. 2018, p. 231).[4]

7.3.1.1 Governance

The WFD leaves up to Member States to identify river basins within their territory, as well as the competent administrative authorities entrusted with the application of the WFD and planning in each river basin (Giakoumis and Voulvoulis 2018). Italy duly implemented such obligation by dividing the national territory into eight River Basin Districts (RBDs) (see Fig. 7.1).[5] RBDs drew from the existing River Basins established under Law no. 183/1989 and duly aggregated (Balzarolo et al. 2011). The European Commission (EC) firmly criticised such geographical apportionment, emphasising its potential inconsistency with the WFD's objectives (Agapito Ludovici et al. 2007). Thus, RBDs' setup was reworked through Law no. 221/2015 by abolishing the Serchio District and extending the Padan District, so as to reduce the Northern Apennines District (see Fig. 7.1).

From a governance standpoint, Italy followed an "institutionally hard solution" (Moss 2012, p. 17) to the river basin approach, initially relying on the existing River Basin Authorities (RBAs) set up pursuant to Law no. 183/1989. RBAs hence remained into operation until the establishment of the River Basin District Authorities (RBDAs) in 2016.[6] RBAs managed the drafting of the first River Basin Management Plans (RBMPs) under Article 11 of the WFD (see *infra*, Sect. 7.3.1.2).

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[4] Moreover, Italy failed to transpose the WFD within the expected deadline (December 22, 2003) and only acted after the European Court of Justice's judgment ascertaining the failure of implementation (Case C-85/05, *Commission v. Italy*, Judgment of 12 January 2006).

[5] Three Italian RBDs share catchments with other Member States: Western Alps (Slovenia, Switzerland and Austria); Padan (Switzerland and France); Northern Apennines (France). On transnational river basins see also, in this volume, Chap. 9 by Tignino and Gambatesa.

[6] RBDAs have been established pursuant to Art. 51 of Law no. 221/2015. RBDAs consist of State-Regions boards composed of three main bodies: (1) the Permanent Institutional Committee, which holds decision-making powers, (2) the Secretary General, holding overall responsibility for the work done by the Institutional Committee, and (3) the Technical Committee, which provides technical support to the Institutional Committee for the development of RBMPs.

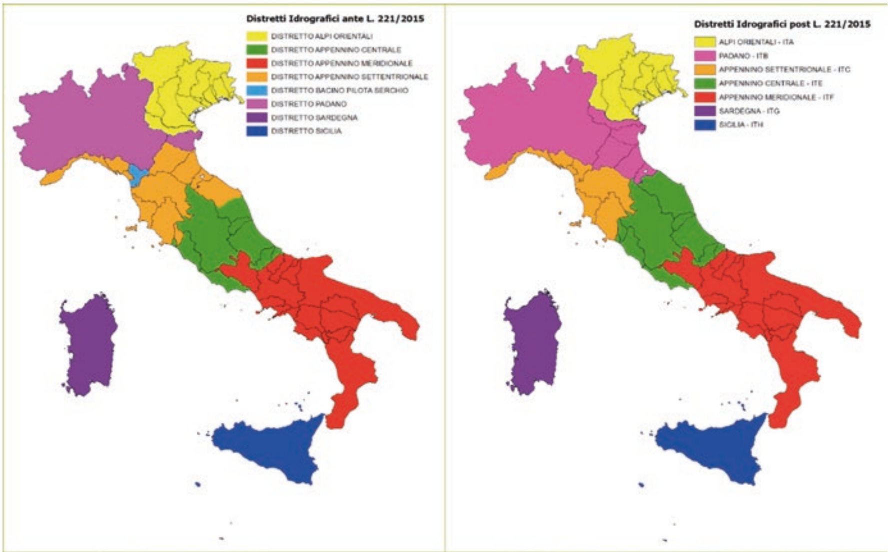

Fig. 7.1 Italian RBDs before and after Law no. 221/2015. (Source: ISPRA)

RBAs were aimed at overcoming fragmentation of competencies and functions in water planning, management and protection between different territorial bodies and functional agencies. In practice, however, Italy's efforts to implement the WFD have been hampered for several years by legislative inconsistencies, institutional conflicts and resistance on the part of key political actors (Rainaldi 2010). The apportionment of legislative competences between the State and Regional administrations as set out in Article 117 of the Constitution, coupled with the overall under-representation of Regional administrations in the same RBAs, led to Regions (unsuccessfully) challenging before the Constitutional Court several provisions of Legislative Decree no. 152/2006 regarding their legislative and administrative role (Alberton 2010). Policy actors have strived not only to maintain the *status quo*, but even to reinforce their powers in contrast to the multi-level governance framework endorsed by the WFD. The central government has sought to strengthen its position by increasing the ministerial representation in the RBAs. Regions, in turn, after ineffective attempts to regain their influence in territorial and water planning, have focused on Regional policies for water management and protection, showing little capacity of mutual coordination at the scale of river basins and scarce proclivity to interact with other local actors (Domorenok 2017). Moreover, no tools for adequately enhancing coordination between Regional and local authorities, stakeholders and the large public have been introduced (Alberton and Domorenok 2012). RBAs' lack of executive powers and autonomous budget, moreover, has contributed to the lingering issues of poor horizontal coordination of water management and protection measures.[7] The EC formally questioned the lack of coordination mechanisms to ensure that the WFD's objectives would be duly fulfilled in all Italian RBDs.[8] Thus, the urge to prevent EC's infringement procedures ultimately forced further cooperation among all actors in Italian water governance (Pellegrini et al. 2019; Massarutto 2015). RBAs were finally attributed stronger operational powers in 2009, as Law no. 13/2009 tasked them with the development of the RBMPs, albeit in shared competence with Regional administrations. Yet, the same RBMPs have been largely developed based on the previous Regional WPPs. This stands to show that Regions, rather than the Basin Authorities (both the previous RBAs and the current RBDAs), have been – and still are – firmly holding the reins of water policy implementation in Italy.

Furthermore, contrary to the WFD's indications, responsibility for monitoring of water resources' qualitative and quantitative status remained split between separate levels of government (Article 75 of the Environmental Code). The Ministry of the Environment holds chief responsibility for policies of protection of the environment, including ecosystems. Regional governments are tasked with gathering and disseminating information on water status, and transferring all relevant data to the National Institute for Environmental Research and Protection (*Istituto superiore per la protezione e la ricerca ambientale* – ISPRA). Although general requirements concerning organisational and procedural issues of the WFD have been formally fulfilled, the Italian system of water governance has neither assumed a more coordinated and cooperative nature, nor has provided for inclusive and integrated water policies on the scale of RBDs.

7.3.1.2 River Basin Management Plans and Exemptions

The RBMPs are the major planning tool adopted in the wake of water bodies' identification and assignment to each RBD, based on hydrological catchments. RBMPs are key to achieve the WFD's environmental objectives (Morgera 2012). Article 117 of the Italian Environmental Code mandates RBDAs to draft the RBMPs in each relevant RBD based on specific guidelines issued at the national level by the Ministry of the Environment.

The first cycle of eight Italian RBMPs required a deferment to be granted by the EC as to the original deadline for adoption (20 November 2009).[9] Institutional tensions within RBAs strongly delayed RBMPs adoption, thus forcing the Italian legislator to introduce by law a specific administrative procedure to respect the extended

[7] Moreover, the repeal of RBAs was contested by Regional administrations and environmental NGOs because the territorial division into RBDs (and the RBDAs supervising them) were deemed unable to reflect local specificities.

[8] EU Pilot 73041/15/ENVI. The EC dismissed the procedure on 20 February 2019.

[9] Moreover, the adoption of the Italian RBMPs occurred in different periods: the first RBMP (20 November 2009) was the one by the 'special statute' Sicily Region, six further plans were approved on 24 February 2010 while the last one was the plan of the 'special statute' Sardinia Region.

deadline (Article 1 of Law no. 13/2009). A major challenge in the development of the RBMPs was the economic analysis of water uses (Berbel and Exposito 2018). Economic analysis is deemed crucial in the WFD as it should underlie decision-making in all phases and be closely integrated with all other RBMPs components (Article 5 and Annex III of the WFD). Italy, as other Member States, has faced dire difficulties in carrying out a thorough economic analysis, and in particular in defining the mechanism for the recovery of costs of water services (Kanakoudis and Tsitsifli 2010).

The European Court of Justice ultimately embraced the EC's request to condemn Italy for failing to submit reports on economic analysis (required under Articles 5 and 15(2) of the WFD) with regard to five Italian RBDs.[10] Following the EC's infringement decision, Ministerial Decree no. 39/2015 was adopted. First, the Decree introduced a general definition of water services and uses. Most RBMPs, however, kept departing from these general definitions on the basis of alleged specific needs related to local environmental pressures, as assessed through impact analysis carried out in accordance with the WFD. Second, the Decree established nation-wide methodologies for calculating environmental and resource costs, further mandating RBDs to carry out analysis of services and uses that exert significant pressures on water resources.[11] This process, too, witnessed information and implementation gaps – for example, with regard to how cost recovery rates per water service are disaggregated to contributions from different water users (European Commission 2019a).

The second cycle of Italian RBMPs was published between 17 December 2015 and 29 June 2016, yet again not in line with the deadline set out in the WFD (2015). Whilst institutional coordination and internal coherence between planning instruments has been strengthened, meaningful pitfalls remain with regard to characterisation and monitoring of groundwater bodies, as well as information on linkages with surface water and terrestrial ecosystems (see *infra*, Sect. 7.3.1.3).

Italian RBMPs comprise several planning tools related to water management and protection. As regards water quality, the Regional Water Quality Protection Plans (WQPPs) are provided for by Article 121 of the Environmental Code. WQPPs implement the obligation to establish a Programme of Measures for each RBD in order to set substantive requirements to safeguard water quality and to achieve the WFD's environmental objectives (Article 11 of the WFD). WQPPs are aimed at designing and developing monitoring systems for both surface and groundwater bodies, while appraising specific measures to reach and maintain both the quality and the quantity objectives for the water system (Baaner 2011). Individual measures included in the programme of measures (as part of the RBMPs) are grouped into

[10] C-85/07, *Commission v. Italy*, Judgment of 18 December 2007.

[11] The Decree has introduced a cost-based approach, which defines environmental and resource costs as the costs of measures required to fill the gap to achieve the good water status objective. Hence, costs of measures to be implemented to fill the gap between the actual situation and the status aimed at are considered as environmental and resource costs. Most RBMPs refer to this methodology, but indicate that it has not yet been applied.

Key Types of Measures for reporting purposes.[12] Due to the above procedural and institutional constraints, while drafting the RBMPs and WQPPs, RB(D)As extensively drew from existing plans, in particular the WPPs (drafted between 2004 and 2009), and the *Piani di assetto idrogeologico* (Hydrogeological Plans), drafted by Regional administrations. The Italian experience with the WQPPs reflects empirical findings showing that WFD programmes of measures have hardly served as a blueprint for local implementation of water protection measures (Kochskämper et al. 2016).

Another matter of utmost concern relates to the timeframe for achieving WFD's objectives, in particular with regard to exemptions to the attainment of water bodies' good ecological status pursuant to Article 4(4)–(5) of the WFD.[13] WFD exemptions have been widely relied upon by Member States, mostly due to different perceptions and interpretations driven by terminological vagueness as to the key conditions for exemptions (Boeuf et al. 2016; Balana et al. 2011). The extensive use of exemptions has ultimately undermined WFD implementation in Italy. Article 4(4) exemptions may be justified by disproportionate costs, technical feasibility or natural conditions, whereas Article 4(5) exemptions by disproportionate costs or technical feasibility. Article 4(4) exemptions have significantly increased in all Italian RBDs, although they have not been meaningfully justified in the RBMPs with regard to technical infeasibility and costs disproportionality. Article 4(5) exemptions have increased in the Eastern Alps and Central Apennines RBDs for surface water. In the second-cycle RBMPs all RBDs include Article 4(4) exemptions, whereas Article 4(5) exemptions have been applied in five RBDs (Padan, Northern Apennines, Serchio, Central Apennines and Southern Apennines). (Fig. 7.2)

7.3.1.3 Water Quality and Monitoring

Article 4(1) of the WFD sets out the general objective to achieve good ecological and chemical statuses of all natural surface and groundwater bodies by 2015 – unless there is ground for exemptions.[14] To this end, Article 8 of the WFD compels Member States to adopt comprehensive programmes for monitoring the status of surface and groundwaters within each RBD.[15] Italy introduced specific norms on

[12] Italy has mapped 2351 national basic measures. Some of them, but not all, apply in all eight RBDs. All the types of basic measures required by Article 11(3) of the WFD have been covered.

[13] Art. 4 of the WFD allows under certain conditions for different exemptions to the objectives: extension of deadlines (Para. 4); relaxation of environmental objectives (Para. 5); temporary deterioration (Para. 6); modifications to the physical characteristics of surface water bodies or to the level of bodies of groundwater (Para. 7).

[14] Within this situation, achievement of good status may be extended to 2021 or 2027 at the latest. The water status assessment is based on an evaluation of ecological, chemical and quantitative criteria. Heavily modified or artificial water bodies must only achieve good ecological potential.

[15] According to Art. 8 of the WFD, for surface waters such programmes shall cover: (i) the volume and level or rate of flow to the extent relevant for the ecological and chemical statuses and ecological potential, and (ii) the ecological and chemical statuses and ecological potential; for

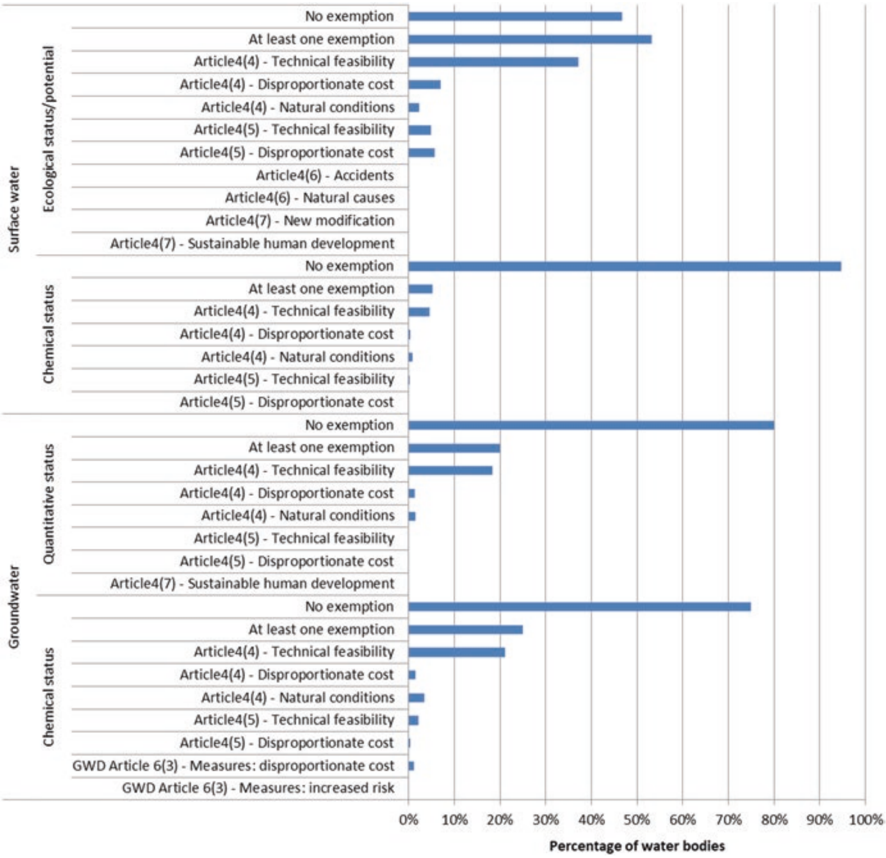

Fig. 7.2 WFD exemptions in Italy for surface and groundwater bodies. (Source: EC 2019a)

water-quality monitoring through Ministerial Decree no. 56/2009 to support the drafting of its first RBMPs. Legislative Decree no. 30/2009, in turn, implemented Directive 2006/118/EC (Groundwater Directive), thus updating monitoring methods for groundwater bodies.[16]

The monitoring and evaluation of the effectiveness of the planned programmes of measures is crucial to linking one WFD planning cycle to the subsequent one.

groundwaters such programmes shall cover monitoring of the chemical and quantitative statuses. Specific rules on the design of different types of monitoring programmes (surveillance, operational and investigative monitoring) are lied down in Annex V of the WFD (Para. 1.3 for surface waters and Para. 2.4 for groundwaters).

[16]Ministerial Decree no. 260/2010 complemented Ministerial Decree no. 56/2009 on technical criteria for the classification of surface water bodies (by amending Annex I to Part 3 of the Environmental Code). Further modifications on environmental quality standards have been introduced through Legislative Decree no. 172/2015 and Ministerial Decrees of 6 July and 15 July 2016 (which implemented Directives 2014/80/EU and 2014/101/EU, respectively).

Yet, monitoring has been a prominent pitfall in the first Italian RBMPs, with particular regard to the lack of specific monitoring systems on physical and hydrological alterations of water bodies, and the heterogeneous number of pollutants monitored in different Regions (Alberton et al. 2018, pp. 237–238).

The introduction of the above Ministerial Decrees greatly strengthened monitoring of water bodies' ecological status in Italy in line with WFD requirements. Hence improvements in Italian second-cycle RBMPs have been noticed, though still far from achieving the overarching WFD objectives for water quality (European Commission 2019a). This is in fact a shared feature of WFD implementation across Member States (Maia 2017). A net increase in monitoring sites (+819) and surface water bodies monitored for operational purposes (+832) occurred between the first- and second-cycle RBMPs (European Commission 2019a). Progress in coherence in monitoring frequency and number of priority substances has also been recognised (European Commission 2019a, p. 101).[17] Ecological status has now been classified for the vast majority of water bodies, in contrast to the first RBMPs.[18] Yet relevant gaps have been detected in some RBDs, especially with respect to surveillance monitoring for groundwaters.[19] Whilst new national guidelines for monitoring of chemical status for groundwaters have been introduced (Sistema Nazionale per la Protezione dell'Ambiente 2017), further work in this respect is needed (European Commission 2019a, p. 124).[20]

Surface Water Bodies There has been an increase in the proportion of surface water bodies with good or better ecological status as compared to the first-cycle RBMPs (see Fig. 7.3). In addition, the number of surface water bodies with unknown ecological status has reduced significantly (from 78% to 20% since the first RBMPs).[21]

As to the chemical status, 59% of the water bodies have been reported as failing to achieve good chemical status in Italy as a whole.[22] Good chemical status of

[17] Monitoring frequencies met the minimum requirements of the Directive at some sites. Conversely, there are some substances and some sites that are monitored less frequently in each RBD. Monitoring frequencies in biota meet the once-a-year requirement of the Directive in each site monitored. In five of the eight RBDs almost all of the priority substances discharged into the RBDs are monitored.

[18] For Italy as a whole, the proportion of unclassified water bodies has decreased from 50% in the first RBMPs to 18% in the second RBMPs for rivers and lakes and from 90% to 27% for coastal and transitional waters.

[19] In particular, no surveillance monitoring activities have been undertaken in five of the seven RBDs (not including Sicily) for transitional waters, three RBDs for coastal waters and one RBD for lakes.

[20] The percentage of groundwater bodies per RBD without monitoring ranges between 18% and 96% and varies amongst different districts. In total, 49% of groundwater bodies are not monitored for quantitative status.

[21] Ecological status is unknown, however, for the majority of water bodies in the Southern Apennines and Sicily RBDs.

[22] For individual RBDs this percentage varies between 40% and 50% for the Northern Apennines, Serchio and Southern Apennines RBDs; between 59% and 72% for the Padan and Sardinia RBDs;

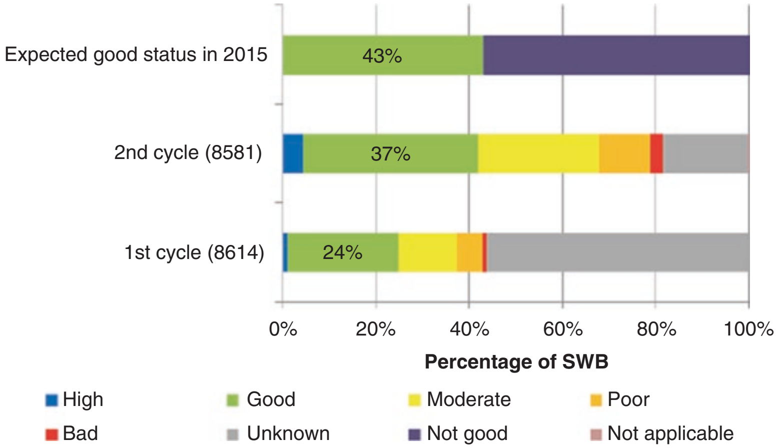

Fig. 7.3 Ecological status or potential of surface water bodies in Italy for the second RBMPs, for the first RBMPs and expected in 2015. (Source: EC 2019a)

surface water bodies is expected to be achieved in Italy by the end of the third WFD planning cycle (2027), albeit with several exceptions in various RBDs.

Groundwater Bodies The number of monitored groundwater bodies increased from 847 in seven reported RBDs in the first-cycle RBMPs to 1052 in eight reported RBDs in the second cycle. The total number of groundwater bodies with unknown status increased slightly, from 252 in the first cycle to 259 in the second cycle.[23] While 61% of groundwater bodies have been reported in good quantitative status, the total number of groundwater bodies failing to achieve that status increased from 115 in the first RBMPs to 151 in the second RBMPs (14% of the total). (Fig. 7.4)

In Italy the overall groundwater chemical status has slightly deteriorated. This goes against the pivotal no-deterioration principle under Article 1(a) of the WFD, although there is room for compensating for deterioration with improvements elsewhere in the (sub-)river basin (Keessen et al. 2010). The total number of groundwater bodies failing to achieve good chemical status has increased since the first RBMPs (from 204 to 263, up to 34.1% of the total groundwater body area). As displayed in Fig. 7.5, 606 out of 1052 groundwater bodies (58%) have good chemical status, 263 groundwater bodies (25%) are failing to reach good status and 183 groundwater bodies (17%) have unknown status.

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and between 86% and 95% for the Eastern Alps, the Central Apennines and Sicily RBDs. The Ministerial Decree no. 260/2010 states that good status is achieved when the concentrations of all priority substances are below the corresponding environmental quality standards, implying that the "one-out, all-out" principle is in place in Italy.

[23] The number of groundwater bodies with unknown status decreased in the Eastern Alps, Padan and Sardinia RBDs, but increased in the Northern Apennines, Central Apennines and Southern Apennines RBDs.

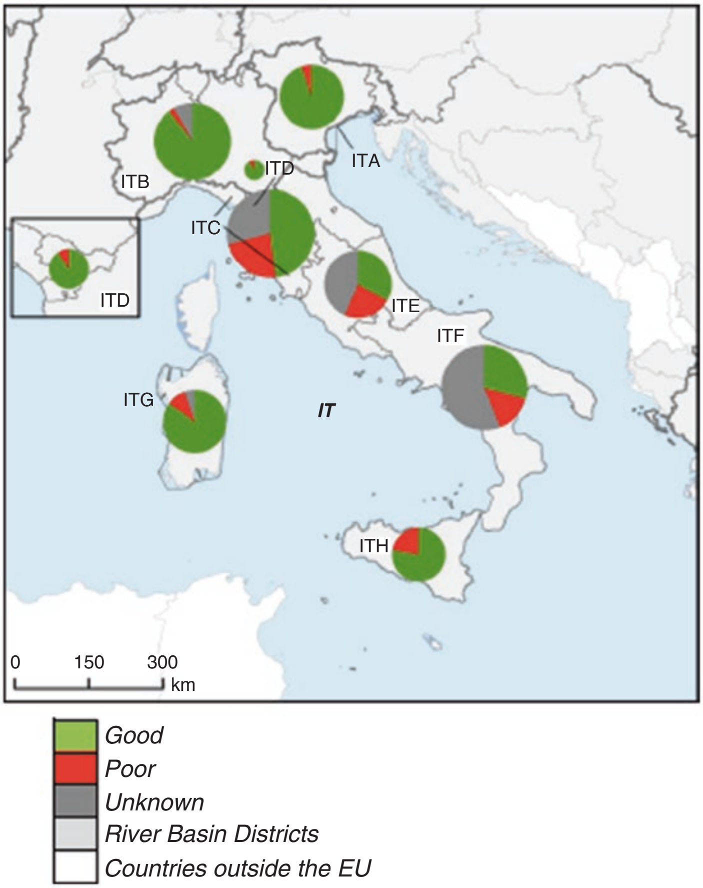

Fig. 7.4 Map of quantitative status of groundwater bodies. (Source: EC 2019a)

7.3.2 Drinking Water Directive

The Drinking Water Directive (DWD) has been first implemented in Italy by Law no. 31/2001, which entered into force on 25 December 2003. Such law transposed the DWD's general principle of pursuing preventive water protection by laying down essential water quality standards (Giampietro 2004). To this aim, a total of 48 microbiological, chemical, and indicator parameters must be monitored and tested regularly (Annex I of the DWD).[24] Moreover, waters for human consumption must

[24] Microbiological and chemical parameters (Annex I, Part A and Part B of the DWD) are of direct relevance to human health, and therefore any exceedance of the values requires Member States to take remedial action (including restriction in waters use). Indicator parameters (Annex I, Part C of the DWD) encompass microbiological, chemical, as well as acceptability parameters (such as water colour, taste, odour, turbidity). These parameters have only indirect relevance for drinking

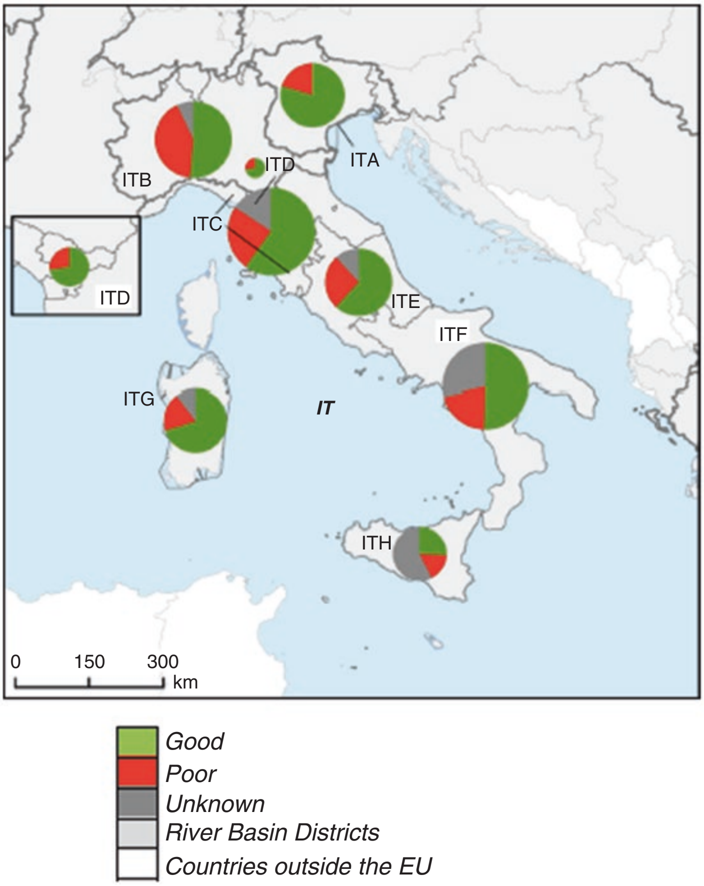

Fig. 7.5 Map of chemical status of groundwater bodies. (Source: EC 2019a)

not contain micro-organisms and other substances exceeding concentration values deemed as potentially noxious for human health. The DWD has been recently amended by Directive 2015/1787/EU, which introduced new minimum requirements of monitoring programmes – general objectives, chemical, microbiological and indicator parameters, sampling frequencies and methods – and risk assessment for drinking water quality under Annexes II and III of the DWD. Directive 2015/1787/EU has been implemented in Italy through Ministerial Decree of 14 June 2017, which entered into force on 29 June 2017.

water quality. Hence exceedances of the values of these indicator parameters require Member States to undertake remedial action only when deemed necessary to protect human health (Art. 8(6) of the DWD).

Attainment of drinking water quality is based on the spatial scale on Water Supply Zones (WSZs).[25] The DWD strikes a distinction between large and small WSZs. Large WSZs serve an average of more than 1000 m^3/day and more than 5000 people. Member States must report every three years to the EC on the drinking water quality in large WSZs. Small WSZs serve less than 1000 m^3/day and less than 5000 people. Reporting on small WSZs is voluntary, but Member States are invited to report if data are available. Italy has not reported on small WSZs – unlike 15 Member States. Regional administrations are tasked with delineating safeguard areas to enhance surface and groundwater quality for human consumption in the Regional Water Management Plans (Article 94 of the Environmental Code).[26] Parameters, monitoring methodologies, technical guidelines for drinking water transportation, excavation and water pipes installation, are set at the national level (by Ministries of the Environment and Health). Regional administrations must adopt water quality monitoring and planning tools locally. Administrative pecuniary sanctions are established if water supply for human consumption is not carried out in compliance with the quality standards (Article 19 of Law no. 31/2001). These sanctions may be applied in combination with those provided for criminal offences for water contamination as set out in the Environmental Code and Criminal Code (see *infra*, Sects. 7.4.1 and 7.4.2).

Overall, Italy proved highly DWD-compliant (between 99.50% and 100%) with regard to all microbiological, chemical, and indicator parameters (European Commission 2016, pp. 12–13). Yet several chemical parameters exceeding the DWD thresholds have been reported, with specific regard to arsenic and fluoride (see Table 7.1).

Furthermore, Italy extensively departed from chemical quality standards as lied down in Annex I of the DWD (Azara et al. 2018). This process is also known as "derogation" pursuant to Article 9 of the DWD. Derogations may be granted up to a period of three years, provided they do not constitute a potential danger to human health and water for human consumption in the area concerned cannot be otherwise ensured by any other reasonable means. A maximum of three derogations can be granted. First and second derogations are under the responsibility of Member States. Italian Regional administrations may seek for a derogation establishing different concentration values within a range set in a Ministerial Decree (Article 13 of Law no. 31/2001). Third derogations may be granted by the EC upon request by Member States in exceptional circumstances. The EC also indicates which measures have to

[25] For example, a WSZ can be a water treatment plant, where raw water from, say, two dammed drinking water reservoirs is collected and processed; or it could also be an elevated tank, by means of which a district is supplied with drinking water.

[26] Safeguard areas are in turn composed of absolute protection zones, i.e. areas immediately close to catchment and/or derivation (at least 10 metres distance) and where only catchments and infrastructure services are allowed; and buffer zones, which include areas adjacent to the absolute protection zones and where industrial and other potential detrimental activities for water quality are forbidden (e.g., excavation activities, wastewater discharges, waste management, fertilisers stockpiling and storage).

Table 7.1 Percentage of water quality parameters limits exceeded in Italy (2011–2013). (Source: EEA 2016)

2011		
Parameters	Frequency of exceedance >1[%]	No. of analyses done
Arsenic	7.38	15536
Sodium	1.83	25365
Fluoride	1.29	22762
Nitrite water works	1.28	4455
Boron	1.18	8585
Coliform	1.13	12351
Oxidisability	1.10	13619
2012		
Coliform	3.32	15109
Boron	1.73	6599
2013		
Arsenic	4.29	14880
Coliform	2.41	20826
Tritium	2.12	12977
Fluoride	1.45	21721

be taken in order to protect public health. As of 2012, 14 Italian Regions have requested DWD derogations for different parameters (most prominently, arsenic and fluoride), as displayed in Fig. 7.6.

The most controversial situation with DWD derogations regarded the Lazio Region, where up to 74 Municipalities requested them for five parameters (arsenic, fluoride, selenium, trihalometanes, and vanadium).[27] The EC granted Italy third DWD derogations in 2010 (up to 20 μg/l for arsenic and 2.5 mg/l for fluoride), for a period ending on 31 December 2012 with regard to the areas of Rome and Viterbo.[28] In July 2014, after recognising non-compliance for arsenic and fluoride values in numerous (37) WSZs in Lazio, the EC sent Italy a formal notice of infringement procedure (no. 2014/2125) under Article 258 of the Treaty on the Functioning of the European Union.[29] Italy's non-compliance with the DWD persisted through 2015, with the EC setting additional and more stringent reporting duties and commanding monitoring and remediation actions in Lazio. In January 2019, the EC sent Italy a reasoned opinion (pursuant to Article 258(3) of the Treaty on the Functioning of the European Union) for its failure to ensure compliance with the limit values for fluoride and/or arsenic in a number of WSZs, all located in the province of Viterbo. Italy had two months to address the grievances in the reasoned opinion, which concerned both compliance with the limit values and the obligation to provide the citizens

[27] It must be noted, moreover, that such high arsenic concentration is mostly due to natural causes, given the highly volcanic nature of a large part of the Lazio territory.

[28] EC Decisions C (2010) 7605 final, and C (2011) 2014 final, respectively.

[29] See European Commission MEMO/14/470 and Press Release IP/14/816, 10 July 2014.

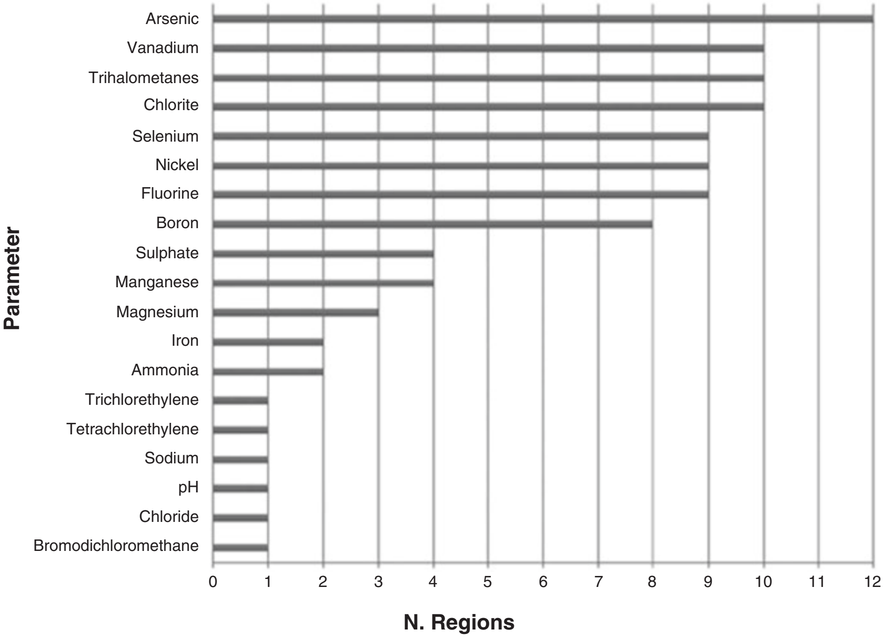

Fig. 7.6 Parameters in derogation and number of Italian Regions involved between 2001 and 2012. (Source: Azara et al. 2018)

concerned with adequate and targeted information, especially on the health risks of arsenic and fluoride concentration for children below three years old.[30] Italy responded by rectifying the EC's findings as to the geographical scope of the violation – 10 Municipalities, instead of the alleged 16 – and ensuring that all necessary measures to achieve full compliance with the DWD would be adopted within 9–10 months. At the time of completion of this Chapter the infringement procedure is still pending.[31]

[30] See European Commission, MEMO/19/462, 24 January 2019a, b, c.

[31] On a separate, yet related score, on July 15, 2019 the EC referred to the European Court of Justice (case C-668/19) another infringement procedure against Italy (no. 2014/2059) for failure to implement Directive no. 91/271/EEC on wastewater treatment. Italy allegedly failed to ensure collection systems in 166 agglomerations (with population equivalent to or more than 2000) and secondary wastewater treatment in 610 agglomerations (with population equivalent to or more than 10,000) across 17 different Regions – including Lazio. Notably, this procedure comes after an EC's formal notice (issued under Art. 260 of the Treaty on the Functioning of the European Union) urging Italy to comply with a Court's decision on another violation of Directive no. 91/271/EEC in other areas of its territory (C-85/13, Commission v. Italy, Judgment of 10 April 2014).

7.3.3 Nitrates Directive

The Nitrates Directive (ND) aims to establish good farming and agricultural practices and measures to reduce all forms of water pollution from nitrogen (N) inputs such as fertilisers, animal manures or biological N_2 fixation to agricultural land.[32] To this end, Articles 3 and 5 of the ND mandate different action programmes to be implemented by the Member States, including water monitoring, establishment of codes of good agricultural practices and action programmes to be implemented in designated Nitrates Vulnerable Zones (NVZs). The limit values for nitrates concentration according to the ND is 50 mg/l for groundwaters, and 25 mg/l for surface waters.

Italy first implemented the ND through Legislative Decree no. 152/1999, which was eventually repealed by Article 92 of the Environmental Code. Article 92 mandates Regions (in cooperation with the RBDAs) to identify and delineate NVZs within their territory[33]; in addition, Ministerial Decree 19 February 1999 regulates good agricultural practices, while Ministerial Decrees of 7 April 2006 and 25 February 2016 set standards for wastewater from agronomic activities. NVZs have been designated in 18 Italian Regions (out of 20), and cover approximately 13.4% of the national territory (40,382.41 km^2, see Fig. 7.7).

Diffuse nutrient pollution from agriculture is a major source of water pollution in all Italian RBDs (APAT 2005). In the larger European framework, total N inputs range from less than 50 kg N/ha/year in Central Europe (e.g. in Bulgaria, Estonia, Latvia, and Romania) to more than 300 kg N/ha/year in regions with intensive livestock systems in Belgium, France, Germany, Ireland, Italy, Spain and the Netherlands (Velthof et al. 2014). According to Ministerial Decree 7 April 2006, all Regions falling within each RBD must have regulations in place (binding controls/requirements at farm level) addressing diffuse nutrient pollution (nitrates and phosphorus) also outside designated NVZs. (Figs. 7.8 and 7.9)

One of the most disputed issues in the Italian implementation of the ND relates to manure relocation in highly intensive livestock areas in Northern Italy, more specifically Lombardy and Piedmont. Recent studies in those Regions have highlighted the current governance framework's unfitness to support knowledge dissemination and changes in farmers' attitudes, thus hampering water quality improvements and efficient farming and agricultural practices (Musacchio et al. 2020). The ND sets the standard of 170 kg N/ha/year from livestock manure in NVZs. Manure exceeding this threshold cannot be utilised, thus resulting in manure surplus and causing production constraints. The ND allows for derogation to the above standard under Paragraph 2 of Annex III to the ND, provided that the objective

[32] Annex II to the ND; see also Case C-258/00, *Commission v. French Republic*, Judgment of 27 June 2002, para. 53.

[33] The specific methodological criteria for the identification and delineation of NVZs, as well as for the carrying out of programmes of measures are set in Annex VII to Section 3 of the Environmental Code.

Fig. 7.7 Map of NVZs in Italy. (Source: Joint Research Centre)

criteria set in the Annex are met and the derogated amounts do not impair the achievement of the Directive's objectives. Derogations are granted by means of an EC Implementing Decision, following the opinion of the Nitrates Committee. On 3 November 2011, the EC granted Italy derogations in four northern Regions (Emilia-Romagna, Lombardy, Piedmont and Veneto) up to 250 kg N/ha/year from cattle manure and treated pig manure on farms.[34] This derogation expired on 31 December 2015. In 2016, Italy requested and was granted another derogation as to N concentration up to 250 kg N/ha/year from cattle and treated pig manure, although with regard to Lombardy and Piedmont only.[35] This derogation expired on 31 December 2019.

Furthermore, Italy has not provided enough information on the status of ND implementation, and has moreover failed to implement the basic ND water protection measures altogether in several central and southern Regions (including Basilicata, Molise, Calabria, Apulia and Sicily). Hence, in November 2019 the EC initiated an infringement procedure (no. 2018/2249) against Italy by sending a

[34] EC Implementing Decision 2011/721/EU, [2011] L 287, 36–41.

[35] EC Implementing Decision 2016/1040/EU, [2016] L 169, 6–13.

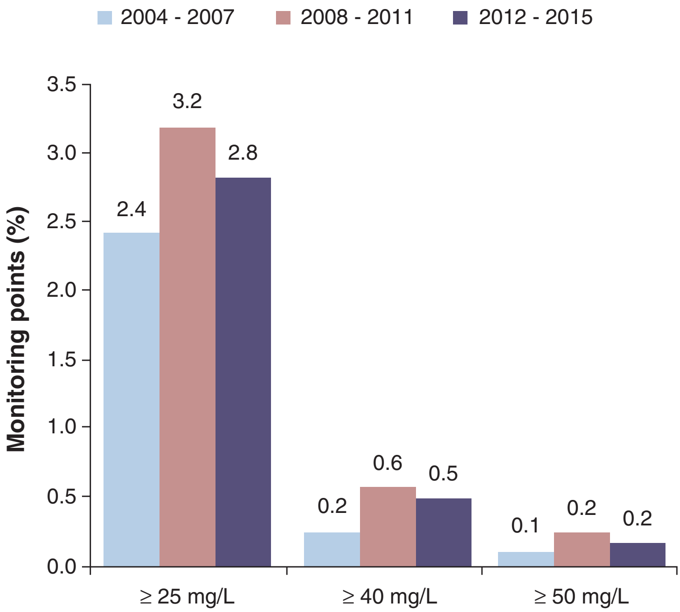

Fig. 7.8 Percentage of N concentration in groundwater stations exceeding different nitrates concentration values per litre on average during different reporting periods. (Source: EC 2018)

formal notice under Article 258 of the Treaty on the Functioning of the European Union for violating Articles 3(4), 5(5) and 5(6) of the ND.[36] In particular, Italy has failed to designate NVZs, monitor its waters and take additional measures in the said Regions.[37]

[36] European Commission, MEMO/18/6247, 8 November 2018.

[37] More specifically, the EC points to the following shortcomings in ND implementation: a) the currently established NVZs are deemed insufficient in light of the many potential high-N-concentration water bodies (i.e., over 50 mg N/ha/year) in non-NVZs areas; b) the lack of N monitoring stations in several NVZs in the above Regions (particularly Calabria and Basilicata); c) the overall inadequacy of the programmes of measures currently adopted in some Italian Regions (especially in Campania, Apulia, Marche, Sardinia, Lazio and Emilia-Romagna) as to properly address N pollution in their NVZs (e.g., from manure).

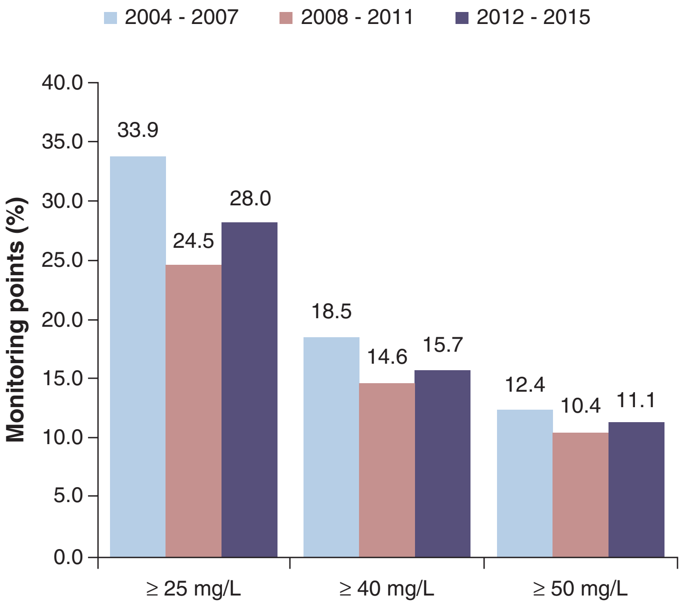

Fig. 7.9 Percentage of N concentration in surface water stations exceeding different nitrates concentration values per litre on average during different reporting periods. (Source: EC 2018)

7.4 Criminalisation of Water Pollution in Italy

7.4.1 Criminal Offences in the Environmental Code

The existing Italian criminal law regime for water pollution is still extensively informed by the Country's traditional political-administrative scheme. Thus, it mostly comprises criminal offences included in the Environmental Code, which are deemed as ancillary to the administrative sanctions (Article 133 of the Environmental Code) for violation of the administrative regime for water quality (De Santis 2012, p. 65). These offences ground criminalisation of water pollution on the mere threat thereof, as opposed to an actual damage or deterioration of water resources. This approach is deemed consistent with the prominent aim to safeguard the carrying out of administrative functions to protect the environment and natural resources (D'Alessandro 2012, p. 344). More specifically, the traditional approach allows to overcome remarkable issues such as the causal nexus between the unlawful conduct and the damage, as well as to relax the subjective element of the offence (mostly based on negligence, rather than intentional conducts). It also enables reliance on flexible procedures for pecuniary sanctions and, more importantly, swift reparation of the environment.

The Environmental Code comprises two subsets of criminal offences: unauthorised discharge of industrial wastewater or discharge with a suspended or revoked authorisation, and discharge of wastewater exceeding the tabled threshold limits. Both subsets apply only to industrial wastewater, thus not applying to residential wastewater.

Unauthorised Wastewater Discharge According to Article 137(1) of the Environmental Code, whoever performs a discharge of industrial wastewater without due authorisation, or after the authorisation has been suspended or revoked, shall be sanctioned by imprisonment (from two months to two years) or by a fine (from €1500 to €10,000).[38] When the conduct concerns the discharge of industrial wastewater containing dangerous substances (indicated in the tables in Annex 5 to Section III of the Environmental Code, i.e. heavy metals such as arsenic, mercury, etc.), the penalties increase up to three months-three years imprisonment and €5000–€52,000 fine (Article 137(2)). Furthermore, this offence may be committed also in case of discharge consistent with the relevant authorisation, if the public authority is prevented from verifying discharges' compliance with legal requirements and undertaking verification and prevention activities with regard to a potential danger.[39] On the other hand, this offence does not include accidental discharges due to an operation, which could not be reasonably foreseen and therefore subjected to previous authorisation.[40]

Furthermore, violations of Articles 103 and 104 of the Environmental Code, on wastewater discharge into soil, subsoil and groundwater, are punished by a penalty of arrest up to three years (Article 137(11)). Specific offences are provided for in case of violation of Regional plans and regulations on rainwaters and run-off waters management (Article 137(9)), and in case of discharges in water bodies specifically apt for breeding of fishes and shellfishes (Article 137(10) and (12)).

Discharge of Wastewater Exceeding Concentration Thresholds Article 137(5) of the Environmental Code sanctions all discharges that exceed the relevant thresholds for dangerous substances as set in Table 5 contained in Annex 5 to Section 3 of the Code. This offence aims at preventing deterioration of the water bodies, regardless of the concrete effects of the discharges on natural resources.[41] Thus, this offence fully embodies the political-administrative approach to water pollution traditionally adopted in the Italian legal system for water protection (De Santis 2012, p. 331). Excessive discharges of substances not listed as dangerous under the abovementioned Annex 5 would lead to administrative sanctions under Article 133(1) of the Environmental Code. Specific sanctions are provided for the owner of the integrated water management system (Article 137(7)). Any action or omission, which may impede verification and sampling of industrial wastewater discharges by public

[38] The conduct must, however, not fall within the cases sanctioned under Art. 29 *quattuordecies*, Para. 1, of the Environmental Code, which relates to the emission and discharge limit values included in the permits issued pursuant to Directive 2010/75/EU (Industrial Emissions Directive).

[39] Cass. Pen., Sec. 3, no. 11518/2019 (dep. 15 March 2019), Rv. 276030 – 02.

[40] Cass. Pen., Sec. 3, no. 5239/2016 (dep. 03 February 2017), Rv. 268989 – 01.

[41] Cass Pen., Sec. 3, no. 21463/2015 (dep. 22 May 2015), Rv. 263750 – 01.

authorities are also sanctioned with arrest pursuant to Article 137(8). Importantly, this offence has been adopted, with a broader scope and more severe penalties (imprisonment up to three years), in the context of the 2015 reform of the Criminal Code (see *infra*, Sect. 7.4.3), and more specifically in its Article 452 *septies*.

7.4.2 Water-Related Crimes in the Criminal Code: A Patchy Framework

Water pollution has traditionally played a prominent role with regard to two subsets of criminal offences included in Italian Criminal Code. More specifically, the Criminal Code provides for different criminal offences with regard to intentional and fault-based water contamination (Articles 439 and 452, respectively) and water adulteration (Articles 440 and 442). The former covers all noxious substances discharges, while the latter covers substances, which are not noxious per se, but nevertheless if discharged lead to a detrimental alteration of the chemical composition of water (Rizzo Minelli 2019). Noteworthy, both offences are primarily aimed to ensure public health protection, rather than the protection of waters as an element of the ecosystem (Assumma 1987). Discharges exceeding concentration thresholds as set out in the Environmental Code would not as such constitute presumption of water contamination for the purposes of Article 439 of the Criminal Code.[42] Thus, Article 439 becomes applicable in combination with Article 137(5) of the Environmental Code when wastewater discharges also constitute a potential impairment of public health. The Gordian knot with regard to Article 439 relates to whether its application should cover only contamination of water for human consumption, or rather be extended to any contamination of an underground aquifer. According to the Italian Supreme Court, in order for the offence under Article 439 to be present, there must be an actual threat to public health, and therefore a quantitative and qualitative dangerous discharge must be scientifically ascertained.[43]

Major accidents leading to water pollution may also fall within the broader umbrella of disasters pursuant to Article 434 of the Criminal Code, also applied in combination with Article 439 (Ruga Riva 2017; Gargani 2017). Article 434 encompasses all large-scale offences to public safety and health, thus engendering major ecological damages, including water pollution.[44] Both manifest, large-scale damaging events (e.g., industrial accidents) and long-lasting, not immediately detectable

[42] Cass. Pen., Sec. 4, no. 25547/2018 (dep. 06 June 2018); Cass. Pen., Sec. 1, no. 45001/2014 (dep. 29 October 2014), Rv. 261135 – 01.

[43] Id.; see also Cass. Pen., Sec. 4, no. 48548/2018 (dep. 24 October 2018), Rv. 274,493–01; Cass. Pen., Sec. 4, no. 15216/2007 (dep. 17 April 2007), Rv. 236168 – 01.

[44] Examples of major water pollution cases are the following: unauthorised extractive activity in a quarry resulting in water bodies alteration, floods, infiltrations, or coastal areas instability; discharge of waste, wastewater and other noxious substances leading to major ecosystem and habitat deterioration.

events (e.g., poisoning from asbestos) are sanctioned, provided that such events jeopardise both natural resources and public health.[45] Article 434 has been resorted to in all major cases of environmental pollution, such as those related to the petrochemical factory in Porto Marghera (Venice), the Ilva steel factory in Taranto, the coal power plant in Vado Ligure (Savona), and notably to groundwater pollution due to high perfluoroalkyl substances concentration in the Veneto Region (De Santis 2012). However, most of these criminal proceedings have been ultimately struck down by the statute of limitations, given that the period of prosecutability starts from the cessation of the polluting activities and not from the manifestation of their noxious effects.[46] Article 434 continues to be applicable in all criminal proceedings on environmental disasters commenced before the entering into force, in 2015, of the new set of environmental crimes (Article 452 *quater* of the Criminal Code; see Sect. 7.4.3).[47]

Lastly, the offence of malicious mischief (Article 635 of the Criminal Code) has been widely used to sanction deterioration of water bodies. Unlike the other offences above, Article 635 is mainly aimed at protecting water's multiple economic uses (Ruga Riva 2017). This offence therefore implies impairment of the relevant water resource's functionality to the extent that it would be rendered unsuitable for human uses.[48] Thus, it can occur also in the absence of specific point sources of pollution, as well as in relation to discharge of non-dangerous substances, which nonetheless results in a degradation of the water bodies (Mazzacuva 2012). In any event, this offence may be applied jointly with other offences, such as unlawful discharge according to Article 137(1) and (5) of the Environmental Code.

7.4.3 Law no. 68/2015 on Environmental Crimes: A Paradigm Shift

Against this fragmented regime of criminal offences for water pollution, Law no. 68/2015 introduced a comprehensive and coherent set of criminal offences specifically devoted to conducts against the environment as a whole. Such law finally implemented Directive 2008/99/EC on the protection of the environment through criminal law. The Italian legislator opted for incorporating the newly introduced crimes against the environment in the Criminal Code (Section 6 *bis*, Article 452 *bis*

[45] See, with regard to the notorious "Eternit" asbestos case in Casale Monferrato (Piedmont), Cass. Pen., Sec. 1, no. 7941/2014 (dep. 23 February 2015), Rv. 262790 – 01 and Cass. Pen., Sec. 1, no. 2209/2018 (dep. 19 January 2018), Rv. 272366 – 01.

[46] Cass. Pen., Sec. 4, no. 36626/2011 (dep. 11 October 2011), Rv. 251428 – 01; Cass. Pen., no. 2209/2018, *supra* n. 45.

[47] Cass. Pen., Sec. 1, no. 58023/2017 (dep. 29 December 2017), Rv. 271840 – 01.

[48] For example, see Cass. Pen., Sec. 3, no. 15460/2016 (dep. 14 April 2016), Rv. 267823 – 01 (where the relevant deterioration was found in increased water turbidity and alteration of marine currents, due to a sand runoff as a consequence of construction works for an artificial island).

ff.), thus formally embedding the environment among the most relevant interests protected by the Italian legal system independently from public health concerns (Catenacci 1996; Siracusa 2007).

Furthermore, and perhaps more importantly, the 2015 reform on environmental crimes marks a radical shift from the previous underlying Western anthropological and ethical approach. According to such a view, a greater deal of inherent values ought to be recognised to human uses of non-human entities, and therefore environmental protection acquires relevance inasmuch as it purports human well-being, and its impairment threatens human integrity (Lipovetsky 1992). On the contrary, Law no. 68/2015 enshrines – at least ideally – a fully ecological perspective, thus embracing ecosystem integrity as the ethical foundation of criminal-law-based environmental protection (De Santis 2017). Yet this aim has been only partially reflected in the criminal offences introduced by Law no. 68/2015. In fact, the 2015 reform encompasses three different levels of protection: a) the protection of *the environment as a whole*, thus separated from a public health and utilitarian perspective; b) the protection of *public health*; c) the protection of *individual health* as resulting from environmental degradation. The pure ecological perspective can be clearly found in the newly introduced Article 452 *bis* (Environmental Pollution) and – partly – in Article 452 *quater* (Environmental Disaster) of the Criminal Code. Penalties under Article 452 *bis* (imprisonment and fines up to €100,000) apply to all unlawful conducts (including omissions) resulting in a significant and measurable deterioration or impairment of natural resources, including water (i.e., sea and all water bodies), air, soil and subsoil, and more generally, any ecosystem (including marine ecosystems), biodiversity, flora and fauna.[49] The general reference to the ecosystem as the interplay between different natural resources crucially unveils the abovementioned ecosystem approach (Di Landro 2019). Ecosystem resilience thus becomes the relevant benchmark for criminalising the alleged unlawful conduct (De Santis 2017). As the Italian Supreme Court recently stated, Article 452 *bis* of the Criminal Code is not directed to protect public health, but rather the environment as a whole, and therefore an actual and concrete prejudice to the same environment is required for it to apply.[50]

Given the vague formulation of the most relevant elements of Article 452 *bis*, judicial interpretation has widely contributed to shed a light on its scope of application. Accordingly, "deterioration" entails any structural diminution of the natural resource's value, which renders utterly impossible or practically unfeasible any reparation or restoration in kind; whereas "impairment" consists of any alteration of natural resources as to their human and/or ecological interests and functions.[51] In light of the underlying focus on ecological integrity, the "significance" and "measurability" elements are by no means correlated to numeric thresholds or

[49] These sanctions are raised (by one-third) if the offence is committed in protected natural areas or against protected species (Art. 452 *bis*, Para. 2, of the Criminal Code).

[50] Cass. Pen., Sec. 3, no. 50018/2018 (dep. 06 November 2018), Rv. 274864 – 01.

[51] Cass. Pen., Sec. 3, no. 15865/2017 (dep. 30 March 2017), Rv. 269489 – 01; Cass. Pen., Sec. 3, no. 46170/2016 (dep. 03 November 2016), Rv. 268059 – 01.

parameters. Thus, such elements should reflect a qualitatively remarkable and quantitatively detectable deterioration or impairment of natural resources, which are to be assessed within their ecologic interrelations.[52] Both elements can be appraised based on several criteria, including the frequency and range of the damage, recovery and remediation costs, as well as the technical complexity of remediation actions (Ruga Riva 2017, pp. 247–249; Siracusa 2015, p. 219). The key – and indeed controversial – "unlawfulness" requirement in Article 452 *bis* must be broadly interpreted as comprising not only unauthorised activities or activities undertaken under an expired (or unlawful) authorisation, but also any actions or omissions (also cumulative) violating laws – State, Regional and Local – and/or administrative acts either aimed at environmental protection or pertaining to other regulations (e.g., workers' health and safety regulations).[53] Unlike the offences embedded in the Environmental Code, all the offences introduced by Law no. 68/2015 are not triggered by imminent threats to the environment or natural resources, requiring instead the detrimental consequences on the environment to be adequately appraised. In this regard, the conceptual framework of the "new" environmental crimes departs from the traditional political-administrative model.

Article 452 *bis* of the Criminal Code on environmental pollution, which does not prevent indictment under other offences under the Environmental Code, has been applied to sanction a wide array of conducts resulting in impairment of water ecosystems, including unauthorised wastewater discharges.[54]

Article 452 *quater* of the Criminal Code explicitly codifies the crime of environmental disaster.[55] Differently from Article 452 *bis*, Article 452 *quater* is applicable to unlawful conducts (actions or omissions) causing irreversible deterioration or impairment of an ecosystem (Paragraph 1(1)), as well as alteration of an ecosystem that would require economically unfeasible remediation measures (Paragraph 2(2)). Differently, Paragraph 1(3) of the provision refers to any threats to public health and individuals' physical integrity, thus re-affirming the abovementioned anthropocentric perspective underlying the criminalisation of disasters provoked intentionally or culpably (Articles 434 and 449 of the Criminal Code). Yet, further interpretation has clarified that in order for Article 452 *quater* to apply, the criminal conduct must also entail effects on the ecosystem or one of its components.[56] In case of sentencing or out-of-court settlement for all the above criminal offences, restoration in kind and remediation actions – unless technically

[52] Cass. Pen., Sec. 3, no. 46170/2016 (dep. 03 November 2016), Rv. 268060 – 01.

[53] Cass. Pen., Sec. 3, no. 158652017 (dep. 30 March 2017), Rv. 269491 – 01. Relevant, this decision stemmed from a case of water body pollution caused by wastewater accumulation. For decisions on marine water pollution resulting from seabed clean-up activities see Cass. Pen., no. 46170/2016 (*supra* n. 51); Cass. Pen., Sec. 3, no. 28732/2018 (dep. 21 June 2018), Rv. 273565 – 01.

[54] Cass. Pen., Sec. 3, no. 52436/2017 (dep. 16 November 2017), Rv. 272842 – 01.

[55] Sanctions under Art. 452 *quater* (5 to 15 years imprisonment) are indeed more severe than those under Art. 452 *bis*. Sanctions are raised by one-third if the crime is committed in protected areas (Art. 452 *quater*, Para. 2).

[56] Cass. Pen., Sec. 3, no. 29901/2018 (dep. 03 July 2018), Rv. 273210 – 01.

unfeasible – must be undertaken at the convicted expense, and seizure of all assets used to commit the crimes must be ordered.[57]

Last, protection of individual integrity is ensured by Article 452 *ter* of the Criminal Code. This offence covers all personal injuries resulting from environmental pollution pursuant to Article 452 *bis*. Article 452 *bis* of the Criminal Code – which relates only to the deterioration or impairment of natural resources and ecosystems – can thus be applied cumulatively with Article 452 *ter*.

The second building block of the 2015 reform relates to the application of all environmental crimes as introduced in Section 6 *bis* of the Criminal Code to corporations pursuant to Legislative Decree no. 231/2001. Violations of Article 452 *bis* and *quater* of the Criminal Code can lead to pecuniary sanctions, seizure and freezing of assets or other interdiction measures (disqualification from tendering, revocation or suspension of authorisations, disqualification from contracting with public administrations, etc.). Moreover, such extension of corporate criminal liability should prompt the adoption of adequate internal organisational models duly coordinated with the (voluntary) environmental management systems (EMAS/ISO 14001).[58]

The third building block of the 2015 reform relates to the amendments to the Environmental Code. Article 1(9) of Law no. 68/2015 introduced a new part (Section 6 *bis*, Article 318 *bis* ff.) in Legislative Decree no. 152/2006, with the aim to better coordinate the criminal offences included in the same Environmental Code with the newly introduced set of offences in the Criminal Code. To this end, a new hybrid (administrative-criminal) out-of-court settlement procedure has been established, which applies to criminal offences in the Environmental Code, provided that no damage (or imminent threat thereof) to natural resources has occurred (Fimiani 2019). This procedure builds on that adopted in case of non-compliance with work health-and-safety regulations (Legislative Decree no. 758/1994). Accordingly, upon verification of timely and full compliance with *ad hoc* instructions issued by public authorities (e.g., Local Environmental Agencies) and payment of reduced pecuniary sanctions, the Public Prosecutor shall acquit the defendant and dismiss the criminal procedure (Article 318 *septies* of the Environmental Code). As recently stated by the Supreme Court, this procedure runs in parallel with the ordinary criminal procedure; therefore, its nonfulfillment does not preclude criminal charges from being pursued before criminal courts.[59] An empirical assessment shows that this settlement procedure has led to more than 5000 instructions issued by the competent authorities nation-wide (more than 400 related to wastewater discharges), with a high rate of compliance (around 70%) and totalling more than €12 million revenues from pecuniary sanctions, thus unfolding its overall efficacy in preventing and

[57] See Art. 452 *undecies* and *duocedies* of the Criminal Code.

[58] Cass. Pen., Sec. 3, no. 9132/2017 (dep. 24 February 2017).

[59] Cass. Pen., Sec. 3, no. 7220/2020 (dep. 24 February 2020). This decision is consistent with previous ones on work health-and-safety regulations: see Cass. Pen. Sec. 3, no. 26758/2010 (dep. 12 July 2010), Rv. 248097 – 01.

remediating small-size water pollution activities (Sistema Nazionale per la Protezione dell'Ambiente 2018; Legambiente 2019).

7.5 Conclusions

This contribution has aimed to provide a hands-on perspective on the Italian administrative and criminal legal regime for water quality protection. As the Organisation for Economic Co-operation and Development stressed, "the need to reform water policies is as urgent as ever, yet governments around the world face significant challenges in managing their water resources effectively" (OECD 2012). At the EU level, little progress in attaining good water quality status has been achieved, mainly because of insufficient ambition and poor implementation of EU legislation at Member States level (European Commission 2019b). In Italy, despite the efforts to address the complex governance and regulatory challenges posed by the EU framework on water quality, actual implementation has been severely hampered by poor institutional cooperation, path dependence, and excessive reliance on derogations and exemptions. As the experience with the Italian first- and second-cycle RBMPs shows, failure in establishing a coherent decentralised governance system has led to inconsistent setting of water quality standards, as well as scattered adoption of monitoring and planning tools within different areas. These elements, coupled with the inherent complexity and location-specific constraints, constituted major hardships in meeting the deadlines and requirements set out by EU legislation (e.g., the NVZs under the Nitrates Directive). Thus, it does not come as a surprise that the most relevant changes and shifts in Italian water quality policy have been triggered amidst – or with the purpose to avoid – EC's infringement procedures. Whilst water governance coordination has finally been strengthened, monitoring networks have been enhanced and water quality is overall slightly increasing, Italy is still far from achieving full compliance with the EU's overarching water quality objectives.

Criminalisation of water pollution in Italy has been traditionally marginalised in the light of the paramount administrative-political model, which attributes prominence to administrative sanctions as a means to ensure water quality. Yet this has not been the case with regard to large-scale water pollution, where the lack of *ad hoc* criminal offences both in the Environmental Code and the Criminal Code has led to the adoption of different, piecemeal approaches. Against this backdrop, the 2015 reform of the Criminal Code has introduced a clear-cut and ecosystem-oriented regime for water-related crimes, while effectively reinforcing coordination with the sanctioning regime in the Environmental Code.

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Chapter 8
Managing Water Scarcity and Droughts: The Po Experience

Antonio Massarutto and Dario Musolino

Abstract This chapter focuses on the case of the Po river basin. After describing the case study area and its vulnerability to drought, we address the characteristics and the effects of drought in the Po river basin, based on the empirical evidence on the socio-economic impacts of drought events occurred so far. Then, we illustrate and discuss the approach to drought management, taking into consideration the key planning documents and experiences. Our work shows that the Po river basin has reached a turning point, as concerns water resources and drought management. The approach adopted by the local public institutions is essentially reactive; however, it is here maintained that proactive and structural measures are required in order to anticipate and prevent better the negative effects of drought.

Keywords Po river basin · Drought event · Vulnerability · Socio-economic impact · Drought management

8.1 Introduction

The Po river basin is the most developed and densely inhabited area in Italy. It covers a very wide area (74,700 km^2), approximately corresponding to the Padana region, the vastest flatland area in Italy, inhabited by about 16 million people (more than 25% of the Italian population). Its economic structure is rather advanced and diversified, ranging from hi-tech sectors, like automation and electronics, to "traditional" sectors, like furniture design and agri-food.

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The presence of the Alpine Arc, with its lakes and its glaciers, historically assured abundant water supply for the water demanding economic activities located in the plain area, like agriculture. However, despite such water availability, the Po river basin has been suffering due to climate change since the beginning of this millennium, when it was hit by a hard water crisis caused by the 2003 drought event.

Therefore, until less than 20 years ago, the level of preparedness in the Po river basin to these extreme events was quite low. This is why national and local actors, both in the public and in the private sector, only recently started a process to improve the governance and the management of drought risk, differently from other regions in Europe and the world, which are more prepared and used to deal with water crises.

Moreover, due to the novelty of this phenomena in this region, analyses of the economic, social and environmental impacts of drought, of drought responses and of drought management, are rare. The few available studies, however, cast light on the relevant, multiple and unpredictable socio-economic effects of drought. Even if we focus our attention only on agriculture, which is an important sector in the economy of the Po river basin, we can observe the remarkable and varied effects of drought on production, income and welfare.

In our contribution we will describe the characteristics and the effects of drought events in the Po river basin, we will analyse its vulnerability, and we will take stock of the situation of drought management. Section 8.2 is devoted to the presentation of the Po river basin and its vulnerability to drought. Section 8.3 presents the key outcomes of a line of research focused on the evaluation of the impacts of droughts on agriculture in terms of welfare in the Po river basin. Section 8.4 presents and discusses the approach to drought management adopted in this region. Lastly, in Section 8.5, we draw some conclusions and the lessons to be learnt from this case study.

8.2 The Po River Basin: A Developed but Vulnerable Area, Increasingly Hit by Droughts

The Po river basin is the most populated, developed, advanced and diversified region in Italy, accounting for a significant share of the Italian GDP. A large part of the Italian firms, as concerns both the industrial and the services sectors, are located in the basin.[1]

Agriculture – the primary sector – plays an important role. Agricultural production in the Po river basin covers an important share of the overall Italian agricultural production: the value added produced in the Po basin accounts for 41% of the sectoral value added in Italy (Musolino et al. 2018b). The utilised agricultural area

[1] 34% of the value added created in Italy comes from the Po river basin, and 29% of the Italian industrial and services firms are located there. In addition, there are several sectoral specialisations, such as mechanics, textile and clothing, and food (Musolino et al. 2018a).

(2,700,000 ha) accounts for 40% of the total basin area. Irrigated farming is made of grain corn (32.5%), rice (14.5%), and alternate fodder (38.3%), mostly cultivated in the northern part of the river basin; and fruit trees (4.5%), industrial crops (4.2%) and open field vegetables (3.58%), typical of the southern part of the river basin (Autorità di bacino del fiume Po 2009). About one third of the Italian high-quality agri-food products comes from the Po river basin (ISTAT 2017).

The Po river basin has a considerable availability of water resources for irrigated farming, and for other uses, thanks to the naturally-regulated Alpine lakes and the artificial reservoirs, which store 1.13 billion m^3 of water (Autorità di bacino del fiume Po 2015). However, the Po river basin is assumed to be vulnerable to drought, in particular as concerns agriculture.

Indeed, this is the most important sector in terms of water consumption, which puts under stress the water management system of the basin. Given the 1,355,258 ha of irrigated area (Zucaro 2013), it accounts for an annual water demand volume of more than 16×10^6 m^3/year, that is, more than 80% of the total annual water demand of the basin (Musolino et al. 2018b). Moreover, most of the irrigation network is technologically inadequate, in particular in the upper part of the basin (Autorità di bacino del fiume Po 2009), and illegal water withdrawals from rivers contribute to make water management more difficult. Without rainfalls, the water resources available in Alpine areas can satisfy the usual yearly needs of all relevant sectors, including agriculture, until the end of June, but beyond this date extraordinary measures of water management are required.

Changes in the climate occurred in the last decades favoured the increase in number and frequency of drought events (Musolino et al. 2018b). Rainfalls have diminished while their intensity increased, resulting both in the reduction of the river flow during the dry season and in the increase in floods. In addition, the average yearly temperature increased of about 2 °C, raising consequently the water needs of specific water-demanding sectors, like agriculture. In the last decades, this trend has caused major drought events in the Po river basin, such as the ones occurred in 2003, 2005–2007, 2012, and 2015, which, as we will see in the next section, had relevant socio-economic impacts.

Due to these phenomena, the Po river basin is likely to become more and more vulnerable to drought in the next decades. For example, long-term projections focusing on agricultural uses in one of the portions of the basin (Muzza-Bassa lodigiana) showed that water resources availability under climate change scenarios is expected to decline in the future (Oberto et al. 2018). The same conclusions were drawn by means of long-term climate projections concerning the impacts of climate change on Po River discharges through a set of climate, hydrological, water-balance simulations (Vezzoli et al. 2015); by assessing the impacts of climate change on water resources in the Upper Po river basin, modelling the effects of variables like seasonal precipitations, snow melt and glaciers volume and elevation (Ravazzani et al. 2015); and by applying a modelling chain for the development of water accounting analysis in the basin (Pedro-Monzonís et al. 2016).

Last but not least, it is worth considering that the heterogeneity of the Po river basin in terms of water availability and water management has an impact on drought vulnerability (in particular, again, as concerns agriculture). We can identify three geographical areas within the Po river basin, approximately covering the territory of three administrative Regions: Lombardy, north of the Po River; Piedmont and Aosta Valley, west of the river basin; and Emilia-Romagna, south of the Po River. Lombardy has a high availability of water, due to the presence of Alpine lakes, reservoirs and glaciers, that makes storage and effective management possible, by releasing water in case of shortage. Piedmont and Aosta Valley have much water as well, although they lack natural and artificial storage capacity. Emilia-Romagna is the poorest geographical area in terms of water availability and storage capacity, so much that its water availability depends on Lombardy, Piedmont and Aosta Valley; this is also probably why its irrigation system is the most advanced and efficient in the Po river basin. As we will see in the next pages, these differences have consequences on the magnitude of the effects of drought in each of these areas.

8.3 Socio-economic Impacts of Droughts: An Assessment Focused on the Agricultural Sector

What socio-economic impacts have been produced by drought in the Po river basin? We estimated the socio-economic effects of drought events the basin using the consumer's surplus theory (Varian 2010; Musolino et al. 2017, 2018a), a theoretical approach which allow to quantify and maesure not only the aggregate economic impact of drought, but also the distributional effects.[2]

Our analysis focused on agriculture. Although drought in the Po river basin had well-known effects on other sectors (Massarutto et al. 2013; Stahl et al. 2016), like hydropower (Massarutto and de Carli 2009) and environment (Pham et al. 2019), due to limitations in data availability, we focused on the primary sector, the most sensitive sector to changes in water availability and, as mentioned above, an important sector in economic terms in the basin.

In essence, our hypothesis based on the consumer's surplus theory is that drought should cause not only a reduction on agricultural production (quantity effect), but also a price increase (price effect), due to the consequent and exceptionally low

[2] Clearly, the literature on the theoretical and methodological approach to the evaluation of the economic impacts of droughts is extremely wide (see, for a literature review, Logan and van den Bergh 2013). There are other approaches and studies that highlight differences in terms of socio-economic impact of drought (Griffin 1998; Ding et al. 2011; Berritella et al. 2007). Mysiak et al. (2013) for example analysed such differences in the Po river basin at the sub-regional scale (agrarian districts, which encompass a bunch of municipalities with similar geographical and hydrological features) and for different crop specializations. However, we decided to use this theoretical approach, the consumer's surplus theory, as it is the only that specifically cast light on the distributional effects of droughts. Moreover, our analyses were the first which applied this approach to the evaluation of drought impacts on the agricultural sector (the consumer's surplus theory was applied to other sectors sensitive to droughts, like urban water supply, by Woo 1994; Garcia-Valinas 2006; Grafton and Ward 2008; Martin-Ortega and Markandya 2009).

supply of agricultural products on the market. According to this theory, this will determine on the one hand a net negative impact (net economic loss) on the social welfare at the aggregate scale; but, on the other hand, such impact will split into multiple effects on different social groups, that is, consumers and producers (farmers). These effects can have different signs, not only negative but also positive, meaning that ultimately drought can cause redistributive effects among social groups. Consumers are supposed to lose as a result of drought, as their welfare will shrink because of both the quantity effect and the price effect (lower production and higher prices); on the contrary, producers are assumed to lose because of the quantity effect, but they will win because of the price effect, being the final net effect on them undefined.

Interestingly, our theoretical hypothesis was substantially confirmed by our analyses, which showed that drought events can hit dramatically the economy and welfare on the whole, but not all people to the same extent: some people paradoxically can even "win" after a drought event.

Our attention focused on the 2003 and 2005–2007 drought events, the first two events after a long period without water crises, as said above. Production of the main crop categories dropped in occasion of both events. In 2003, cereals lost about 10% of production compared to the average of the previous years, whereas fruit lost about 12% and industrial crops 30%. On the contrary, prices increased remarkably. For example, price of cereals rose by 3.1% in 2003 and by 13.5% in 2005–2007, price of industrial crops by 14% and 10% respectively, and price of fruit by 25.7% and 10.3%. The combination of these two effects on production and prices (quantity effect and price effect) determined, according to our analyses, four key results (Figs. 8.1 and 8.2).

First, in aggregate terms, drought had considerable negative economic effects on the Po river basin. In 2003, total losses suffered by the agricultural sector amounted

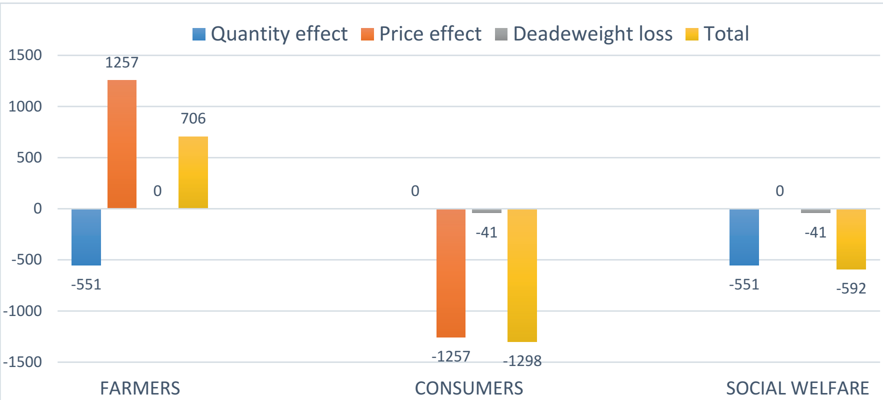

Fig. 8.1 Socio-economic impacts of the 2003 drought event in the Po river basin (€m). (Source: Our elaboration based on Musolino et al. 2018a)

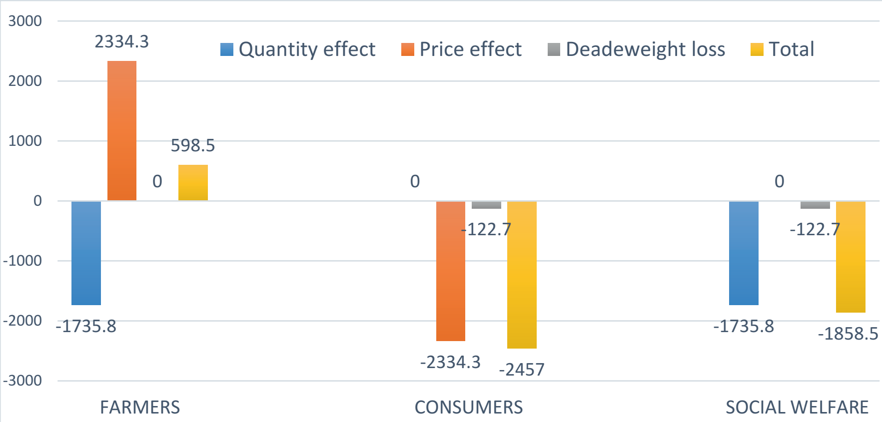

Fig. 8.2 Socio-economic impacts of the 2005–2007 drought event in the Po river basin (€m). (Source: Our elaboration based on Musolino et al. 2018a)

to 592 million euros, while in 2005–2007 they were even estimated in 1858 million euros.

Second, as assumed by the consumer's surplus theory, breaking data down by social groups (producers and consumers) we discovered that, although the aggregate net effect was negative, some groups (consumers) actually lost because of drought – as one would usually expect to occur – but others (farmers) won. This was, in particular, the case of farmers who did not lose their crops due to drought, and who could then take advantage of the so called "price effect": indeed, they could sell their crops at a higher market price thanks to the dramatic reduction on the supply side. We estimated that farmers gained 706 million euros in 2003, and almost 600 million euros in 2005–2007.

Third, breaking data down by crop category, we could realise how the sign and the magnitude were highly diverse, showing that drought has anything but homogenous and predictable socio-economic effects. We found that not all consumers lost to the same extent; not all farmers were "winners"; and not all those who won gained to the same extent. For example, while farmers specialised in industrial crops had a net loss both in 2003 and 2005–2007, vegetable farmers obtained considerable gains in both occasions (the loss of production – quantity effect – was offset by a relevant – positive – price effect).

Fourth, conducting an analysis by geographical area within the basin, we found that all consumers, independently from where they live in the Po river basin, had remarkable losses because of drought. Instead, farmers "won", but not in all areas. While in Lombardy they had the greatest economic benefits, they lost in Emilia-Romagna (in particular, in 2005–2007). As said above, the most plausible reason is that the latter area, situated in the southern part of the basin, is the geographical area disadvantaged by the scarcest availability of water resources.[3]

8.4 Drought Risk Management: The Experience of the Po River Basin

Clearly, the impact of the 2003 drought event took by surprise the competent public bodies: in fact, after a long time without water crises the level of preparedness was very low. Suffice it to say that at that time there wasn't drought management plans, neither the basin nor at the regional and local level. Only recently the planning process started, but it has not been completed yet.[4] This creates a sort of "institutional vulnerability" of the Po river basin (Musolino et al.2018b), besides the economic vulnerability described above.

Since the first dramatic drought event occurred at the beginning of this century, the competent public institutions have learnt the lesson and have defined a strategy to respond to drought. However, they have taken a reactive approach to drought management, rather than a proactive one. That does not mean that their strategy is not effective: it was improved time after time ("learning by managing"), but still now it maintains many weaknesses and a "reactive" nature. In particular, such an approach has two main characteristics (Musolino et al. 2018b).

First, all public bodies, water managers and stakeholders arrange voluntary agreements in order to achieve their primary objective: maintaining a minimum water flow level for irrigation farming and for other primary uses (for example, thermopower), exploiting Alpine lakes and reservoirs and fostering an efficient and resource-saving water use. In 2005, they signed a "Memorandum of Understanding". All those who participate in these agreements are coordinated by the *Osservatorio Permanente*, a technical committee where the key role is played by the Po river basin Authority.[5] The *Osservatorio Permanente* is in charge of analysing the hydro-meteorological characteristics and identifying the effects of water crises, and it proposes measures to reduce the magnitude of negative impacts. It was first established in 2003[6] and since then it became a permanent body meeting at least once per year in order to set the yearly outline for water management. This technical committee bases its activity on the "Drought Early Warning System for the Po River

[3] Pérez-Blanco et al. (2018) provide additional elements to explain the economic losses suffered by this region because of drought events. The application of their model points out that the reduction in agricultural production due to drought causes an excess of demand that propels the production of substitute goods elsewhere in Italy. Therefore, implicitly, they reduce the magnitude of the price effect in this region.

[4] This means that the following events that occurred in the Po basin – in 2005–2007, 2012 and 2015 – were managed out of any plan.

[5] See the website of the *Osservatorio Permanente*: https://adbpo.gov.it/osservatorio-permanente/

[6] At that time, and until 2016, its name was *Cabina di Regia*.

Basin" (DEWS-Po), an advanced early warning and drought modelling system (Autorità di bacino del fiume Po 2015). The *Osservatorio Permanente* has now become such an efficient and effective body for drought management at the basin level that its role has been recognised as a good practice at the national level, by the central Government.

The second characteristic is the state of emergency, which is declared in case of drought by the central Government. The state of emergency entails the appointment of a commissioner in charge of accomplishing extraordinary and urgent activities, in coordination with all governmental bodies at the national and regional level.

As mentioned above, as of now the planning process, which would foster the adoption of a proactive approach to drought management, is far from being fulfilled: in fact, so far only the Po Water Balance Plan has been adopted (in 2017).[7] The Drought Management Plan (DMP) for the Po river basin (Po-DMP) and the development of regional/sub-basin-level DMPs have not been concluded yet.

As pointed out by Musolino, Vezzani and Massarutto (2018b), these plans under development will "fill the gap" which characterises the current approach to drought management in the Po river basin. In particular, they will address the lack of:

- a wide, systematic and updated knowledge of drought vulnerability throughout the basin;
- the identification and a socio-economic assessment of all actual and potential impacts of drought events, throughout all sectors (not only agriculture);
- the definition of the actions that each relevant actor should implement, and of their expected effects.

Therefore, strengthening the current monitoring system (DEWS-Po) linked to the monitoring of water withdrawals; defining new tools and models for identifying and measuring impacts (for example, "Sicc-Idrometro")[8] and their economic value; and devising new mitigation actions, are the key steps that are being taken by planners to shift from a reactive to a structured proactive approach to drought management in the Po river basin.

[7] The latest document produced within the planning process is the *Valutazione Globale Provvisoria* (VGP) (Autorità di bacino distrettuale del fiume Po 2019), which provides for the basis and the framework for the next upgrade of the Po Water Balance Plan. See: https://adbpo.gov.it/partecipazione-pubblica/

[8] Invented and defined by Claudia Vezzani, it is a kind of "Drought-Hydrometer", "a shared visualisation tool of the impacts of low flow periods on river discharge, developed for the entire basin. It consists of a thematic map of a whole river in which, at every reference cross-section, the major impacts are represented versus discharge value, in order to make the effects of water management (effects of upstream withdrawals or release, etc.) clear to all the upstream and downstream users" (Musolino et al. 2018a, p. 209).

8.5 Conclusions

The Po river basin has evidently reached a turning point, as concerns the availability of water resources and drought management. The challenge posed by climate change, in particular by drought events, on the environment, the economy and the whole society in this region can no longer be neglected: indeed, its effects, as seen in the case of one of the key economic sectors (agriculture), are increasingly relevant and varied. As said by Bozzola and Swanson (2014), local farmers can adapt to climate change but "they can do little to respond to the greater uncertainty inherent in climate change". Drought vulnerability in the Po river basin has reached such a dramatic level that it requires the adoption of urgent and adequate measures by the competent institutions.

Clearly, the current approach to drought management has to change substantially. Institutions have learnt a lot from the latest drought events, in particular as concerns the effectiveness of some drought responses (such as water releases from Alpine reservoirs and lakes); the cooperation of all stakeholders and decision-makers; the production and exchange of adequate data and information (for example, the data on hydro-meteorological variables, in order to assess, monitor and forecast droughts), and the coordination of the decision-making process.

However, the shift from a reactive to a proactive approach has not been completed yet. Proactive and structural measures must be designed in order to anticipate and prevent the negative effects of droughts (Kampragou et al. 2015). They concern the well-known factors which make the system vulnerable: illegal withdrawals, obsolete and inadequate irrigation technologies, in particular in the upper part of the basin, the lack of infrastructure and technologies for water saving, the need for an integrated and systematic evaluation of drought impacts, including social and environmental impact assessment and analyses of economic impacts. Only when this "revolution" will be achieved, that is to say, when the planning process will be completed, the Po river basin will be ready to face the challenges that climate change has set for the future of this strategic area of Italy.

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Chapter 9
The Management of International River Basins: The Case of Transboundary Water Cooperation Between Italy and Its Neighbours

Mara Tignino and Benedetta Gambatesa

Abstract This chapter analyses the norms and principles concerning the management of transboundary waters under international law, as well as the provisions of the Water Framework Directive on the same issue under European Union law. Then, the focus is moved to the hydrographical situation of Italy and the waters the country shares with neighbouring States. Even though, unlike other European countries, Italy does not share major watercourses or water bodies with other States, in at least a couple of cases (Lake Maggiore and Lake Lugano shared with Switzerland, and River Isonzo/Soča shared with Slovenia) joint management and control systems are in force, which pre-date the WFD by many years.

Keywords International river basins · Transboundary cooperation · International water law principles · International legal framework · EU legal framework

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9.1 Introduction

The management of international watercourses is often thought of as conflict management (Rieu-Clarke and Wolf 2009). Hydro-climatic changes that make river flow variability more and more unpredictable, transboundary floods, altered precipitation patterns, but also phenomena such as population growth, economic development and pollution have a huge impact on the global hydro-political balance and make co-riparian relations increasingly unstable and conflictive. Thus, the role played by inter-State cooperation becomes fundamental and the need for shaping a common approach in transboundary water resources management is evident.

Many are the reasons that encourage States to engage in cooperative and interdependent relationships: hydraulic interconnectedness; actual and potential economic, social and ecological benefits; concerns of national security; information and data exchanges, in particular in case of emergency; climate change concerns. All these factors have pushed States to adopt common principles and rules in the management and protection of shared water resources. International water law sets out a comprehensive corpus of rules defining what States can and cannot do with respect to transboundary water resources, and fosters the durability, predictability and peaceful nature of their relationships. International water law includes (i) treaty law, which is composed of bilateral and multilateral agreements signed by States, (ii) customary international law, or widely-shared rules crystallised over time, and (iii) various principles, mainly deriving from domestic laws and case law.

Contemporary international water law includes these different sources of international law and ensures a sustainable management and protection of shared water resources. Cooperation in matter of transboundary water resources is also characterised by principles and norms established at different levels including universal agreements such as the UN Convention on the Law of the Non-Navigational Uses of International Watercourses (hereinafter, the Watercourses Convention) and the Convention on the Protection and Uses of Transboundary Watercourses and International Lakes (hereinafter, the Water Convention) as well as agreements concluded at the regional and basin levels.

This contribution analyses the norms and principles concerning the management of transboundary waters under international law, as well as the provisions of UE Directive no. 2000/60/EC (Water Framework Directive – WFD) on the same issue under European Union law. This general legal framework influences the bilateral relationships on shared waters between Italy and its neighbours, enhancing transboundary cooperation and environmental protection. The chapter focuses on the hydrographical situation of Italy and the waters the country shares with neighbouring States. As it will be seen, unlike other European countries, Italy does not share major watercourses or water bodies with other States. However, in at least a couple of cases (Lake Maggiore and Lake Lugano shared with Switzerland, and River Isonzo/Soča shared with Slovenia), joint management and control systems, which pre-date the WFD by many years, are in force.

9.2 International Water Law and the Regulation of Transboundary Water Cooperation

The need for regulating the management of transboundary water resources is not only the result of a process of consideration of interests and benefits. It also derives from the intrinsically dynamic nature of the water cycle, which puts under discussion two essential attributes of the State under international law: territorial sovereignty and territorial integrity. Both principles, stemming from that of State sovereignty, evoke "the supreme, absolute, and uncontrollable power by which any independent State is governed" (Black 1990, p. 342). On the one hand, absolute territorial sovereignty means that the State can exercise its full powers within its territory without any restrictions. On the other hand, territorial integrity stands for the State's right to prohibit any impacts on its territory arising from the territory of another State.

9.2.1 The Theory of Limited Territorial Sovereignty

The first and most widely accepted principle that qualifies the relationship between international water law and State's territory is that territorial sovereignty is limited. The importance of this principle should be understood in light of two other conflicting doctrines: the theory of absolute territorial sovereignty and the theory of absolute territorial integrity. The former, also known as the Harmon Doctrine, affirms that every nation can utilise the waters of an international watercourse flowing through its territory regardless of the possible negative consequences that it would cause in co-riparian countries (McCaffrey 1996). The latter, the theory of absolute territorial integrity, assumes that the lower riparian State has the right to "a full flow of water of natural quality, and interference with the natural flow by the upstream State requires the consent of the downstream riparian" (Rahaman 2009, p. 210).

Since both theories result in huge privileges for either the upstream State (theory of absolute territorial sovereignty) or the downstream State (theory of absolute territorial integrity), they have been dismissed and have been progressively replaced by the theory of limited territorial sovereignty.

This doctrine, which was adopted and reaffirmed in several international treaties,[1] claims that every State has the right to use shared rivers flowing through its territory, but that such utilisation should not cause a damage or prejudice to the rights and interests of co-riparian States. This shows that the concept of territorial sovereignty is subject to limitations in the management of shared water resources, and sanctions

[1] See for example Arts. 4 and 7 of the 1995 Agreement on the Cooperation for the Sustainable Development of the Mekong River Basin; Arts. 7 and 9 of the 2002 Framework Agreement on the Sava River Basin; Art. 2 of the 1995 Protocol on Shared Watercourses Systems of the Southern African Development Community (SADC).

the international water law principle that sovereignty over shared water resources is restricted by the sovereign rights of the other riparian countries. Based on that, all co-riparian States, upstream and downstream, have mutual rights and obligations: they are all entitled to a reasonable use of water resources and equitable share of their benefits and simultaneously uphold the obligation not to deprive other co-riparian States of their own right to a reasonable and equitable utilisation (Boisson de Chazournes 2013). This is the widely accepted and solid basis of modern international water law, from which all other principles and rules derive. The principle of limited territorial sovereignty is thus the cornerstone of the management and protection of shared water resources between Italy and its neighbours.

9.2.2 The Principle of Equitable and Reasonable Utilisation

A pillar of customary international law and first affirmed by the International Court of Justice in the *Gabcikovo-Naymaros* case,[2] the principle of equitable and reasonable utilisation provides that each co-riparian State is entitled to a reasonable and equitable share of water resources for the beneficial uses within its own territory. Its universal acceptance as a binding rule is confirmed by its inclusion in many international agreements and non-binding instruments, as well as by its recognition by decisions of courts and tribunals and the doctrine.[3]

Although the wording may be a little misleading, the principle does not stand for an equal share of waters. Instead, the definition of "equitable" and "reasonable" should be understood on a case-by-case basis, taking into consideration concrete factors pertaining to the international watercourse in question, as well as the needs and uses of the watercourse States concerned. Relevant factors include, but are not limited to, the geography and hydrology of the water resource, the population depending on it, the climate affecting the basin, the past utilisations of the waters as well as the economic and social needs of each watercourse State (Caflisch 2018).[4] As noted by the commentary to Draft Article 6 on the Law of the Non-Navigational Uses of International Watercourses, the implementation of the principle of equitable and reasonable utilisation depends therefore on the weighing of all relevant factors

[2] International Court of Justice, *Gabcikovo-Nagymaros Project* (Hungary/Slovakia), judgment of 25 September 1997, ICJ Reports, 7.

[3] Arts. IV, V, VII, X, XXIX of the 1966 Helsinki Rules on the Uses of the Waters of the International Rivers ("Helsinki Rules") of the International Law Association (ILA); Arts. 5, 6, 7, 15, 16, 17, 19 of the 1997 UN Watercourses Convention; Art. 2 of the SADC Protocol on Shared Watercourses Systems; Arts. 7, 8, 9 of the Framework Agreement on the Sava River Basin; Arts. 4, 5, 6, 26 of the Agreement on the Cooperation for the Sustainable Development of the Mekong River Basin; Arts. 3, 7, 8, 9 of the 1996 Mahankali River Treaty between India and Nepal; Arts. 10(1), 12, 13, 14 of the 2004 Berlin Rules on Water Resources ("Berlin Rules") of ILA; Art. 2(2)(c) of the 1992 UNECE Water Convention.

[4] See Art. 6 of the UN Watercourses Convention and Art. V of the Helsinki Rules.

and circumstances.[5] Although this principle is not expressly affirmed in the bilateral treaties between Italy and Switzerland and Italy and Slovenia, this rule plays an important role in ensuring an equitable share of transboundary waters.

9.2.3 The Obligation Not to Cause Significant Harm

The obligation not to cause significant harm, also expressed in the maxim *sic utere tuo ut alienum non laedas* ("use your own property in such a manner as not to injure that of another"), requires co-riparian States to refrain from a utilisation of the international watercourse that may cause significant harm to other basin States, to the environment, to human health or safety, and to the living organisms of the watercourse systems. The obligation is enshrined in most modern international water conventions as well as in international environmental conventions and declarations and can be considered as part of customary international law.[6] As a customary principle, Italy, Switzerland and Slovenia are bound by this obligation.

One of the major misunderstandings about international water law is that harm can only be caused by upstream riparians to those downstream, because it can only "travel" downstream with the flow of the waters. This misconception is not preposterous: it derives from the fact that it is more evident that riparian States downstream can be harmed by the physical impacts of changes in water quantity and quality caused by riparian States upstream. Such reduced quantity of water in downstream countries may also create tensions among competing users (Salman 2010). It is much less obvious that the upstream riparian States can be affected or even harmed by the use of water made by downstream riparian States, as it is difficult to understand that this use might cause negative effects such as the foreclosure of future use of water. However, projects on shared water resources such as dams, mining or irrigation works carried out by downstream riparians might create "historical" or "prescriptive" rights foreclosing future utilisations by upstream countries. Current uses of water resources – by both upstream and downstream users – could create expectations of future quantities of water allocation. Therefore, it is necessary to consider that harm is a two-way matter. Cooperation and goodwill of all riparians,

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[5] See Draft Articles on the Law of the Non-Navigational Uses of International Watercourses and Commentaries Thereto and Resolution on Transboundary Confined Groundwater, *Yearbook of the International Law Commission*, Vol II, Part Two, 1994, p. 101.

[6] Arts. V, X, XI, XXIX(2) of the Helsinki Rules; Arts. 7, 10, 12, 15, 16, 17, 19, 20, 21(2), 22, 26(2), 27, 28(1), 28(3) of the UN Watercourses Convention; Art. 2 of the SADC Protocol on Shared Watercourses Systems; Arts. 2 and 9 of the Sava River Basin Agreement; Arts. 3, 7, 8 of the Mekong Agreement; Arts. 7, 8, 9 of the Mahankali River Treaty; Arts. 8, 10(2), 16 of the Berlin Rules; Arts. 2(1), 2(3), 2(4), 3 of the UNECE Water Convention. Moreover, this principle is also acknowledged by modern international environmental conventions and declarations, such as in Principles 21 and 22 of the 1972 Stockholm Declaration of the UN Conference on Human Environment; Principles 2, 4, 13, 24 of the 1992 Rio Declaration on Environment and Development; and Art. 3 of the 1992 Convention on Biological Diversity.

upstream as well as downstream, ensure the efficient use and sound management of shared watercourses.

9.2.4 The Principles of Notification, Consultation and Negotiation

Every riparian State has the right to prior notice, consultation and negotiation in all cases where the use of a shared water resource proposed by another riparian State may cause serious harm to its rights or interests. The rationale for this obligation comes from the assumption that allocating shared water resources should be the result of a cooperative process. Therefore, all interested parties should cooperate to put in place a system of mutual information and consultation, which offers a strong and effective tool to co-riparian States to communicate and peacefully "reconcile any competing interest" (Rieu-Clarke 2014).

When planning a measure in a transboundary water resource, a riparian State is required to notify and consult with other riparians (Sangbana 2018).[7] Notification and consultation both refer to the idea of keeping all relevant parties informed before an action is implemented or taken. The duty to notify entails that the planning State communicates its project to the other parties, while the duty to consult requires all States that are likely to be affected by the planned projects to engage in a dialogue. These two obligations foster the creation of a platform where the planning State can demonstrate the positive impact of its project for the shared watercourse on the one hand, while the other co-riparian States can raise their concerns, ask questions and make suggestions on the other. The planning State will then have the possibility to adjust the project – where needed – according to the comments and points raised by the co-riparian States, which in turn will have the possibility of taking an informed and conscious decision on the project itself. These principles, now considered part of customary international law, are included in many international water agreements, international environmental conventions and declarations.[8] It is also worth noting that they are embodied in regional and basin agreements, such as the Revised Protocol on Shared Watercourses in the South African Development

[7] It should be noted that the procedure of notification and consultation concerns the situation where a State (or a person under its jurisdiction) plans measures or activities, including a new use or change in existing use, of an international watercourse that may cause a significant adverse transboundary environmental effect to other States.

[8] Arts. XXIX(2), XXIX(3), XXIX(4), XXX, XXXI of the Helsinki Rules; Arts. 3(5), 6(2), 11–19, 24(1), 26(2), 28, 30 of the UN Watercourses Convention; Art. 2(9)–(10) of the SADC Protocol on Shared Watercourses Systems; Art. 22 of the Sava River Basin Agreement; Arts. VII(2) and VIII of the 1960 Indus Waters Treaty; Arts. 5, 10, 11, 24 of the Mekong Agreement; Arts. 6 and 9 of the Mahankali River Treaty; Arts. 57, 58, 59, 60 of the Berlin Rules; Art. 10 of the UNECE Water Convention. Moreover, this principle is also acknowledged by modern international environmental conventions and declarations, such as in Principles 18 and 19 of Rio Declaration on Environment and Development; and Art. 21(1) of the Convention on Biological Diversity.

Community (1995), the Senegal River Water Charter (2002) and the Nile Basin Cooperative Framework Agreement (2010). As we will see, Italy is engaged in negotiations with Switzerland to ensure the regulation of the Maggiore and Lugano lakes. The principles of notification, consultation and negotiation play a central role in the decisions concerning new projects which may have a negative impact.

9.2.5 The Principles of Cooperation and Exchange of Information

The principles of cooperation and information-exchange require each riparian State to cooperate by exchanging data and information regarding the status of the watercourse, and its current and future uses that the State is planning. As in the previously mentioned principles of notification, consultation and negotiation, the purpose of the duty of cooperation and exchange of information is to encourage an open dialogue between co-riparian States, to prevent conflicts and possible damages to the environment.

The concept of cooperation among States crosses all domains of international law and is evoked in many international instruments, including the UN Charter[9] and a UN General Assembly Resolution of 1970,[10] as well as in international conventions and multilateral agreements.[11] The principle of cooperation applies beyond international water law, and has a particular importance in transboundary cooperation as it is aimed at preventing and settling conflicts of interests among several parties. For example, the 1973 Convention concerning the Protection of Italo-Swiss Waters against Pollution provides that Italy and Switzerland should exchange information on the origin and nature of pollution as well as carry out joint assessment on the data concerning the quality of waters (Article 3).[12]

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[9] Arts. 1(3), 55, 56 of the 1945 Charter of the United Nations.

[10] Progressive Development and Codification of the Rules of International Laws Relating to International Watercourses, GA Res 2669, UN GAOR, 25th, supp No. 8, UN Doc A/8028 (1970).

[11] Arts. XXIX(1), XXIX(2), XXXI of the Helsinki Rules; Arts, 5(2), 8, 9, 11, 12, 24(1), 25(1), 27, 28(3), 30 of the UN Watercourses Convention; Arts. VI–VIII of the Indus Waters Treaty; Arts. 2–5 of the SADC Protocol on Shared Watercourse Systems; Arts. 3–4, 14–21 of the Sava River Basin Agreement; Arts. 6, 9, 10 of the Mahankali River Treaty; Preamble and Arts. 1, 2, 6, 9, 11, 15, 18, 24, 30 of the Mekong Agreement; Arts. 10, 11, 56, 64 of the Berlin Rules; Arts. 6, 9, 11, 12, 13, 15, 16 of the UNECE Water Convention. The principles of cooperation and information exchange are also acknowledged by modern international environmental conventions and declarations, e.g. in Principles 13, 22, 24 of the Stockholm Declaration of the UN Conference on Human Environment; Principles 7, 9, 12, 13, 17, 27 of the Rio Declaration on Environment and Development; and Arts. 5, 17 of the Convention on Biological Diversity.

[12] Convention for the Protection of the Italian-Swiss Waters against Pollution (20 April 1972). www.admin.ch/opc/it/classified-compilation/19720079/197308070000/0.814.285.pdf

9.2.6 Peaceful Settlement of Disputes

Under international law, States are required to settle their disputes by peaceful means.[13] However, unless they have agreed otherwise, there is no obligation to resort to a specific mechanism. They may choose between diplomatic and judicial means.[14] Rivers may serve several purposes: from agriculture to domestic uses, from transportation of people and goods to connecting countries and communities, from municipal uses to fisheries, from hydropower to recreational purposes. This broad set of uses makes conflicts of interest and disputes very likely to happen among co-riparian States. Thus, the principle of peaceful settlement of disputes aims to build bridges and break the barriers that may arise between riparian States regarding shared water resources management, as it requires all co-riparian States to seek a peaceful settlement of disputes through diplomatic or judicial means. In the context of the relationship between Italy and its neighbours, bilateral commissions such as the Commission for the Protection of Italo-Swiss Waters against Pollution (CIPAIS) and the Permanent Italian-Slovenian Commission for Water Management also play an important role in the prevention and resolution of disputes.

9.3 Transboundary Water Cooperation in the Pan-European Region

One of the most successful examples of water management and protection throughout the world comes from the European continent. Europe has a considerably high number of river basins and a dense system of basin treaties and agreements. Cooperative water resources management is thus a widely shared political priority.

9.3.1 The Convention on the Protection and Use of Transboundary Watercourses and International Lakes

The Water Convention was adopted in 1992 under the auspices of the United Nations Economic Commission for Europe (UNECE) and entered into force in 1996. Originally, it was only open to member States of the United Nations within the UNECE region. In 2003, the Parties adopted an amendment aimed to extend the Convention's geographic scope.[15] According to this amendment, entered into force

[13] See Art. 33 of the UN Charter.

[14] The diplomatic mechanisms include negotiation, good offices, mediation, inquiry and conciliation. Judicial mechanisms include the submission of a dispute to the International Court of Justice and arbitration.

[15] See UNECE, "Amendment to Arts. 25 and 26 of the Convention on the Protection and Use of Transboundary Watercourses and International Lakes", UN Doc ECE/MP.WAT/14 (12 January 2004).

in 2016, all UN member States may accede to the Convention. The objective of this amendment is to allow as many States as possible to ratify the Convention in order to expand the reach of its regulatory framework.

Like the UN Watercourses Convention, entered into force in 2014, the UNECE Water Convention is a framework agreement. Both conventions should be used as a basis for the development of more specific instruments. At the basin level, the UNECE Water Convention acted as a catalyst and frame of reference for the adoption of agreements such as the 1994 Convention on Cooperation for the Protection and Sustainable Use of the Danube River and the 1999 Convention on the Protection of the Rhine.

A significant aspect of the UNECE Water Convention is the establishment of an institutional framework where all Parties can cooperate, consult and exchange information, elaborate joint objectives and action programs, share their knowledge and provide mutual technical and legal assistance (Bernardini 2015). The functioning of this robust institutional system is also ensured by regular meetings of the Parties, as well as the existence of working and expert groups, joint bodies, a Secretariat and an implementation mechanism (Tanzi and Contartese 2015).

The Convention sets out two types of obligations: the first, enshrined in Part I, includes the duties generally applied to all Parties (obligations *erga omnes partes*) that aim to protect the common interests of the community in the preservation of the environment. Conversely, in Part II, the Convention defines the obligations addressed to all riparian States that are Parties to the Convention and share common transboundary waters. The role of this Convention is particularly important in the case of the waters shared by Italy, Switzerland and Slovenia since the three countries are parties to this agreement. This framework enhances the cooperation between these States and reinforces the environmental protection of their transboundary water resources.

9.3.2 Water Governance in the European Union

The majority of European countries are also members of the European Union (EU) or candidates for its accession. Over the years, the EU has played an increasingly important role in defining common objectives and policies and has provided a comprehensive and harmonised framework in many different domains, from customs unions to monetary policy, from the conservation of marine biological resources to common commercial policy, and others.[16] The implementation of water policy falls under the broad category of environmental policy as set out in one of the EU funding treaties, the Treaty on the Functioning of the European Union (TFEU). Therefore, it is subject to the principles and mechanisms typical of the EU environmental policy, that is, the ordinary legislative procedure. Accordingly, legislation is adopted by the joint decision of the Council of Ministers and the European Parliament. However,

[16] Art. 3 of the consolidated version of the Treaty on the Functioning of the European Union.

there is a major exception to this rule that concerns the measures having an impact on the quantitative management and availability of water resources. In this case, a special procedure is applied where the Council unanimously decides and the European Parliament is only consulted.[17] This mechanism, whose purpose is to safeguard the right of Member States to regulate the flow of water as they wish, results in the huge power attributed to the Council of Ministers to block legislation through its veto power and the *de facto* exclusion of the European Parliament from the decision-making process (Baranyai 2019).

As said before, the implementation of water-related policies is shared between the European Union and its Member States. This implementation at two levels implies that the EU defines minimum standards while Member States are left the freedom to establish stricter and more detailed protection measures. The discussions on water law at European level started in 1973 with the adoption of a directive prohibiting the sale and use of certain detergents with a low level of biodegradability.[18] Since then, the legislation has considerably evolved.

A milestone of the current EU water legal framework is the Water Framework Directive. Adopted in 2000 after five years of negotiations, the Directive first defined the key elements to achieve an effective and comprehensive water governance at the EU level. Its broad scope suggested a remarkable change in EU water legislation from the protection of particular waters of special interest, to the protection of all waters, including all inland freshwater bodies within the territory of the EU as well as coastal waters and wetlands, and all terrestrial ecosystems directly depending on water. The WFD establishes environmental objectives called "good water status" that have a slightly different meaning according to what they refer to. For surface waters, "good status" means good ecological and chemical status, including any deviation from the aquatic biodiversity found or estimated to exist under conditions where there has been a minor human impact.[19] The "good status" of groundwater, instead, stands for groundwater quality and quantity that does not negatively affect surface water status or the ecology of terrestrial ecosystems. In this regard, Member States are called to use geological data to identify volumes of water in underground aquifers, in order to detect and stop any pollution of groundwater.

One of the pillars of the WFD consists in the organisation and regulation of water management through the so-called river basin management plans (RBMPs) (Götz 2016). Starting from the assumption that rivers do not stop at national frontiers but flow on through different countries, the Directive considers natural geographical and hydrological units as managements units, instead of using administrative or political boundaries. Acknowledging that unilateral measures cannot be successful

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[17] Art. 192(2) TFEU.

[18] Council Directive 73/404/EEC of 22 November 1973 on the approximation of the laws of the Member States relating to detergents.

[19] The ecological status is determined by biological, hydro-morphological and physico-chemical quality elements, and takes into consideration the abundance of aquatic flora and fish fauna, the availability of nutrients, and aspects like salinity, temperature and pollution by chemical agents, but also quantity, water flow, water depths, and others.

without taking account what happens upstream and downstream, the Directive proposes a holistic approach to protecting the whole body of water. Therefore, the EU and its Member States have divided the river basins and associated coastal areas into 220 river basin districts, 40 of which are international and cross borders. The river basin districts comprise the area of land and sea, together with their associated ground and coastal waters, so every decision having whatever impact on the aquatic system within the river basin district should be taken in consideration in an integrated and coordinated manner. Accordingly, Member States will designate one or more competent authorities within their territory or, for international waters, in coordination with other States (Articles 3(2) and 13, and Annex I, of the WFD). Beside this mechanism for coordinated management, Member States shall hold broad consultations with the public and all relevant stakeholders to determine the problems and then find the solutions to be included in the RBMPs (Preamble, Recitals 14 and 46, and Article 14 of the WFD). This happens through a comprehensive consultation process that allows European citizens to play a key role in implementing the Directive and in helping governments balance the social, environmental and economic issues to be taken into account. It is well established that the success of the WFD comes from its exemplary legal system that binds together fragmented environmental legislation, vast public consultation and planning processes.

Europe is the home of a complex web of bilateral and multilateral freshwater agreements. The legal frameworks governing shared water resources between Italy and its neighbouring countries are an example of the specificities of these relationships. Although these agreements rely on the general principles of international water law analysed in the previous sections, they also have specific features, as we will see in the rest of the chapter.

9.4 Transboundary Water Cooperation Between Italy and Its Neighbouring Countries

Italy shares a negligible part of the basins of the Danube,[20] Rhine[21] and Rhone[22] rivers. The most important river basin shared with neighbouring countries is the Po river basin. This basin is shared by France (230 km^2), Italy (70,000 km^2) and Switzerland (4118 km^2) and is the longest river in Italy (UNECE 2011). The 652-km-long River Po has its source at Mount Monviso and flows through Northern

[20] According to UNECE (2011, pp. 170, 182 and 191), Italy shares 0.25% of the entire Danube basin. In particular, Italy shares with Austria, Germany and Switzerland the River Inn which is the third largest tributary of the Danube by discharge. It also shares the River Drava, another tributary of the Danube, with Austria, Croatia, Hungary and Slovenia.

[21] According to UNECE (2011, p. 315), the Rhine covers less than 100 km^2 of the Italian territory. Italy shares with France the River Roya which is a tributary to the Rhone (European Commission 2019).

[22] According to UNECE (2011, p. 254), the Rhone only covers 50 km^2 of the territory of Italy.

Italy, discharging into the Adriatic Sea. Near the outflow to the sea, the river forms a wide delta area, which presents a habitat of precious environmental and landscape value. In 1995, the area comprising the urban centre of Ferrara and adjoining agricultural lands within the ancient and vast Po river delta was included in the UNESCO World Heritage List. Moreover, there are five biosphere reserves which are part of the UNESCO programme "Man and Biosphere" along the River Po, from the sources to the delta, including two transboundary sites between Italy and Switzerland (Ticino Val Grande Verbano) and Italy and France (Monviso) (UNESCO, Ministero dell'ambiente e della tutela del territorio e del mare and Italian MAB National Committee 2019). The Po river basin also includes two transboundary lakes, namely Lake Lugano and Lake Maggiore.

While the Po river basin is managed by a District Basin Authority in accordance with the EU Water Framework Directive, the protection of the quality of the waters of the Lugano and Maggiore lakes are covered by an international agreement concluded by Italy and Switzerland in 1972.[23] Among the first agreements between Italy and Switzerland, the Agreement Concerning the Concession of Hydraulic Forces of the Reno di Lei concluded in 1949[24] and the Convention for the Utilisation of the Hydraulic Forces of the Spöl of 1957,[25] should be mentioned. Both instruments focus on the sharing of hydropower energy. The 1949 convention ensures that a single company is holder of the concession contract and carries out the works necessary to create a water reservoir in the Valley of Lei. This reservoir is to be used to produce energy attributed to Switzerland for 70% and to Italy for the other 30% (Article 5). The 1957 treaty regulates the development and management of the derivation works of the River Adda and the creation of an accumulation basin in Livigno. Switzerland agreed that Italy deviates a section of the River Spöl, flowing in the Swiss and Italian territories, to produce hydroelectric energy (Article 1).

9.4.1 The Po River Basin

The Po river basin includes two big Alpine lakes, the transboundary Lake Lugano (also called Lake Ceresio) and the Lake Maggiore (also called Lake Verbano), shared by Italy and Switzerland. The most significant transboundary river is the Ticino, also shared by Italy and Switzerland. The River Po and its tributaries flow through several cities in Northern Italy. The main water management problems in the basin are surface and groundwater pollution (including drinking water contamination) and changes in land use coupled with climate change effects (floods

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[23] Convention for the Protection of the Italian-Swiss Waters against Pollution (20 April 1972). www.admin.ch/opc/it/classified-compilation/19720079/197308070000/0.814.285.pdf

[24] Agreement Concerning the Concession on Hydraulic Forces of the Reno di Lei (18 June 1949). www.admin.ch/opc/it/classified-compilation/19490145/index.html#fn1

[25] Convention for the Utilisation of the Hydraulic Forces of the Spöl (27 May 1957). www.admin.ch/opc/it/classified-compilation/19570089/index.html

and landslides). These problems derive from pressures from agriculture, industry and urban areas.

The plan for the management of the hydrographic district of the River Po operationalises the WFD. It was prepared by the Authority of the Po River Basin District and includes all necessary measures to achieve good ecological and chemical status and to reduce the pollution of surface and groundwater in the district. The plan, adopted in 2016, points out the measures for the reduction of nutrient, organic compound and pesticide pollution, preservation of mountain basins and improvement of land use in order to mitigate hydrogeological risk and improve environmental status of water bodies. Following this plan, current actions include saving and using water resources sustainably, especially in agriculture.

Climate change has had important effects in the Alpine part of the Po basin, in particular the effect of modifying the run-off regime. This is why the Authority of the Po River Basin District has also identified in the Water Balance Plan of 2016 some adaptation measures for dealing with these impacts of climate change. Although the pollution of the Po is significant in some areas (ISPRA 2017), the management of the Po River Basin District represents a useful guidance for Italy on how to implement the WFD and to develop effective, efficient and integrated water policies.

9.4.2 The Lugano and Maggiore Lakes

Lake Lugano has a surface of 48.72 km^2, of which 18 km^2 are located in Italy. The catchment basin covers 368 km^2, of which 60% are in the Swiss territory. The administrative division is rather complex and the lake extends between the Canton of Ticino (Switzerland) and the Provinces of Como and Varese (Italy). Particular is the position of Campione d'Italia, historic Italian enclave surrounded by Swiss territory. The three main tributaries are the Cassarate, the Vedeggio and the Cuccio. From the western part of the lake the River Tresa begins; it belongs to the river basin of the Ticino and flows into Lake Maggiore.

Regulation of the outflow of Lake Lugano is ensured by a transboundary agreement between Italy and Switzerland, concluded in 1955 and entered into force in 1958,[26] that is implemented through a surveillance commission composed of six members.[27] The Convention provides for the construction of hydraulic works for the

[26] Convention Between Italy and Switzerland on the Regulation of the Lugano Lake (17 September 1955). www.admin.ch/opc/it/classified-compilation/19550154/index.html

[27] *Ibid*., Art. VI. The Commission is composed of three members appointed by the Swiss Federal Council and three members appointed by the Italian Government (Para. 1). During the construction period, the Commission had the tasks of approving the regulation works that the Cantonal Council of Ticino submitted to it, of supervising the implementation of the works, of deciding, if necessary, any modification of the projects, of submitting to the two Governments periodic reports on the progress of the work, as well as on the compliance with the agreed-upon terms. Since the

regulation of the waters; such works had to be carried out by the Canton of Ticino soon after the adoption of the Convention[28] and are operational since 1963. The objectives of these works are to regulate the quantity of the outflows from Lake Lugano and reduce the probability of floods. Yet, already during the first years of their functioning, the positive impacts of the hydraulic works appeared to be limited, both in terms of management of the low levels of the lake and the regulation of floods. In particular, the events of 2002 have reawakened the interest of policy makers and the local population in revising the regulation of the outflows of the lake (Riva 2003).

Lake Maggiore is the second largest lake in Italy, after Lake Garda. It covers 212 km^2 and most of its surface lies in Italy (80%). However, the catchment area of the lake, amounting to about 6599 km^2, is shared in roughly equal parts between Italy (3229 km^2) and Switzerland (3370 km^2). The largest tributaries are the Ticino, the Maggia, the Toce and the only emissary is the Ticino, flowing from the lake to Sesto Calende.

The construction of the Miorina dyke during World War II by the Consortium of Ticino has allowed to regulate the waters of the lake.[29] In a concession issued in 1940 by Italy, the width of the adjustment range was set, within which the Consortium can freely decide the water flows.[30] The regulation of the levels of the lake had the positive impact of increasing the utilisations for agriculture and the industrial uses downstream.

9.4.2.1 The Regulation of the Level of Lake Maggiore

The level of Lake Maggiore has been at the centre of a bilateral dialogue between Switzerland and Italy since 1938. The first two meetings took place in 1941 in Bern and in 1943 in Basel. In the first meeting, the discussions concerned the relationships between the water levels at the various hydrometers and the heights of the hydrometric zeros, as well as the Swiss proposals regarding the flood reporting service. The state of implementation of the arrangement was also assessed and it

completion of the works, the Commission has the competence to examine and resolve any question concerning the regulation of the levels of the lake, the functioning of the dam, and the maintenance of the works. It supervises the execution of its decisions and submits to the approval of the two Governments the changes it deems useful to make to the regulation (Paras. 2 and 3).

[28] The hydraulic works for regulating the levels of the lake include: the correction of the strait of Lavena, the regulating barrier at the Rochetta and the correction of the Tresa between Ponte Tresa and Madonnone (Art. II of the 1955 Convention).

[29] The dyke started to function in 1942.

[30] During the summer period (16 March – 31 October), the limitations are between −0.5 m and +1 m in respect to the hydrometric zero calculated at Sesto Calende. During the winter time (1 November – 15 March), the limitations are between −0.5 m and +1.5 m in respect to the hydrometric zero calculated at Sesto Calende. Interview with Dr. Francesco Puma, General Secretary of the Authority of the Po River Basin District, 8 July 2019. See the Concession Specifications of 24 January 1940 and Royal Decree no. 3344 of 6 June 1940.

was decided to provide information on the regulation of the manoeuvre of the mobile crosspiece.[31]

In the second meeting of 1943, the examination concerned the relationships between limnometric heights in Brissago, Angera and Sesto Calende and the operation of the telegraphic flood signalling system, while other discussions dealt with the methods of transmitting reports on executed manoeuvres and daily outflows. The Italian delegation undertook the commitment to transmit the approved variant plans for the adjustment works and the exercise programme with the new flow curve.[32]

After World War II, on 21 October 1947, the Swiss and Italian delegations met to examine the request presented to the Italian Government by the Consortium of Ticino – a consortium between the Provinces of Milano, Novara and Pavia promoting the regulation of the levels of Lake Maggiore. The request sought to obtain the concession to increase the invasion limit of Lake Maggiore during the winter months from 1 m to 1.50 m, with reference to the Sesto Calende hydrometer. The Swiss delegation pointed out that it had no capacity to take the necessary decisions. The Italian delegation stated that if no objections were raised by the Swiss side it would have immediately proceeded to experiment the regulation proposed by the Consortium.[33]

On 17 February 1971, almost 24 years after the last meeting, an Italian-Swiss Commission for the regulation of Lake Maggiore met in Milan. The head of the Swiss delegation clarified that the Commission's mandate was very limited and that the objectives of the meeting solely concerned the problem of water economy, and excluded other issues such as navigability, fishing and pollution. The Italian representatives recalled the results of the previous meetings, in particular the acceptance by the Swiss side of the winter boost up to the quota of 1.50 m on the zero of the Sesto Calende hydrometer. They also evoked the new request of the Consortium to raise the level of withholding from +1 m to +1.50 m, with a linear trend from 1 m to 1.50 m from 1 June to 15 June and return to 1 m by 15 September. For experimental purposes, they proposed to immediately reach the height of 1.20 m. The Swiss representatives raised the issue of the failure to build the subsidiary channel for the rapid flare that appeared in the original project, which could have solved some water problems that had affected, in November 1968, the riparian communities of the Piano del Magadino and the water treatment plant of Locarno. As to the experimentation, the Swiss delegates affirmed that they could not give an answer without adequate prior studies. It was ultimately decided to set up a working group with the aim of proceeding to the necessary assessments for both sides to take an informed decision.[34]

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[31] See the proceedings of the meeting of 1941, available at www.adbpo.it/PAI/Attuazione_del_Piano/Piani_Laminazione/ANNESSI/Lago_Maggiore/Conferenza_Italo-svizzera_1938.pdf

[32] See, *ibid*., the proceedings of the meeting of 1943.

[33] See, *ibid*., the proceedings of the meeting of 1947.

[34] See, *ibid*., the proceedings of the meeting of 1971.

Fifteen years later, a new meeting was held in Bern on 12 March 1986, during which the existing problems were discussed, notably the increase in outflow capacity from the lake, and the need to identify other lines for regulating the lake and to realise a modern system of hydrological surveys. Both delegations identified the necessity, on the one hand, to conduct new studies, and on the other hand, to experimentally adopt a regulation line 20 cm lower than the reference meter from mid-June to late August and from beginning of September to the end of November.[35]

The subsequent meeting of the Commission was held in Parma in September 1988. It discussed the increases in outflow capacities, the verification of the lake regulation line and the verification of the state of implementation of remote sensing. The Commission decided to continue with the experimentation. It was also noted that some measurement stations and a data processing centre were built by the Ticino Consortium, and a project was approved for the installation of a network of rain gauges in the Italian part. The connection of the Italian network with the Swiss network was envisaged, together with the preparation of a general project.[36]

On 2 March 1995, after the disastrous flood of 1993, a meeting was held in Bellinzona between a Swiss delegation composed of seven members and an Italian one consisting of only three members. The studies undertaken were examined in order to identify the most useful interventions to reduce the damage caused by the floods of the lake. The Swiss presented a study aimed at increasing the outflow in Sesto Calende. The Italian delegation pointed out the need for a global solution to the problem that would take into account the possibility of rolling upstream, in hydroelectric basins, and the constraints present downstream, particularly in the city of Pavia.[37]

During the subsequent meetings of November 1995 in Golasecca, of May 1996 in Cadenazzo and of July 1997 in Mezzana-Balerna, the progress of the studies was presented, but the results did not appear to be completely satisfactory. Indeed, discussions revealed remaining complex problems and risks. These issues, the participants noted, could be better determined downstream by realising rolling hydroelectric reservoirs.[38]

In July 2014, the River Po Basin Authority approved the implementation of the regulation to increase the levels of the lake during summer.[39] Moreover, a binational

[35] See, *ibid.*, the proceedings of the meeting of 1986.

[36] See, *ibid.*, the proceedings of the meeting of 1988.

[37] See, *ibid.*, the proceedings of the meeting of 1995.

[38] See, *ibid.*, the proceedings of the meetings of 1995, 1996 and 1997.

[39] In particular, the levels of the regulation in the summer period from 1 m to 1.50 m in respect to the hydrometric zero of Sesto Calende were approved. Decision no. 1/2014 of the Institutional Committee of the Po River Basin Authority (22 July 2014). www.ticinoconsorzio.it/attachments/article/13/d%20Delibera%20Comit.%20Istituz.%20Po%20n%c3%82%c2%b0%201%20del%202014%20-%20Avvio%20sperimentazione%20regolazione%20estiva%20Lago%20Maggiore.pdf. The decision to increase the levels of the lake was renewed on 12 May 2015 for a five-year period (2015–2020). See Decree no. 96/2019 of the General Secretary of the Po River Basin Authority (6 May 2019). https://adbpo.gov.it/wp-content/uploads/2019/08/96_06.05.2019.pdf

Commission composed of Swiss and Italian members (*Commissione italo-svizzera* (or *italo-elvetica*) *per l'idrovia Adriatico-Lago Maggiore e la sistemazione del Lago Maggiore – Commission italo-suisse pour la navigation Adriatique-Lac Majeur et la régularisation du Lac Majeur*) was created to monitor the levels of the lake. To date, the Commission has held four meetings to discuss its mandate and tasks. Despite the continuing dialogue between Switzerland and Italy on the level of Lake Maggiore, the relationship remains strained. In particular, Switzerland considers the decision to increase the levels of the lake as unilateral and points out the risks to the ecosystem of the Bolle di Mogadino (Franciolli 2019).

9.4.2.2 The Commission for the Protection of Italo-Swiss Waters Against Pollution

During the 1940s and the 1950s, the Italian-Swiss Fisheries Commission (CISPP) started to study the issue of pollution of the two countries' transboundary waters. This new interest derived from the events that were affecting the lacustrine ecosystems in those years, such as the decrease and the deaths of fish in Lake Lugano and the increase in algal blooms in Lake Maggiore via the River Tresa. The first studies promoted by the CISPP highlighted that the chemical and biological characteristics of Lake of Lugano were going to progressively worsen with an accelerated evolution towards eutrophy. Thus, for the first time, CISPP found itself dealing with the new phenomenon of eutrophication, which from then on strongly influenced the history of the Maggiore and Lugano lakes. Between 1945 and 1965, pollution also affected watercourses. Indeed, massive industrial discharges gave rise to serious episodes of fish mortality and worsened the quality of the shared waters, that suffered from eutrophication.

In 1960, the CISPP established a first Italian-Swiss Commission for the Protection of the Waters, composed of experts from the two countries. The Commissioners, endowed with operational autonomy on the technical and scientific plan, had the task of drafting periodic information reports to the Commissioners for fisheries on the "health studies of the Ceresio and Verbano lakes and their tributaries, as well as on the assessment of the sources of pollution" (CIPAIS 2018).

Over the years, the membership of this new Commission increased with the involvement of other experts gathered in technical sub-commissions and working groups. This body recognised the need to address the topic of the quality of the waters in a more comprehensive and autonomous way. It underlined the need to put in place research programmes aimed at identifying the causes of pollution and formulating concrete proposals for the protection of common waters. In 1965, the Fisheries Commission, based on the experiences of similar treaties adopted for Lake Constance (27 October 1960), Lake Geneva (11 November 1962) and the River Rhine (29 April 1963), submitted a draft convention to the two States. This draft also included the proposal to create an international body endowed with adequate financial resources to promote in-depth research on common waters, and suggested a set of necessary measures to reduce and prevent existing and future pollution. In

1972, Italy and Switzerland signed the Convention for the Protection of the Italo-Swiss Waters against Pollution, which entered into force the subsequent year.

This instrument covers the surface and groundwaters of the Lugano and Maggiore lakes as well as the rivers crossing the borders between Italy and Switzerland, notably the Doveria, Melezza, Giona, Tresa, Breggia, Mera, Poschiavino and Spöl rivers. The scope of application also includes the tributaries, which may contribute to the pollution of the common waters (Article 1).

As noted above, the 1972 Convention established a Commission (CIPAIS) which includes representatives of the respective central administrations, as well as of the Regions of Lombardy and Piedmont and of the Cantons of Ticino, Valais and Grisons.[40] The tasks of the Commission are: to examine any problem inherent to the pollution or any other alteration of the Italo-Swiss waters; to organise and carry out any necessary research to determine the origin, nature and importance of pollution, and assess the data obtained; to prepare an annual financial plan for this research work, to be submitted to the two Governments for approval; to propose to the contracting Governments the necessary measures to prevent and reduce existing pollution; and to propose to the contracting governments a draft regulation to ensure the quality of the Italo-Swiss waters (Article 3).

In 2018, the CIPAIS adopted a second Action Plan, covering the years from 2019 to 2027 (CIPAIS 2018). A specific tool called “Control Panel”, consisting of a set of environmental indicators, monitors the quality of the waters of the Lakes Maggiore and Lugano and their main tributaries. The Control Panel has permitted to adopt an integrated operational strategy to verify the achievement of the Action Plan’s objectives. The Control Panel is also conceived as a dissemination instrument used by CIPAIS to circulate information on the status of water bodies (CIPAIS 2018).

It should be noted that the 1972 Convention does not expressly cover the Adige/Etsch river basin.[41] However, the documents of the Commission refer to it. The cooperation focuses on the restoration of the natural state and functioning of the river. As pointed out, the cooperation on the Lugano and Maggiore lakes focuses on the control, prevention and reduction of pollution. The development of a set of common indicators by the two countries may be a useful tool to monitor the quality of the waters of these two water bodies.

[40] The Commission also includes a Sub-Commission which carries out studies on specific technical and scientific issues. This body also proposes updates to the Action Plan and formulates proposals and recommendations to the Commission to ensure an efficient protection of the shared waters. Finally, the Commission also includes a Secretariat entrusted with administrative and financial tasks (Art. 4(3)).

[41] Only 1% (approximately 186 km^2) of the catchment of the Adige/Etsch is in Switzerland, the remaining 99% of the catchment lying in Italy.

9.4.3 *The Permanent Italian-Slovenian Commission for Water Management*

The 138-km-long River Isonzo/Soča is situated in the Adriatic River Basin District in Slovenia and in the Eastern Alps District in Italy, and flows through western Slovenia and north-eastern Italy. It has its source in the Upper Trenta Valley in Slovenia and it discharges into the Panzano Gulf in the North Adriatic Sea near Monfalcone/Tržič in Italy. The basin area is characterised by the presence of groundwater bodies related to different transboundary aquifers (UNECE 2011, p. 262). The total area of the shared catchment is about 3400 km^2, of which about 1150 km^2 are in Italy and 2340 km^2 in Slovenia (European Commission 2019, p. 295).

The Osimo Agreement on the Development of Economic Cooperation concluded between Italy and the former Yugoslavia in 1975 established a Permanent Italian-Slovenian Commission for Water Management to study water problems of common interest and to propose appropriate solutions. The Commission should ensure the improvement of water and electricity supplies (Article 2).

Slovenia and Italy attach particular importance to regulating the waters of the Isonzo/Soča, Judrio/Idrija and Timavo/Timav river basins and utilising them for the production of hydroelectric power, for irrigation and for other public purposes. To that end, the two Governments agreed on the joint construction and utilisation of power generation facilities. Of particular interest in this context is the construction near Salcano of a dam on the Isonzo/Soča and of a hydroelectric plant. The purpose of the dam is the regulation of the flow and the irrigation of the land situated in the Italian territory south of Gorizia (Article 3). However, the compensation reservoir near Gorizia, part of the technical installation and to be used as source of water in case of dry periods, has not been built yet.[42] This may have transboundary impacts on the availability of water in Italy.

Water from the Isonzo/Soča is withdrawn for hydroelectric, industrial and agricultural uses, creating pressure in particular during the drought period. In both countries, there are dams along the river that can create pressure on natural river discharges. The Solkan/Salcano and Kanal/Canale dams are situated in Slovenia, and the Crosis dam in Italy.[43] While one of the main purposes of the dams situated in Slovenia is the production of hydropower, their reservoirs have an impact on the downstream discharge, in particular on the agricultural uses in the Italian part of the basin.

The Permanent Italian-Slovenian Commission for Water Management entrusted an expert group with the task of preparing a road map for the implementation of the first Italian-Slovenian Isonzo/Soča Common Management Plan. A wide monitoring network has been set up in order to define the quality and quantity of water bodies in accordance with the WFD and Directive no. 2007/60/EC (Flood Directive) since

[42] Interview with Dr. Aleš Bizjak, Slovenian Water Agency, 8 July 2019.

[43] This dam is situated on a tributary of the river Isonzo/Soča: interview with Dr. Aleš Bizjak, Slovenian Water Agency, 8 July 2019.

2015. In that year, a meeting of experts under the Commission concluded that the Parties "agreed a programme of actions to be systematically implemented in 2016 and beyond to coordinate the technical details of implementation of the plans in the shared international river basins" (European Commission 2019, p. 297).

9.5 Conclusion

The 1972 Convention between Italy and Switzerland and the 1975 Convention between Italy and Slovenia offer good examples of cooperation between riparian countries. The establishment of joint bodies has helped address environmental challenges such as the impacts of climate change. For example, the CIPAIS has pointed out the need to collect data for a better understanding of extreme events such as droughts and floods. The scientific studies carried out by the Commission have allowed to conduct ecological assessments on the Maggiore and Lugano lakes and determine future trends in the quality of waters. Moreover, these studies also represent a reference to put into place river rehabilitation and restoration measures.

In the case of the cooperation between Slovenia and Italy, projects of water management have been financed under the EU European Territorial Cooperation programme (better known as INTERREG),[44] which includes the Vipava/Vipacco and Other Transboundary River Basin Flood Risk Management (VISFRIM)[45] and the Green Infrastructures for the Conservation and Improvement of the Condition of Habitats and Protected Species Along the Rivers (GREVISLIN)[46] projects, aiming at decreasing the flood risk and developing green infrastructure (including natural retention areas, green corridors and fish ladders) in the Isonzo/Soča river basin (European Commission 2019, p. 297). Data sharing and joint monitoring activities are also planned in order to strengthen the technical capacity to address common water issues between Italy and Slovenia.

It should be noted that as a non-EU member, Switzerland is not bound to implement the WFD. However, the Swiss legal system sets comparable targets regarding water protection and management (European Environment Agency 2018, p. 16). In contrast to the WFD, which is based on planned periods with precise deadlines, the Swiss legislation formulates binding requirements including a set of

[44] The objective of the INTERREG V-A Italy-Slovenia programme is to promote sustainability and cross-border governance. It includes the development of environment-friendly technologies for the improvement of water management. Further information on the programme is available at www.keep.eu/programme/2014-2020-interreg-v-a-italy-slovenia

[45] The VISFRIM project aims to manage risk in transboundary basins by developing methodologies and technological tools for the implementation by 2021 of existing flood risk management plans as required by the EU Floods Directive. The website of the project is available at www.ita-slo.eu/en/visfrim.

[46] The objective of this project is the strengthening of integrated ecosystem management for sustainable development in cross-border areas. The website of the project is available at www.ita-slo.eu/en/grevislin.

national limits which must be met at all times. As a member of the CIPAIS, Switzerland collaborates with Italy to achieve water protection goals and to implement WFD objectives. Therefore, Switzerland could benefit from referencing to EU directives when establishing water policies, especially as it would help manage transboundary water bodies according to a river basin approach, overcoming political and administrative boundaries.

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Chapter 10
The Italian Virtual Water Trade and Water Footprint of Agricultural Production: Trends and Perspectives

Stefania Tamea, Marta Antonelli, and Elena Vallino

Abstract The purpose of this chapter is to contribute to the knowledge about the water-food-trade nexus in Italy by introducing the concepts of water footprint and virtual water trade. Virtual water is the water "embedded" in the production of agricultural and industrial goods and services, whereas virtual water trade refers to the exchange of such embedded water that takes place as a result of the international commodity trade. The chapter aims at outlining the Country's green and blue water footprint of agricultural production, as well as providing a comprehensive overview of virtual water trade embedded in the agricultural commodity trade, over the period 1985–2016. The quantitative analyses are complemented by a policy-relevant discussion detailing the practical causes and implications of the results.

Keywords Virtual water · Water footprint · Agricultural production · Food trade · Water-food-trade nexus

10.1 Introduction

Challenges and issues related to the water-food-trade nexus can be well described by taking the perspective of water footprint and virtual water trade. The two concepts are closely interrelated, being rooted in the key role of water as a primary input for agricultural production. Virtual water (VW) is the water used for the production of agricultural and industrial goods and embedded as a factor of production

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when goods are traded (Allan 1993). Accordingly, VW trade refers to the exchange of embedded water that takes place as a result of the international commodity trade. The concept was introduced to explain how water-scarce countries could survive through food imports, without depending on scarce local water resources but importing water embedded in agricultural products (Allan 1993, 2001). Water-scarce countries thus rely on VW trade as an adaptation strategy to overcome the local limits to population and wealth growth (Distefano and Kelly 2017), while enabling a global water saving when food is imported from water-use efficient countries (Hoekstra and Chapagain 2008). VW trade may help explain the absence of wars explicitly related to water in water-scarce regions, such as the Middle East and North Africa (Allan 2001, 2003), although the public discourse on water security and policy in these countries has been downplayed (Antonelli and Allan 2019). However, VW trade implies a dependency of countries on foreign resources, a corresponding vulnerability to external crises, as well as an externalisation of pollution, costs and water-management problems. An extensive review of details and impacts of the global VW trade can be found in D'Odorico et al. (2019).

The concept of VW has been complemented by that of water footprint (WF), defined as an indicator of direct and indirect use of freshwater resources (Hoekstra et al. 2011). The WF may be referred to the production of agricultural and industrial goods and services or to their consumption by individuals or countries. When referred to a country's consumption, a WF assessment also includes the imported and exported goods of the nation and, thus, the corresponding VW trade (Hoekstra and Chapagain 2008). The WF has three components: green water (rainfall), blue water (from surface- and ground-water bodies) and grey (freshwater required to assimilate loads of pollutants discharged into a receiving body based on existing water quality standards) (Hoekstra and Mekonnen 2012). Studies have shown that agricultural goods contribute with an overwhelming 92% to the WF of humanity and that many countries have externalised their WFs by relying on trade (e.g. Hoekstra and Mekonnen 2012). The concept proved to be useful to raise public awareness on the role of water in the production of goods of daily use, to shed light on the environmental consequences of consumers' choices, and to highlight the role of different dietary regimes in shaping our impacts on water resources. For example, it has been proved that meat products are relatively water-intensive if compared to crops (Hoekstra 2015). An abandonment of the Mediterranean diet – which is widely recognised as a healthy and sustainable dietary pattern – may thus have an environmental impact, while a shift towards a healthier diet with reduced meat content can limit the WF of current European diets (Vanham et al. 2018). Therefore, an increasing awareness and appropriate actions can have the potential to reduce WFs, at the same time pursuing nutrition- and sustainability-related goals.

The VW fluxes associated to the international trade of agricultural goods have been assessed at various scales and with different approaches since the early 2000s (e.g. Hoekstra and Hung 2005; Dalin et al. 2012; Tamea et al. 2013), as extensively detailed in a recent review by D'Odorico et al. (2019). From 1986 to 2007, the number of trade connections and the total volume of water associated to global food trade more than doubled. The Asian region increased its VW imports by more than

170%, especially from North America and South America. At the same time, North America shifted to an increasing intra-regional trade (Dalin et al. 2012). Over the same period, the Middle East increased dramatically VW imports, while the Central African region and China shifted from being VW exporters to net importers (D'Odorico et al. 2019). Domestic political economy changes in the agricultural sector affect global VW trade and have environmental consequences. For example, increased soy imports in China, due to a domestic policy shift in the 2000s, translated into an increased Chinese VW import and a water saving process in the global soy market. However, it is also associated to an augmented soy production in Brazil with probable negative effects on deforestation (Dalin et al. 2012). Global VW fluxes are dominated by cereal grains, followed by soybeans, vegetable oils and luxury goods such as coffee and chocolate. Many developing countries are net exporters of VW related to luxury goods, but they are net importers as far as food crops are concerned (D'Odorico et al. 2019).

The diffusion of both VW trade and WF assessments for agricultural products has been facilitated by an open-access database of WFs provided by the Water Footprint Network (Mekonnen and Hoekstra 2010a, b). The database includes sub-national and national scale values of WFs of single crops and agricultural products, averaged over the period 1996–2005. Data are based on a global-scale model of crop growth coupled to hydro-climatic variables (rainfall, temperature) through a soil water balance, and values for derived products are obtained from their supply chains. Recently, significant progresses have been made in WF and VW trade assessment. For example, Tuninetti et al. (2017) validated a simplified approach to account for the temporal variability of WF of crops, showing the role of the yield increase as the leading factor of the interannual WF changes. Regarding the spatial dimension, trade data are usually aggregated at the country scale, e.g. in United Nations or Food and Agriculture Organisation data (FAO 2018) or in input-output tables (Arto et al. 2016). Commodity flow analyses at sub-national level have been used in studying the VW trade for the United States of America and few other countries (D'Odorico et al. 2019 and references therein), although scarcity of small-scale (sub-national) trade data is a major limiting factor for the application of the advances in WF estimation to VW trade analysis (Hoekstra 2017). VW trade studies are attempting to introduce the watershed unit as a base dimension of assessment, beside the common country or regional levels of analysis. The attempt is motivated by the purpose of developing policies informed by high-quality data linked to the local context of agricultural production, accounting for the heterogeneity of climatic and geographical conditions within countries (Vanham 2013; D'Odorico et al. 2019). These spatially and temporally refining efforts make the evaluation of the links between water scarcity, water resources sustainability, and complex supply chains even more opportune.

The VW trade has also been studied through the lens of economics (e.g. Duarte et al. 2016; Reimer 2012; Fracasso 2014). It has been highlighted that analyses of VW trade have the advantage of providing new significant information with respect to traditional price-based analysis of food trade. Indeed, global food prices are only weakly correlated with physical commodity flows and VW flows (Distefano et al.

2018). Scholars have analysed VW trade by applying both network analysis techniques and gravity models, focusing in particular on its determinants (e.g. Fracasso et al. 2016). Interesting applications of the VW trade concept are also in the field of food crisis propagation and country vulnerability (Tamea et al. 2016; Sartori and Schiavo 2015).

Within the literature, the VW trade of Italy has been analysed with reference to both global and bilateral trade (Tamea et al. 2013; Winter et al. 2014; Miglietta and Morrone 2018 on wine; Lamastra et al. 2017 on olives) utilising, among other tools, also the input-output tables approach (Ali et al. 2018). Italy is placed among the largest importers of VW worldwide. Only 1% to 3% of the world population exhibits its per-capita net import higher than Italy. Moreover, the dependence on imports has increased over the last years and it has overcome the reliance on internal production (Tamea et al. 2013). With respect to the rest of the world, Italian VW import and export have grown by 82% and by 208%, respectively, from 1986 to 2010. This growth rate is coherent with the general behaviour of the global network, and trade fluxes are shown to connect Italy to almost all countries in the world. In particular, Italy trades VW to/from distant countries, with a mean travelled distance per cubic meter estimated to be about 3800 km for imported products and 2500 km for exported ones – with distances which have increased significantly in the last decades (Tamea et al. 2013). The water footprint of production and consumption in Italy has been assessed at the national level (Hoekstra 2015; Antonelli and Greco 2014), applied to specific sectors (Nicolucci et al. 2011), crops and products (e.g. Bocchiola 2015; Bocchiola et al. 2013; Amicarelli et al. 2011), as well as companies (Ruini et al. 2013). At the level of intra-EU agricultural trade, Italy has also emerged as one of the largest VW importers over the period 1993–2011, and one of the major blue VW exporters in the region, despite being close to water stress thresholds (Antonelli et al. 2017).

Within this context, this chapter provides a state-of-the-art assessment of Italy's WF of agricultural production and engagement in VW trade, explicitly taking into account the temporal variability of the WF of agricultural goods. The chapter closes with some considerations about the importance of these indexes for policy and management.

10.2 Data and Method

The quantification of the WF and VW trade is based on two main data sources: FAOSTAT, i.e. the Food and Agriculture Organisation database (FAO 2018), and WaterStat, i.e. the Water Footprint Network database (Mekonnen and Hoekstra 2010a, b). FAOSTAT is the source of bilateral trade data of agricultural goods from 1986 to 2016, of export data from 1961 to 2016, as well as data about production and yield from 1961 to 2013. Countries considered in the present analysis include all countries active for at least one year in the considered period, for a total of 255 countries. Goods considered in the present analysis include primary crops, processed crops (such as juices or bread), livestock primary goods (e.g. meat and milk), and livestock processed goods (e.g. cheese), with data for 345 traded or produced goods. Goods are aggregated into categories, namely cereals, fruits (including olives), vegetables, seeds and oils, animal meat, dairy products and eggs, luxury foods such as sugar and coffee, and non-edible products (such as fibres and tobacco).

The quantification of the WF for each good is obtained by multiplying the quantity, X, of the produced or traded good (FAO 2018) by the WF per unit weight of the good, or unit WF (uWF), in the country and year of production, i.e.

$$WF = X \cdot uWF. \tag{10.1}$$

For crops, the unit WF is defined as the ratio between the water used by the crop during the growing season and lost through actual evapotranspiration (ET in mm), and the crop yield, Y (in ton/ha), i.e.

$$uWF = 10 \cdot ET / Y, \tag{10.2}$$

where the factor 10 converts the units of uWF into m^3/ton. The unit WF thus expresses an inverse measure of efficiency, because the lower is the value, the more efficient is the use of water resources in the crop production. The water evapotranspired may be originated from rainfall, in which case it is called green water, or from irrigation, in which case it is called blue water. Blue water may also include additional volumes used in the processing phase of the good and usually withdrawn from surface water or groundwater bodies (for methodological details, see Hoekstra et al. 2011). In the present analysis, only the consumptive WF is considered, thus blue and green WF, but not grey water.

Previous studies about the WF and VW trade of Italy (e.g. Tamea et al. 2013; Antonelli and Greco 2014) were based on the use of a constant uWF provided by the WaterStat database (Mekonnen and Hoekstra 2010a, b), which reports green and blue unit WF of a large number of goods, per country of production, averaged over the period 1996–2005 (uWF_0). However, the unit WF of crops changes over time due to climatic and anthropic factors, including mechanisation, fertilisation, irrigation, and technical advancements. In order to account for the temporal variability, the method proposed by Tuninetti et al. (2017) is adopted in the present analysis, which computes the total (green plus blue) uWF in a generic year, t, as

$$uWF(t) = uWF_0 \cdot \left(Y_{96-05} / Y_t\right) \tag{10.3}$$

where uWF_0 is the (green plus blue) value reported in WaterStat, Y_{96-05} is the average crop yield in the period 1996–2005, and Y_t is the crop yield in year t. This method does not account explicitly for climate-driven oscillations of actual evapotranspiration, but reproduces well the statistically significant trends introduced by anthropic factors (Tuninetti et al. 2017).

The role of the temporal variability of the unit WF is expressed in Fig. 10.1, showing the unit WF of some crops in Italy from 1961 to 2016. The crops are chosen for having the largest production (in terms of weight) and the largest economic value of production in Italy in the most recent years. The marked decreasing trend is evident in all crops: it dominates over the interannual fluctuations and is statistically significant at the 5% level. Olive production, shown only in the figure inset, is characterised by large biennial fluctuations in the unit WF, motivated by the yield fluctuations reported in FAO (2018) and likely caused by the biological cycle of olive plants which alternates rich and poor production years (a phenomenon named alternate – or biennial – bearing). The recent increase in the unit WF of olives is motivated by the reduction of yield as olive production is threatened by climate change and pests (e.g. *Xylella fastidiosa*). It is worth noticing that, when green and blue water are considered together (as in Fig. 10.1), the unit WF of rice is comparable to other cereals and even lower than wheat, whereas when separating the two components, the blue water required for rice overtops the other crops.

For processed crops, the production can use local or imported primary goods. For this reason, the unit WF is taken as a weighted average of the unit WF in Italy and in countries from which primary crops are imported, using production and import quantities as weights. As opposed to crops, the unit WF of goods with animal origin is currently kept constant in time and equal to the WaterStat value, for the lack of sufficient data allowing to quantify its temporal variability. Details about the computation of WF data can be found in Tamea et al. (2021). The blue unit WF variable in time is computed through Eq. (10.3), substituting for uWF_0 the blue unit WF

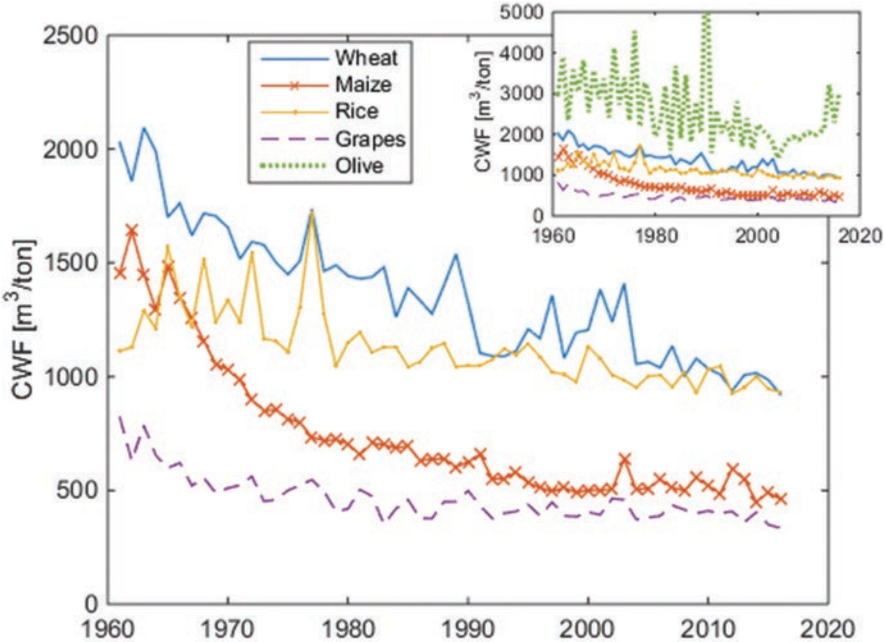

Fig. 10.1 Unit water footprint (green plus blue water) of major agricultural products in Italy, from 1961 to 2016 (in m^3/ton)

from WaterStat, implicitly assuming a constant-in-time ratio of blue-to-total unit WF.

The total WF of Italy's production is obtained by summing the WF (from Eq. 10.1) of all goods produced in the Country. Processed goods, having crop or animal origin, are not considered in the sum in order to avoid the double counting of water volumes required to produce primary and derived goods. Goods used both as food and feed for animals, that in turn produce goods which are further included in the sum, would be subject to double counting of water volumes. For this reason, the fraction of goods being used as feed is omitted from the sum, by multiplying their WF by a factor $(1-f)$, where f is the ratio between feed and total supply of each good, obtained from the Food Balance Sheet of Italy (FAO 2018).

As explained, the VW trade is the WF of agricultural goods that are traded internationally. Quantification of the VW flows is based on Eq. (10.1), where X identifies the quantity of a good traded between two countries in a given year. Bilateral trade data from FAO (2018) are arranged in trade matrices connecting exporting and importing countries, per each good and year in the period 1986–2016. The associated WF is computed by multiplying each flow by the good's unit WF, considering the country of origin of the trade flow as the producing country. Similarly, VW exports are also computed from export data available from FAO (2018) for the period 1961–2016 (for details, Tamea et al. 2021).

10.3 Trends in the Water Footprint of Agricultural Production in Italy

Italy is a country with spatially heterogeneous water endowment.[1] The average annual volume of precipitations is 241 km^3, corresponding to an average precipitation depth of 800 mm, but the spatial distribution has a marked gradient from North to South, with regions receiving from 505 to 1145 mm per year (ISTAT 2015). The water returning to the atmosphere through actual evapotranspiration (evaporation from soil and open water plus transpiration from plants) has been estimated to have an average annual volume of 156 km^3 (ISTAT 2015), lost from cultivated, non-cultivated and non-vegetated areas.

Regarding general considerations on the evolution of the agricultural sector in Italy, we notice that cultivated areas (or cropland) represent about 30% of the Country's surface. Such area has been decreasing markedly over time, from 124,000 km^2 in 1971 to 90,000 km^2 in 2016 (FAO 2018). The temporal evolution of cropland area is depicted in Fig. 10.2, together with other variables, expressed as a relative change with respect to the base year 2005. It appears that cropland area has

[1] A detailed description of Italy's water resources is provided by Benedini and Rossi in Chap. 1 of this volume.

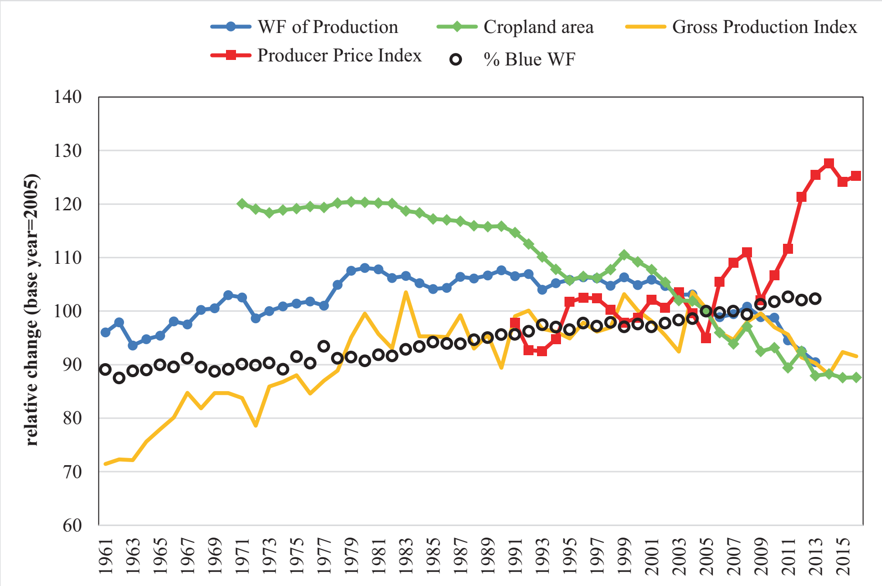

Fig. 10.2 Evolution of variables related to the agricultural production in Italy, from 1961 to 2016, normalised by the value in 2005

evolved differently from, for example, the Gross Production Index,[2] which quantifies the overall agricultural production of Italy. In the 1970s, the cropland area remained constant while the production increased, indicating a strong improvement in agricultural yields. Then, up to the mid-1990s, the area decreased significantly, while the production fluctuated around a plateau, suggesting a reduction of low-efficiency areas which did not compromise the overall production. In the last two decades both area and production, as well as water use, decreased, reflecting the declining share of the agricultural sector as relative contribution to the total Gross Domestic Product. However, the fact that the production decreased less than the cropland suggests an overall increase in agricultural productivity that occurred in the same period (Romano 2012).

The decrease in production quantity has occurred simultaneously with the increase of producer prices, with a mirror dynamic of the two indices. The Italian agricultural Producer Price Index[3] reflects the general dynamics of the whole economy, as it falls during recessive phases and it increases during expansionary periods.

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[2] The Gross Production Index is obtained with production quantities of each commodity weighted by 2004–2006 average international commodity prices in International Dollars and summed for each year. To obtain the index, the aggregate for a given year is divided by the average aggregate for the base period 2004–2006 (FAO 2018).

[3] The Producer Price Index measures the average annual change over time in the selling prices received by farmers (prices at the farm-gate or at the first point of sale). The indices are constructed using the Laspeyres formula with price data in Standardised Local Currency (FAO 2018).

Moreover, it follows also agricultural price trends worldwide, as it is observable in fluctuations around 2008 and 2010 (Romano 2012). In particular, the last change may be related to the peak in cereal prices that occurred in 2010–2012 on the international markets.[4] Although this chapter focuses on the water embedded in the quantities of food produced and traded, considering the price trends of the agricultural sector is useful since prices provide crucial incentives for production and commercial decisions on food quantities and consequently on the volumes of VW utilised. Moreover, statistics on agricultural production are usually expressed in monetary terms, and it is informative to observe differences with respect to the trends of more environmentally-oriented variables, such as virtual water (Distefano et al. 2018). Finally, given the increasing globalisation over time, prices are the channels through which shocks propagate to the domestic agricultural market, and represent the variables that encounter early changes, due to rigidities in changes in produced quantities (Romano 2012).

Figures on the WF of crops provide a more environmentally-oriented information on agricultural dynamics. They are therefore useful to complement the data derived from the variables that are more commonly used in the evaluation of agricultural performance, which are quantities and prices. The WF of agricultural production in Italy, accounting for all primary goods and explicitly avoiding double counting of food and feed, has an annual average volume of about 75 km^3 (considering green plus blue water). The temporal dynamics of the WF of production, indexed at year 2005, is also shown in Fig. 10.2 and compared to the other variables. The comparison with the Gross Production Index reveals that in the 1970s the WF of agriculture in Italy was similar to 2005, but production was much smaller, indicating a lower efficiency in the use of water because larger (green and blue) water volumes were necessary for the same agricultural production. This confirms the trends observed in Fig. 10.1 for the unit WF of single crops, and extends to the whole agricultural production our previous consideration about an improved efficiency. In most recent years, the overall WF has been decreasing partly thanks to the decreasing unit WF (corresponding to an increased efficiency), but also because of a decrease in production quantities and cropland area. In contrast, the ratio of blue-to-total WF of agricultural production of Italy has been increasing constantly over time, indicating a growing relevance of irrigated crops in the Italian agriculture. Of the total cultivated area in Italy, more than 20% is irrigated, with a percentage that is among the largest in Europe. In irrigated areas, the evapotranspiration of crops is contributed by both precipitation and irrigation, and the blue WF is mostly originated in these areas. Blue water is provided by withdrawals from streams, lakes and groundwater. The annual volume of freshwater withdrawn for irrigation in Italy equals 16 km^3, whereas the total annual freshwater withdrawals for agricultural, industrial and municipal uses amount to 34.2 km^3 (FAO 2016).

[4] The 2010–2012 peak in food prices was due to diverse factors. An increase in oil prices led to increased production of corn for ethanol. Rise in global population jointly with changes in dietary habits increased the cultivation of corn for animal feed. The consequent decrease in supply of cereals for human consumption led to a peak in its prices (Coulibaly 2013).

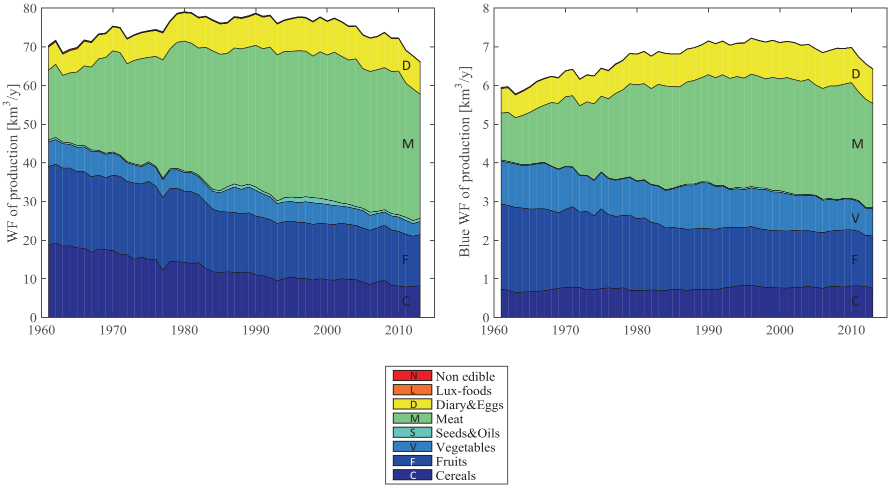

Fig. 10.3 Temporal variability of water footprint of agricultural production in Italy, per category, from 1961 to 2016, in terms of total (left) and blue water (right) in km^3/year

The WF of agricultural production in Italy is detailed in Fig. 10.3, where total and blue water volumes are shown (left and right panels, respectively) for different categories of goods. Only primary products are included in the sum, in order to avoid double counting of water volumes; thus, for example, olive oil is not included, but olives are included in the "fruit" category. Currently, the largest total WF is generated by the production of meat, followed by fruits, cereals, diary and eggs, and vegetables. The most dynamic category is "meat", whose WF (total and blue) has grown significantly in the first three decades, then became more constant to finally shrink in the most recent years. Since in this category the unit WFs are kept constant in time, the temporal dynamics of WF mirrors the production quantities without reflecting efficiency variations. With respect to the past, cereal production shows a decreasing trend in WF, justified by the decrease in the cereal-cultivated area, which has halved during the studied period (FAO 2018). This can be made explicit considering that in computing the WF of production of a crop, the produced quantity (X in Eq. (10.1)) can be obtained from the crop yield and the harvested area, A (in ha). In such case, Eq. (10.1) becomes

$$WF = (Y \cdot \mathrm{A}) \cdot (10 \cdot ET / Y) = 10 \cdot \mathrm{A} \cdot ET \tag{10.4}$$

and the WF equals the volume of water, computed from the actual evapotranspiration depth (ET in mm) and the harvested area. Since in our approach the temporal variability of ET is neglected, WF reflects the temporal variability of harvested areas, or the changing composition of agricultural production, when the WF of different goods are summed.

The blue WF of overall agricultural production (marked by the upper line in the sequence of categories in Fig. 10.3) increased significantly from 1960 to 1990, then remained more constant and finally decreased in the last years. With respect to total (green plus blue) WF, the volumes increased for a longer time and more markedly in the first three decades. The share of categories in the blue WF is similar to that of total WF, even though goods with greater associated volumes are different between total and blue WF. The increase of blue WF over time is ascribable again to meat, while other categories behave differently. For example, the "cereals" category, which for the blue WF is dominated by rice, has a constant WF because the rice-cultivated area has not varied much. On the contrary, fruits have decreased their blue WF to a greater extent than the reduction of total WF.

10.4 The Virtual Water Trade of Italy

The agricultural production of Italy (and the associated use of water resources) is connected with the rest of the globe by international trade, because part of the local production is exported to other countries. Moreover, a relevant share of agricultural goods is imported from abroad, connecting Italy to external water resources and motivating the so-called water-food-trade nexus. According to the present analysis, Italy exported 24 km^3 of (green and blue) VW in 2013, which represents the 36% of the WF of agricultural production (66 km^3 in the same year). The enlargement of foreign demand has played a central role in the increase in the Italian export of agricultural products. The export from Italy toward extra-European countries doubled in the last ten years, while the one toward EU-28 increased by 70% (ITA 2017).

Figure 10.4 presents a description of Italian exports of agricultural goods by an economic and VW perspective, comparing variables indexed at year 2005. As explained in the previous section, it is useful to insert value trends in the overall description, because of its complementarity with the other metrics. In Fig. 10.4 it is possible to observe that export steadily increased from the 1960s to 2016. The Export Quantity Index, the Export Value Index[5] and the total VW associated to crop export show a constant positive trend. However, the price trend followed the other two metrics only until the late 1990s, whereas afterwards we observe a decoupling of the metrics evolution. The Export Value Index slightly decreased from 1997 to 2002, while the quantities exported were increasing. It later experienced a strong peak, with a growth rate of about 20 points per year, overcoming sharply the growth of the Quantity Index and the related VW content. This constant increase fully reflects the global trend of food prices. However, while the Italian agricultural export prices peak of 2008 coincides with the worldwide figure, the second peak that is globally registered around 2011 reached Italy only in 2014 (Bellmann and Hepburn 2017). According to ITA (2017), the export value of the Italian agro-food

[5] The Export Quantity and Export Value Indices represent the changes in the price-weighted sum of quantities and of values of agricultural products traded between countries. The weights are the unit value averages of 2004–2006. These indices are calculated using a Laspeyres-type formula with price data in International Dollars (FAO 2018).

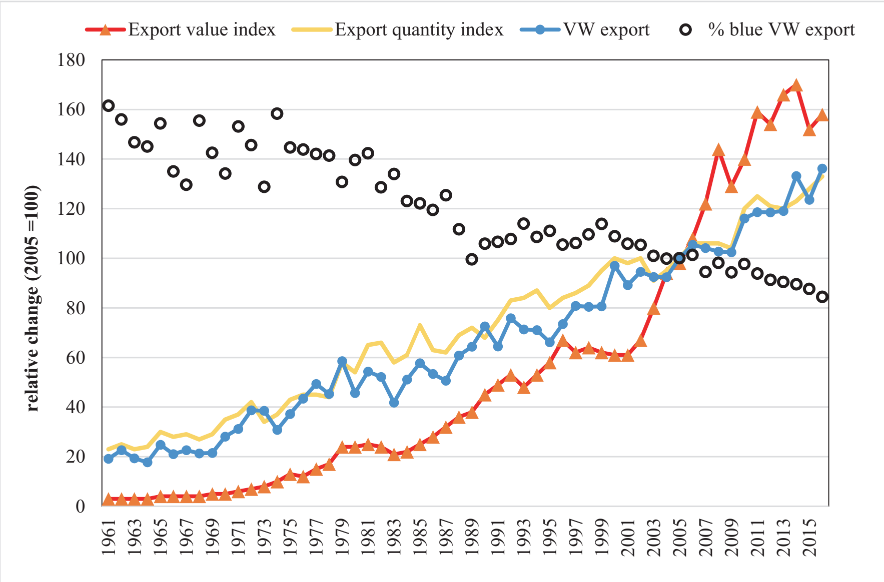

Fig. 10.4 Evolution of variables related to the export of agricultural goods from Italy, from 1961 to 2016, normalised by the value in 2005

sector increased by 79% in the decade 2006–2016, as compared to the 47% of the total Italian exports. With reference to Fig. 10.4, this sharp increase seems to have been driven more by the increase in the agricultural prices than by the increase in quantity.

The trends relating to VW and quantity are very similar, with the exception of some selected periods: the 1980s and the 1990s. In such periods, the composition of export could have changed, with the share of water-intensive goods (such as meat, dairy and luxury food) growing at an irregular pace within the export basket, as it can be observed in Fig. 10.5 (left). A correspondingly variable Export Value Index confirms that in early 1980s and early 1990s the value dropped, to recover again in few years. Another possible explanation of the quantity/VW gap of the early 1990s could be related to an increase in production efficiency, reflected in a lower amount of water used per ton. The blue VW export of Italy, as well as its total VW export, increased significantly over time and almost doubled from 1986 to 2016. However, as opposed to what happened to the WF of production, the share of blue water over total VW export constantly decreased over time (Fig. 10.4), first with fluctuations, then more regularly, with a period of relative stability during the 1990s. The product associated to the greatest blue VW export is rice, with an average blue VW export of 1 km^3/year, which has been roughly constant over time. The increase of blue VW export is due to the increase for all other categories, which amounted to 0.4 km^3 in 1986 and went up to a maximum of 1.5 km^3 in 2016. Such rate of increase is small with respect to the increase of green VW export, thus leading to a decreasing share of blue-to-total VW export. A role is also played by the improving agricultural techniques and a more efficient use of blue water (decreasing blue unit WF), which limited the inflating effect of export increase on the draining of Italy's water resources.

Figure 10.5 shows that the total amount of agricultural VW imports, from 1985 to 2015, is higher than the exports. However, in the last decade VW exports increased more than imports, and with less fluctuations. This figure reflects the findings of ISMEA (2018), that noted that the trade balance of the Italian agro-food sector is in structural deficit, but also that this deficit recently decreased thank to an increase in the export value more robust (+18% from 2013 to 2017) than the increase in the import value (+14% in the same period). With respect to the partition of exports among product categories, we observe a larger role of luxury crops, seeds and oils, meat, dairy products and eggs (listed in order of magnitude of the share increase). The shares of cereals, fruit and vegetables did not increase in the same period. Overall, we observe that while in 1985 the highest percentage of VW export was related to cereals, in 2015 it was dominated by the role of luxury foods and of seeds and oils. VW imports have followed similar trends than exports, but with a stronger presence of vegetables and non-edible products.

It is interesting that, from a VW perspective, although overall volumes of water imports overcome exports, the weights of categories in both fluxes are similar. This seems to suggest that Italy's food trade, especially the import, is not driven by the impossibility of producing goods locally due to domestic water deficits that must be rebalanced through foreign water resources, such as in the case of the Middle East and North Africa region (Antonelli and Tamea 2015; Antonelli and Allan 2019). This is not surprising, because water is not a major determinant of trade patterns (Reimer 2012) as it generally accounts for a share of production costs which is very

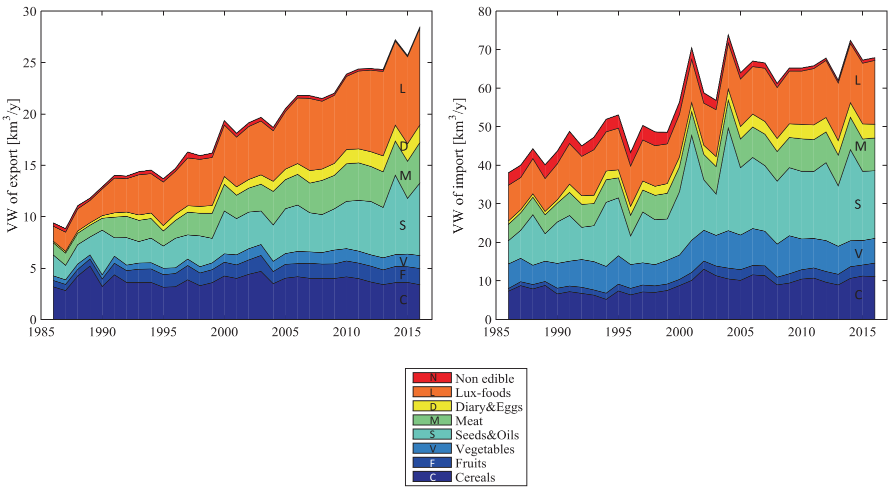

Fig. 10.5 Temporal variability of VW trade (total: green plus blue water) of Italy, per category, from 1986 to 2016: export (left) and import (right) in km^3/year

small or often close to zero. Patterns of trade are therefore driven largely by which country can be the low-cost producer to a given destination. For agricultural products, this is greatly affected by distance (freight costs) as well as tariff and non-tariff barriers to trade, which are also quite high in this sector (Reimer and Li 2010). As water resources account for a tiny share of overall costs of production, the international trade system is not necessarily organised to achieve maximum water savings, but it is driven rather by costs and consumer preferences (Reimer 2012). If observed from the perspective of the economic value instead of that of VW, we realise that the main Italian food imports and exports are dominated by different categories (FAO 2018), which shows that more complex economic reasons, such as dynamics along the value chain, may be stronger determinants of food exchange. For example, raw products like cereals and coffee beans are among the most imported crops in terms of economic value, while processed food, such as pasta and roasted coffee are among the most exported (FAO 2018). Moreover, fresh fruits are among the top Italian exports with respect to value, but from a VW perspective they play a minor role.

10.5 Blue Water and the Euro-Mediterranean Context

Analyses about total (green plus blue) WF or VW trade are sometime misinterpreted, unless the accounting of rainfall (green) water is made explicit. Green water and blue water have different sources, the latter being withdrawn from surface- and ground-water bodies, but they both contribute to crop evapotranspiration during the growing season, with blue water provided as irrigation. A careful planning and management of green water can indeed save blue water, as well as process optimisation can save blue water along the production chain.

A focus is here presented about the blue water imported and exported by Italy, averaged over the period 2012–2016. Indeed, Italy imports more blue water (around 4.7 km^3/year) than it exports (around 2 km^3/year), as shown in Fig. 10.6. In exports, the share of blue water among product categories seems to be more uniformly distributed than for imports. Blue VW export is dominated by cereals (rice), followed by seeds and oils (olive oil) and meat (ham and other preparations). Blue VW import is dominated by luxury goods (sugar) and seeds and oils (olive oil), followed by fruits (dried fruits, olives and many other), cereals and meat (pig meat).

Comparing the Italian VW trade with that of a few Mediterranean countries in the same period highlights that Italy is the only net importer of blue VW among them, with imports larger than exports. Italy shows the largest blue VW imports compared to Spain, Greece and France, while Spain plays the strongest role in blue VW export (>9 km^3/year), followed by France, with Italy and Greece being overall into a lower position (<2.5 km^3/year). Spain's blue VW exports are related to trade in seeds and oils, meat and fruits, while in France they are strongly led by luxury goods (mostly sugar). Only Greece and Spain show a considerable share of blue water export associated to non-edible products. Blue VW import in seeds and oils is

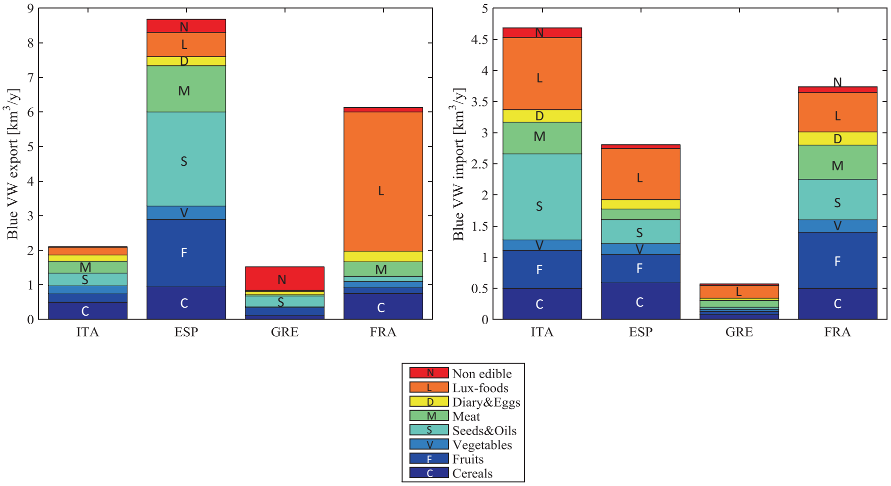

Fig. 10.6 Blue VW trade of different countries averaged in the period 2012–2016: export (left) and import (right) of Italy (ITA), Spain (ESP), Greece (GRE) and France (FRA), in km^3/year. Vertical axes are different to optimise categories visibility

large for Italy, and lower in Spain and France. The volume of blue VW export associated to cereals is similar among the three countries, but different in products, because it is dominated by rice in Italy and Spain and by maize in France. Blue VW imports for luxury goods are present in all the four countries, with a concentration in Italy and Spain, mainly due to sugar products. In general, luxury goods and oils and seeds are the most represented categories in the blue VW trade of these four countries, followed by cereals.

The main trade partners of Italy for blue VW imports are Spain (1.5 km^3/year), France (0.5 km^3/year) and Greece (0.2 km^3/year), while for exports are the United Kingdom (0.11 km^3/year), then Germany and other countries in Central Europe. VW flows in the EU market are intense (Antonelli et al. 2017). Spain, France and, to a lower extent, Greece are net exporters of VW, both towards Italy and globally, as confirmed by Fig. 10.7, which shows the net importing and exporting countries in the area for blue VW. Italy is confirmed to behave differently than the surrounding countries, and more similarly to others in Central Europe, the United Kingdom, or Turkey. It is well-known that blue water plays an important role in Egypt, due to irrigation fed by the Nile river, leading to high figures in blue water use in both production and export. Other countries, such as Greece, Morocco and Tunisia, show a peculiar figure, resulting in a net blue VW export, despite being net importers of total (green plus blue) VW. Their net blue VW export indicates that they are able to sell abroad the food produced through irrigation, demonstrating positive economic impacts of investments in water management. On the other hand, it may be surprising that Israel is a net blue VW importer, despite having an advanced level of water management and control for irrigation and thus a comparative advantage in self-producing water-intensive goods. The figure is probably due to a general tendency

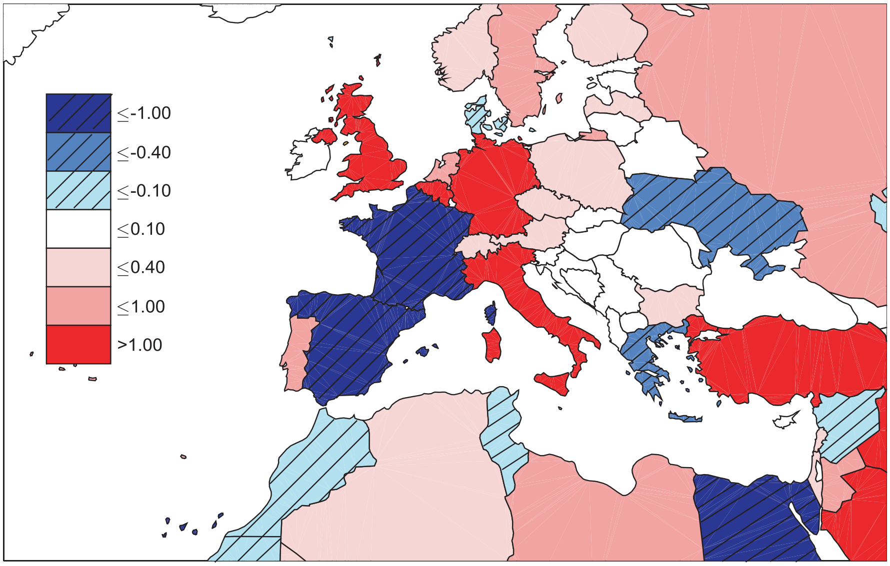

Fig. 10.7 Map of net blue VW import, averaged in the period 2012–2016 in km³/year. Blue (striped) countries are net exporters and red (solid) are net importers

of wealthy countries to import large amounts of food, derived from both rainfed and irrigated cultivations.

10.6 Italian Excellence: Olive Oil and Wine

Olives and wine are analysed here as they represent two of the most strategic exported agricultural products for Italy. Both are highly reputed internationally for their Italian origin, and are also generally associated with the typical diet of the Country. Over the period 2012–2017, the EU produced 67% and consumed 55% of global olive oil production and exported 67% of worldwide export (European Commission 2019a). Italy is the second largest exporter of olive oil in the world, after Spain and before Tunisia and Greece, and it contributes to about 20% of all EU production, two thirds of which is extra-virgin olive oil (Carbone et al. 2018). Currently, Germany, France, and the United Kingdom are the main importers of olive oil from Italy, while Italy is itself a net – and the largest – importer worldwide (FAO 2016). The price of olive oil from Italy is by far higher than the price from Spain and Greece, which are net exporters, and its national average for the years 2018/2019 stands at 5.30 Euro/kg for extra-virgin olive oil (European Commission 2019b). Both the profile of the producer and the production area affect the price (Carbone et al. 2018). Since 2008, the olive oil regime is part of the EU Single Common Market Organisation (CMO) (European Commission 2019a).

Most of olive production in Italy is non-irrigated (about 80%), with southern-insular regions of Sicily, Sardinia, Calabria, Puglia and Basilicata being the largest in terms of production areas (European Commission 2012). Yields vary depending on the year, climate, growing practices and planting density, as well as the above-mentioned alternate bearing, but low and erratic rainfall is often a cause of a reduction in production levels (European Commission 2012). As shown by Amicarelli et al. (2011), the WF of olive oil production in Italy ranges between 3.6 and 6.7 km^3/year, comprising both internal and external WFs. Previous studies, for example on Spain, have shown that most of the water use in olive oil production occurs as evapotranspiration in olive fields (Salmoral et al. 2011). Pellegrini et al. (2016) have demonstrated that the high-density olive cropping system is the most water-saving and produces the lowest aggregated WF compared to other agronomic cropping schemes in Italy.

As shown in Fig. 10.8, Italy's olive oil exports corresponded to 1.27 km^3 of exported water in 1985 and 5.39 km^3 in 2016. Olive oil export has reached, in the most recent years, the 60% of the national production of olives, in terms of VW. VW export of olive oil varies across years and mostly depends on green water, which is therefore the main component of VW trade. Green water accounts for an average 88% of the total exports associated to olive oil between 1985 and 2016. The difference between olive oil production and exports depends on the final stock resulting from each season, meaning that a fall of production in one year may be reflected in a reduction of exports in the following year (such as in the case of Spain after the fall in olive oil production in 2002: Salmoral et al. 2011). As mentioned, Italy is a net importer of olive oil, in terms of both quantity and embedded VW, with an import-to-export ratio of about 2.

As concerns wine, the EU represents 45% of global vineyard areas, 65% of global production, 57% of consumption and 70% of worldwide exports (European Commission 2019a). Italy is the top wine producer in the world, accounting for 19% of global production, and is followed by France (16%) (Miglietta and Morrone 2018). Figure 10.8 shows that the production of wine has decreased in quantity by 37% over the period 1986–2013; however, the 1980s were characterised by a peak of wine production in Italy, that was lower (6 million tons) in 1961 (FAO 2016). The wine sector in Italy experienced a number of changes over these decades, such as a shift in wine consumption towards lower per-capita volumes but higher average quality, as well as the entering of newcomers in the international wine market. Between 1980 and 2005, the total production decreased, while controlled denomination grew from 10.7% to 25.3% of total production (Corrado and Odorici 2009). Consistently with what found by Miglietta and Morrone (2018), green water is the largest WF component of wine production. Lamastra et al. (2014) also developed a specific methodology to analyse the WF components of different grape-wines production of one winery in Sicily. In all cases, green water was the largest contributor to the WF. The study has also shown that the factors determining the largest differences in terms of WF included the distance from the water body, the degree of fertilisation and the eco-toxicological behaviour. VW exports from Italy rose from 0.41 km^3 in 1986 to 1.02 km^3 in 2016, with a limited blue water component. Italy is

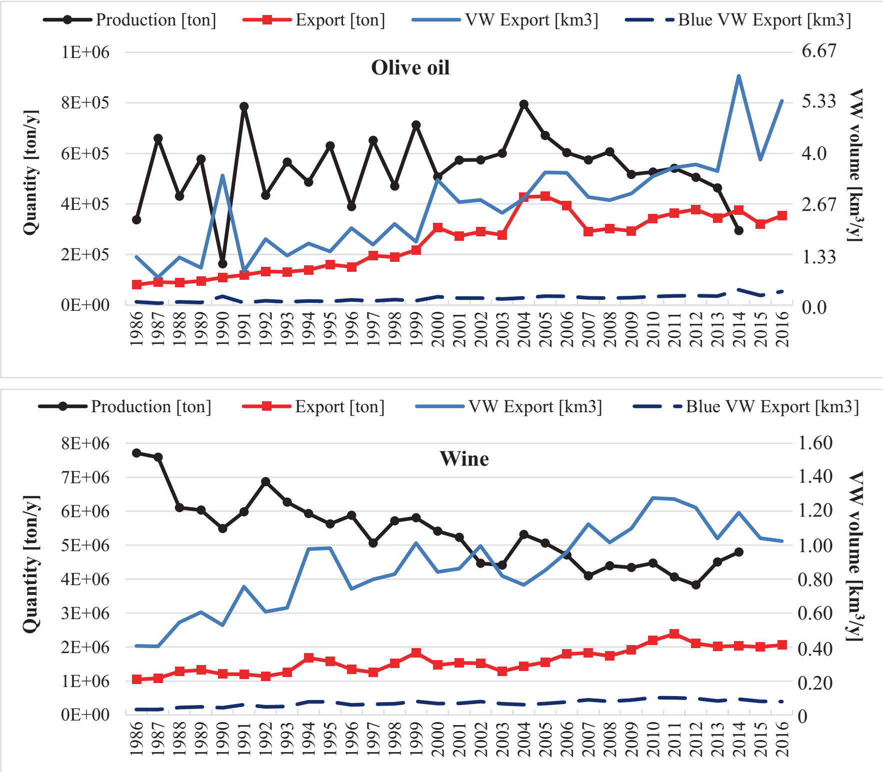

Fig. 10.8 Production, export, VW export and blue VW export of olive oil (above) and wine (below) in Italy, in 1986–2016

a net exporter of wine both in terms of quantity and of embedded VW, with very small import with respect to export.

10.7 Discussion on the Policy Relevance of Water Footprint and Virtual Water Trade

Since their inception, a number of authors have highlighted that the concepts of WF and VW trade can be considered as effective tools for contributing to better water use, management and policy (e.g. Aldaya et al. 2009, 2010; Velázquez 2007; Ma et al. 2006). These concepts can be applied to identify challenges and criticalities related to local and global water resources and to address issues related to the water-food-trade nexus (Allan 2003). By assessing the origin and destination of water resources associated to goods and services, the two concepts enable quantifications of water volumes, which can support analyses of impact and sustainability as well as preparation of multiple scenarios.

At the global scale, WF and VW trade can be applied to evaluate the human pressure on freshwater resources (Hoekstra and Mekonnen 2012) as well as to appraise the impacts of final consumption (also associated with imports) and production (also associated with exports). At the national or regional level, they can explain the balance between imported and exported water with respect to local water endowments (Zhang et al. 2017). They can show the major role of agricultural export from dry areas in exacerbating the pressure on water resources, with consequences for the health of ecosystems and access to water of local communities (e.g. Dalin et al. 2017; Lenzen et al. 2013). In this vein, the WF and VW perspective allows to detect the presence of paradoxes, such as the fact that a number of countries with water deficits like India and China are VW net exporters, whereas countries like the Netherlands and the United Kingdom, are net importers (Vos and Boelens 2016). The WF argument reveals much about the dependency of nations or regions on water resources, and whether it is a local or foreign dependency (Delbourg and Dinar 2020). In many regions, such a perspective has allowed to recognise that VW fluxes successfully replaced costly real water transfers (Antonelli and Sartori 2015), or to alleviate local water deficits such as in the case of the Middle East and North Africa region (Antonelli and Allan 2019).

Some authors suggested that water-scarce nations can gain from international trade by importing VW from nations with larger water endowments and higher water productivity (Yang and Zehnder 2002; Shuval 2007; Velázquez 2007; Chapagain and Hoekstra 2008), thus engendering positive consequences for local food availability (Antonelli and Sartori 2015). The adoption of a WF and VW trade perspective in this context has enabled and enriched the discussion on the relationship between water resources and food security.

It has been argued that VW trade metrics provide new information with respect to price-based analyses, traditionally used to analyse food production and trade (Distefano et al. 2018). The VW dimension, together with the economic value and the caloric equivalent of food, give a multidimensional description of international trade of agricultural goods.

The WF assessment allows to appraise the sustainability of all social actors' behaviour, including that of corporations. Namely, it enables us to account for both direct and indirect water use in a process, product, company or sector. This can usefully be applied also to the case of corporate water use and can inform business reporting as well as risk management throughout the full production cycle, from the supply chain to the consumer (Ruini et al. 2013). A few authors have also recognised that the concept is helpful in generating public awareness regarding the volume of water required to support production and consumption, as producers and consumers are currently very disconnected from one another (among others, Roth and Warner 2008). In addition to that, appraising the spillover effects of agricultural trade and VW trade can be usefully applied for the purpose of monitoring the Sustainable Development Goals of the 2030 Agenda of the United Nations (Hoekstra et al. 2017).

A few controversial issues regarding the use of the WF and VW metrics for informing policy-making deserve attention and further research. For example, comparing WF figures sheds light on differences in the productivity of water use across regions and countries, but these figures remain difficult to interpret because of the diversity of inputs and local conditions. For a more comprehensive and policy-relevant interpretation, one should place WF and VW trade figures into a larger physical, economic, political, and historical context. A given amount of water required per unit of crop production may or may not be sustainable, depending on local water conditions (Dalin et al. 2017; Tuninetti et al. 2019; Delbourg and Dinar 2020). Decisions on trading in specific goods are influenced by multiple factors that, besides water endowments, include the availability of land and capital, and trade agreements and policies (Antonelli and Sartori 2015). It has also been pointed out that the policy relevance of the VW perspective can be greater where scarcity values – that is, opportunity costs – are substantial (Wichelns 2010).

Then, one should not confuse WF with environmental impact. For example, a higher use of fertilisers leads to increased yield and to lower WF, but with harmful consequences in terms of land and water quality. A strategy that takes into account VW issues must form part of a comprehensive system for water resource management and needs to be overall ecologically acceptable (Horlemann and Neubert 2006).

Water scarcity issues, which involve the imbalance between supply and demand, are regional and local, rather than international. Reducing the WFs of residents in one city will not enhance water availability in another town (Wichelns 2015). However, the development of stewardship programmes, compensation measures or optimisation strategies can enhance the efficiency of water use at larger scales and increase water availability for local and downstream communities and the environment.

Also, practices that lead to a lower WF are highly dependent on other critical dimensions linked to agriculture, like capital, technology, labour and energy (Antonelli and Sartori 2015). These dimensions as well should be included into the WF discourse. Examples of the need of broadening the view are given by the coexistence of groundwater depletion and the Green Revolution in India, or the role of capital-intensive technologies in the decrease of the WF of Singapore and Israel (Delbourg and Dinar 2020).

To conclude, despite the acknowledged limitations, we argue that VW trade and WF methodologies can contribute to build a comprehensive framework for better water management, use and policy at the national level. A number of examples can be provided on the potential of these indicators to inform sound water policies. For example, they can contribute to comply with the EU Water Framework Directive (WFD).[6] As pointed out by Serrano et al. (2016), the WFD targets only part of the "real water" use in the EU, namely, blue water, while omitting the green water component and VW trade. Spain is the first country in the EU that has decided to include WF analysis into governmental policy making in the context of the WFD. Another

[6] For further information on the WFD, see Part IV of this volume.

example is that WF and VW trade can help choose between the production of water-intensive crops and their import, stressing that the latter option may be a strategy to achieve national water savings and release blue water resources to be used for higher-value irrigated crops. Understanding the interlinkages between green and blue water and unlocking the full potential of green water in rainfed farming can lead to local water savings and therefore deserve consideration, also in view of climatic and socio-economic changes and the need to adapt to them.

WF and VW trade can help us understand the implications of the production of goods for export, in terms of water withdrawal and pollution in the producing area or country. However, in order to enhance the usefulness of VW as a tool to support policy making it is important to integrate it in multidisciplinary assessments of the national socio-economic and political conditions that influence or are influenced by water use and management. Currently, an increased integration of VW into broader environmental and economic studies in water management is needed.

Finally, although WF and VW trade have been presented as tools for enhancing food security, and optimal strategies related to local production or trade of agricultural goods, public policy objectives should consider also other social, economic, and environmental dimensions. In some situations, when conditions for effective food trade (driven by food lack) are missing (Horlemann and Neubert 2006), improvement of management of local water resources would be more helpful than implementing VW trading strategies, while under other circumstances the opposite may be true (Wichelns 2010; Antonelli and Sartori 2015). Finally, one should be aware that, since the VW trade is deeply linked to dynamics of commercial strategies and international land transactions, the governance of global fluxes of VW goes beyond the sphere of water management and enters other realms of political economy (D'Odorico et al. 2019).

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Part III
The Provision of Water and Sanitation Services

Chapter 11
The Human Right to Water in Italy's Foreign Policy and Domestic Law

Paolo Turrini and Marco Pertile

Abstract The tenth anniversary since the adoption by the United Nations General Assembly of a resolution recognising the right to water is a good occasion for taking stock of Italy's efforts in implementing this right. The human rights discourse in water matters has often resonated in civil society's initiatives in the last decade, so that it cannot be excluded that these stances have influenced the relatively fast evolution of the Italian legislation in this field. Indeed, in the very last years some laws have been passed that require the competent regulatory authority – ARERA – to take into account the basic needs of users in formulating the pricing scheme for what is known as the integrated water service, as well as in putting forth the rules limiting disconnection from the service. The authority, however, has not been the only institutional actor to move in this direction: governmental bodies at any level have done so, from Municipalities to Regions, up to the national legislature. Even though this process has not been devoid of some conflictual aspects, which have also involved the judiciary, something that can be called a "right to water" is definitely taking shape in Italy – as the Country's domestic legal system and foreign policy seem to witness.

Keywords Human right to water · Human right to sanitation · Water resources as commons · Principle of non-disconnection · Minimum vital quantity of water

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11.1 Introduction

It is not rare for people living in countries of the Global North to think that international rules protecting basic social and economic rights are primarily addressed at people living in the Global South. True, developing countries fare worse, on average, than developed ones in fulfilling such rights, if only because of the latter's greater financial availability and larger gross domestic product (both in absolute terms and per capita). Therefore, one can be tempted to say that social and economic rights – at least the very basic ones – are no matter of interest for rich States. For these, satisfaction of vital needs is a standard practice, which does not necessitate formal sanctioning, and even less, supranational monitoring by human rights bodies. After all, there will be a reason if most States that have expressly recognised the right to water in their constitutions are African and Latin American ones… Clearly, they are the ones that need this kind of constraints.

Of course, things are actually very different. First-world countries do have problems in ensuring economic and social rights to all their citizens, so much that formal recognition of such rights and supervision over their effective implementation are not superfluous at all. The case of the right to water in Italy is a good example of this. A recent report by the National Institute of Statistics (ISTAT 2020) has shown that the irregularity of water provision is a widespread problem in some Regions: it reaches peaks of 30% in Calabria (followed by Sicily at a short distance), but Southern Italy in general fares quite poorly. Moreover, one-third of those who had experienced an irregular supply of water complains that the issue goes on all year round. Where water is scarce, especially due to the service of water supply by pipeline being inefficient, the solution lies in the resort to tanker trucks. Although the overall situation has slightly improved recently, in some cities (Cosenza, Catanzaro, Trapani, Palermo, Enna and Sassari) the rationing of water in the whole Municipality or part thereof is still a routine. The report also reveals Italian residents' common mistrust of the quality of tap water, with 7.4 million families, amounting to 29% of the total, declaring to be suspicious about water safety (but here, too, Regional differences are broad). At any rate, this does not necessarily imply the actual existence of a correspondingly extensive problem, as users' diffidence may be partly due to cultural reasons.[1] As to the right to sanitation, which is part and parcel of the right to water as understood at the international level, a few Municipalities (where some 400,000 people live, corresponding to 0.7% of Italy's total population) still lack sewers, so that households must have recourse to private options such as septic tanks. The image thus painted is confirmed by other analyses: for instance, no-less-worrying figures are in a 2018 overview by REF.[2]

These data should be enough to demonstrate that applying the legal notion of the right to water to an industrialised State such as Italy is not futile. Other valid reasons

[1] On the cultural relationship of Italians with water see, in this volume, Chap. 4 by Oncini and Forno.

[2] Laboratorio REF Ricerche, "Un anno di acqua in pillole" (22 March 2018) www.refricerche.it/it/un-anno-di-acqua-in-pillole

will become clear to the reader by going through this chapter, which is organised as follows. Section 11.2 provides a general overview of the right to water under international law, with a view to, on the one hand, identifying the most important legal or "quasi-legal" instruments on which this right may be grounded (Sect. 11.2.1) and, on the other hand, outlining the content of the right by breaking it down to a number of different, more specific obligations (Sect. 11.2.2); in the end, the tracks revealing the presence of the right are also followed in the European Union (EU) legal system (Sect. 11.2.3). Italy appears in Sect. 11.3 as a backseat character of the process that led to the establishment of the right to water at the world level, or as an international actor promoting the actual concretisation of the right beyond the Country's boundaries. In Sect. 11.4, such boundaries delimit the territorial scope of the analysis as Italy is turned into the stage of the implementation of the right to water. After describing the social context which, in the last decade, has seen the flourishing of grassroot initiatives centred on water (Sect. 11.4.1), a thorough examination of the relevant legal framework is carried out (Sect. 11.4.2). Some final remarks are proposed by way of conclusion.

11.2 An Overview of the Right to Water Under International and EU Law

Scholarly works on the right to water often start their analyses highlighting a manifest paradox (McCaffrey 2005; Craven 2006). Despite the self-evident, undeniable importance of access to water for human beings, the debate on the right to water only started at the beginning of the 1990s (McCaffrey 1992; Gleick 1998) and the very existence of a binding right to water at the international level has not been firmly established yet. Access to water – one of the essential requirements for life – has only recently been sanctioned by the discourse of human rights. One of the most important human rights, in other words, is amongst the youngest ones and seems to lie on shaky foundations.

11.2.1 The Legal Basis of the Right to Water

A review of the core human rights documents and treaties adopted at the global level is revealing. Water is not mentioned in the 1948 Universal Declaration on Human Rights and in the two principal human rights treaties: the 1966 International Covenant on Civil and Political Rights and the 1966 International Covenant on Economic, Social and Cultural Rights (ICESCR). Similarly, regional human rights treaties, such as the 1953 European Convention on Human Rights, the 1961 American Convention on Human Rights, and the 1981 African Charter on Human and Peoples' Rights do not mention the existence of a "right to water". Reference to water was included in some more recent sectoral treaties such as the 1979 Convention on the Elimination of All Forms of Discrimination against Women (Article 14, Paragraph 2, letter (h)), the 1989 Convention on the Rights of the Child (Article 24, Paragraph 2), and the 2006 Convention on the Rights of Persons with Disabilities (Article 28). Water is also mentioned in some treaties of international humanitarian law, also called the law of armed conflict, with reference to the treatment of prisoners of war and the protection of civilians.[3] However, these latter documents do not affirm the existence of an autonomous right to water, but merely refer to the need to ensure access to water in the context of other rights, such as the right to adequate living conditions or to health, or with respect to the needs of specific categories of people.

A possible explanation for the lack of explicit provisions on the right to water lies most probably in the fact that in the foundational era of international human rights, that is, the second half of the nineteenth century, water scarcity had not yet emerged as a matter of concern for the international community (Langford and Russell 2017). The phenomena of climate change, desertification and overpopulation surfaced in all their gravity at a later stage. Another, partially overlapping, explanation is that the drafters of the first human rights documents and treaties probably took it for granted that all individuals had to have access to a sufficient quantity of water to ensure their survival (Gleick 1998).

Be that as it may, the absence of black letter provisions sanctioning the existence of a human right to water at the international level has given rise to significant uncertainties in two crucial respects: both the legal bases and the content of the right are still subject to debate.

With regard to the legal bases, two main arguments have emerged.

Firstly, the view has been taken that the right to water can be derived by logical implication from the existence of other rights, which are present in several human rights treaties, such as the right to an adequate standard of living, the right to health, and the right to life. That is the approach famously adopted by the Committee on Economic, Social and Cultural Rights (CESCR) in its 2002 General Comment no. 15 (GC 15) on the "right to water". From this perspective, the right to water would be a derivative right (Cahill 2005; Kirschner 2011), that is, a precondition for the exercise of other fundamental human rights, and could be established through the interpretation of the relevant treaty provisions. The legal foundation of the right would thus be found in treaty law as interpreted in the light of its object and purpose (Bulto 2011).

Secondly, it has been held that a customary process for the consolidation of the right to water would be under way (Bates 2010; Aguilar Cavallo 2012). In line with the theory of the sources of international law, the proponents of this thesis have to show that a sufficiently general State practice (i.e., the repetition by States of

[3] See Arts. 20, Para. 1; 26, Para. 3; 29, Para. 3; and 46, Para. 3, of the Geneva Convention (III) relative to the Treatment of Prisoners of War of 12 August 1949; Arts. 85, Para. 3; 89, Para. 3; and 127, Para. 2, of the Geneva Convention (IV) relative to the Protection of Civilian Persons in Time of War of 12 August 1949.

behaviour complying with the right to water) coupled with a corresponding *opinio juris* (i.e., the conviction of States that the right to water imposes binding obligations on them) have come into existence.

A holistic approach is generally adopted in this respect and various international documents of different origin and nature mentioning the existence of the right to water, or merely its social importance, have been diligently listed. The problem with this method is that the pieces of evidence are at best soft-law documents and that their simple repetition cannot overcome the explicit positions taken by a number of influential States in the sense of the non-existence of the right to water as a self-standing customary right. The oft-quoted 1977 Mar del Plata Declaration, 1992 Rio Declaration or 2002 Johannesburg Declaration, for instance, are clearly political documents, presumably adopted by States in the knowledge that they would not create binding legal obligations. Along similar lines, GC 15 is a technical document offering guidance to the State parties to the ICESCR as to how the monitoring body, the Committee itself, will interpret the obligations contained in the treaty. Notwithstanding its undeniable authoritativeness, GC 15 is not relevant, *per se*, to establish the practice or the *opinio juris* of States.

The most promising steps for the consolidation of the right to water as a customary norm took place with the repeated adoption of General Assembly and Human Rights Council resolutions after the first decade of the new millennium. Drawing from the elaboration of GC 15, the abovementioned United Nations (UN) organs solemnly affirmed the existence of the right to water[4] and the contextual independent existence of a right to sanitation.[5] Notwithstanding the fact that single resolutions are generally non-binding, it has been shown that the repeated adoption of resolutions by UN organs can effectively contribute to the crystallisation of customary norms. In the case of the right to water, however, the process of adoption of the relevant resolutions revealed that several States are still not prepared to accept the existence of a self-standing customary right to water. Suffice to say that 41 States, including some key donor States such as the United States, Japan, Australia, the United Kingdom, and several other European States, abstained on Resolution no. 64/292 of 2010, on the "human right to water and sanitation". The United States explicitly asked that the text of the resolution be put to a vote and motivated its subsequent abstention explaining that the right to water did not exist under customary law.[6] Some other States, such as the United Kingdom, made it clear that they

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[4] UN General Assembly Resolution A/RES/64/292 of 3 August 2010; Human Rights Council Resolution A/HRC/RES/15/9 of 6 October 2010. See also, Human Rights Council Resolution A/HRC/RES/16/2 of 8 April 2011; UN General Assembly Resolution A/RES/74/141 of 18 December 2019.

[5] UN General Assembly Resolution A/RES/70/169 of 17 December 2015.

[6] For the declarations of the States and the record of the vote, see General Assembly, Sixty-fourth session, 108th plenary meeting, Wednesday, 28 July 2010, 10 a.m., New York – UN Doc. UNGA A/64/PV.108.

accepted the existence of the right to water under treaty law but did not regard the right as having attained a customary status.[7]

Another argument which has been used to substantiate the finding that the right to water would be part of international customary law revolves around the presence of the right to water in several legal orders of States, at the constitutional level and/or within national legislations. A recent study has shown that 52 countries have incorporated the right to water in their national legal systems (Brunner et al. 2015). It is not entirely clear, however, to what extent and for how many States the national recognition of the right to water can be taken as a form of implementation of international obligations, rather than a discretionary and reversible policy choice.

What can then be said on the legal basis of the right to water under international law? Whereas the interpretation of the existing treaties in the light of their object and purpose rests on solid grounds, under customary law the right to water can at best be described as a norm *in statu nascendi*, which has not crystallised yet (McCaffrey 2016; Ndeunyema 2020). The observation of State behaviour in the next years will be crucial, bearing in mind that customary rules might come into existence also through a process of acquiescence, that is, when States faced with the repeated and specific affirmation of the right do not object and comply with its requirements. In this respect, the role of UN monitoring bodies and of the monitoring system as a whole, can be of fundamental importance (Bulto 2011). By repeatedly adopting the language of the right to water to scrutinise the conduct of States and maintaining a constant dialogue with them on the subject, monitoring bodies might gradually induce a change in both practice and *opinio juris*.

11.2.2 The Content of the Right to Water

The lack of a universally accepted legal basis of the right to water inevitably reverberates on the second element of uncertainty mentioned above, that is, the content of such a right. It goes without saying that the absence of specific treaty provisions providing for a definition of the right to water results in significant uncertainty. It bears stressing that, in the language and the logic of human rights protection, affirming the existence of a human right implies that States have a set of corresponding obligations chiefly towards the individuals located on their territory (Winkler 2019). Given the uncertainty of the legal bases of the right to water, in other words, it is not altogether clear which specific international obligations territorial States have in relation to access to water by individuals within their jurisdiction.

In this respect, notwithstanding the non-binding nature of GC 15, it is fair to say that such document has become a reference point for the debate on the definition of the right to water not least because its content has been mirrored in the relevant UN resolutions subsequently adopted. Bearing in mind that there can be different

[7] *Ibidem.*

conceptualisations of the right to water, the description of the right spelt out by the CESCR is the starting point of any analysis on the obligations of States in this domain.

In Paragraph 2 of GC 15, the CESCR clarifies first of all that "[t]he human right to water entitles everyone to sufficient, safe, acceptable, physically accessible and affordable water for personal and domestic uses", underlining that "[a]n adequate amount of safe water is necessary to prevent death from dehydration, reduce the risk of water-related disease and provide for consumption, cooking, personal and domestic hygienic requirements".

It is immediately clear from this definition that the right to water, as conceived within the United Nations, focuses primarily on the basic needs of the individual and of the household (Fantini 2019). The questions posed by the economic and productive uses of water are left on the sidelines. Indeed, GC 15 tackles the delicate issue of the prioritisation of water uses within society only once, briefly affirming that "priority in the allocation of water must be given to the right to water for personal and domestic uses. Priority should also be given to the water resources required to prevent starvation and disease, as well as water required to meet the core obligations of each of the Covenant rights" (Paragraph 2).

The definition provided for by GC 15 is thus centred on the identification of three main components of the right to water that must be implemented by States: availability, quality and access. Availability requires water supplies to be sufficient and continuous for personal and domestic uses. In order to assess the required quantity of water, reference is made to the WHO guidelines on drinking water quality, according to which the threshold of minimum access is at least 20 litres of water per person per day. For intermediate and optimal access, however, at least 50 and 100 litres are needed, respectively (Winkler 2019). With respect to quality, it is specified that States must develop procedures and standards to ensure drinking-water safety. To be safe, water must be "free from micro-organisms, chemical substances and radiological hazards that constitute a threat to a person's health" and must have an "acceptable colour, odour and taste" (Paragraph 12). Accessibility concerns water and water facilities, which must be physically and economically accessible. In this respect, water and water services must be affordable and States are under an obligation to ensure that individuals are not denied access to water because they cannot afford related costs and charges. Such costs, as a rule, should not exceed 5% of the available household income. Finally, accessibility entails a general prohibition of discrimination on grounds of "race, colour, sex, age, language, religion, political or other opinion, national or social origin" (Paragraph 13).

In line with the traditional tripartite subdivision of the obligations arising from human rights, the CESCR also establishes that the right to water must be interpreted in the light of the "respect, protect and fulfil" framework. That means that States must first of all respect the right by refraining from interfering with its enjoyment by persons within their jurisdiction; second, they must protect the right by repressing violations by third parties; finally, they must fulfil the right by adopting appropriate legislative, administrative, budgetary, judicial and other measures.

As for any socio-economic right, the obligations connected to the right to water are thus subject to the principle of progressive realisation. Having been primarily conceptualised as a derivative socio-economic right, in principle the right to water should not be conceived of as envisaging a set of obligations of immediate realisation. In the logic of economic rights, each State is bound to adopt measures to implement progressively its obligations using, with some flexibility, the maximum amount of the available resources.

It is noteworthy, however, that GC 15 also identifies nine core obligations, which correspond to the individuals' most basic needs and should therefore be immediately implemented by States (Paragraph 37). Such core obligations include for instance:

(a) To ensure access to the minimum essential amount of water, that is sufficient and safe for personal and domestic uses to prevent disease;
(b) To ensure the right of access to water and water facilities and services on a non-discriminatory basis, especially for disadvantaged or marginalized groups;
(c) To ensure physical access to water facilities or services that provide sufficient, safe and regular water; that have a sufficient number of water outlets to avoid prohibitive waiting times; and that are at a reasonable distance from the household;
(d) To ensure personal security is not threatened when having to physically access to water;
(e) To ensure equitable distribution of all available water facilities and services […].

The main problem with the immediate realisation of these obligations is that water is not only a basic human need but also a finite natural resource strictly dependent on the physical endowment of a given country and, potentially, on its economic conditions. In addition, a number of factors such as population growth, economic development and climate change are clearly placing a greater strain on the availability of this vital resource in recent times. For this reason, GC 15 underlines that the fulfilment of the obligations is also dependent on the role of third parties, which are called on to "provide international assistance and cooperation, especially economic and technical which enables developing countries to fulfil their core obligations" (Paragraph 38). This last point, however, touches upon the delicate issue of the scope and the legal nature of the notions of international cooperation and assistance within the ICESCR. On this aspect, it bears recalling that "developed" States have never accepted the existence of binding obligations to provide international cooperation and assistance (Sepúlveda 2006; Coomans 2007). Such activities have rather been seen as the object of policy choices.

In the end, the CESCR is aware of these economic constraints and when describing, in GC 15, the violations of the obligations stemming from the right to water explains that "[t]o demonstrate compliance with their general and specific obligations, States parties must establish that they have taken the necessary and feasible steps towards the realization of the right to water. In accordance with international law, a failure to act in good faith to take such steps amounts to a violation of the right" (Paragraph 40). It is then also added that in determining a violation "it is important to distinguish the inability from the unwillingness of a State party to comply with its obligations in relation to the right to water" (Paragraph 41). The description of the level of State responsibility in GC 15 thus shows that the obligations related to the implementation of the right to water are conceived of as obligations of due diligence to be assessed in light of "good faith".

Finally, having clarified in the main the content of the right to water, it is of order to discuss two of the most common misconceptions on the obligations arising from it. First of all, it is important to notice that GC 15, the subsequent UN resolutions and, in general, the documents of the UN Special Rapporteur on the right to water do not affirm that States have a general obligation to provide water free of charge to the individuals under their jurisdiction. Free or low-cost water is just one of the options in a set of policies aimed – as Paragraph 27 of GC 15 states – at guaranteeing that no social group is "disproportionately burdened with water expenses". Free services are necessary only in exceptional circumstances, when people are unable to pay.[8] To the contrary, universal provision of free water would probably not be economically sustainable and would go to the detriment of low-income households.[9]

In the second place, one should recall that the UN documents do not take an explicit position on the public versus private dichotomy for the provision of water services. There is no international rule or recommendation directing States to supply water exclusively through the public sector and delegation of water services to the private sector is admitted. One should underline, however, that GC 15 adopts a very cautious approach towards the privatisation of water services. It has been pointed out that a first draft of the text had called "for the deferral of privatization until sufficient regulatory systems were in place" (Langford 2017, p. 473). Even the final text of GC 15, however, while admitting both public and private providers, notes that "water should be treated as a social and cultural good, and not primarily as an economic good" (Paragraph 11) and further adds that "[w]here water services [...] are operated or controlled by third parties, States parties must prevent them from compromising equal, affordable, and physical access to sufficient, safe and acceptable water" (Paragraph 24). According to GC 15, in order "[t]o prevent such abuses an effective regulatory system must be established [...] which includes independent monitoring, genuine public participation and imposition of penalties for non-compliance" (*ibidem*). Recently, the Special Rapporteur has hardened its stance on the implications of the privatisation of water services, adopting a report which starts from the assumption that "the processes underlying water and sanitation service provision are not neutral and shape the social, political and economic environment in which human rights are realized".[10] The Rapporteur identifies several risks

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[8] Report of the Special Rapporteur on the human right to safe drinking water and sanitation, 5 August 2015, UN Doc. A/HRC/30/39, Paras. 6–7.

[9] *Ibidem*.

[10] Report of the Special Rapporteur on the human rights to safe drinking water and sanitation (Léo Heller), 21 July 2020, UN Doc. A/75/208, Para. 4. The previous Special Rapporteur, Ms. Catarina de Albuquerque, had taken a more neutral stance on the governance regime of water in national legal orders: Report of the independent expert on the issue of human rights obligations related to access to safe drinking water and sanitation, 29 June 2010, UN Doc. A/HRC/15/31, Paras. 6–10; Report of the special rapporteur on the human right to safe drinking water and sanitation, 5 August 2015, UN Doc. A/HRC/30/39, Paras. 21, 37.

entailed by the delegation of water services to the private sector, such as price increases, deterioration of services, lack of investment in the infrastructure, lack of transparency and accountability, and the exclusion of vulnerable groups.[11] In the light of such analysis, the report puts forward a number of recommendations to States, private actors, and financial institutions. International financial agencies, in particular, are invited, to "[b]an conditionalities that require States to engage in the privatization of water and sanitation services when providing grants, loans and technical assistance".[12]

11.2.3 The Right to Water in the EU

Despite its shaky legal foundations and the uncertainties regarding its content and nature, the emergence of the right to water at the international level has performed several roles. Overall, it can safely be said that the right to water is not just a "new norm of modernity emulated by all" and devoid of practical effects (Langford and Russell 2017, p. 8). Leaving aside the theoretical hurdles and the difficulties of measuring the effect of legal rules, it seems undeniable that the debate on the right to water has contributed to shape the policy choices of States. A number of States have amended their legal orders by recognising the right to water at the constitutional level or within their legislation. National courts have referred to the right to water as recognised by the relevant international documents. NGOs and civil society have heralded the international right to water in their struggle against the privatisation of water services and the commodification of water. In more general terms, the elaboration of the notion of the right to water has given the monitoring systems of the UN a specific benchmark to scrutinise the behaviour of States on a continuous basis. Against this background, the right to water is one of the few human rights to have been explicitly included in the sustainable development goals agenda of the UN.[13] Even when it is deeply criticised for being anthropocentric, individualistic, gender-unbalanced and Eurocentric (Fantini 2019; Sultana and Loftus 2015), the right to water still is the point of reference of all of the new international debates on the allocation of water at the global level.

It may thus come as a surprise that the penetration of the international right to water within the EU legal system has been less effective so far. One could start by noticing that there is no official proclamation of the right to water in the 2000 Charter of Fundamental Rights of the EU, notwithstanding the fact that this is a relatively recent legal instrument. Neither the founding treaties, nor the relevant directives mention the right to water.

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[11] Report of the Special Rapporteur on the human rights to safe drinking water and sanitation, 21 July 2020, UN Doc. A/75/208.

[12] *Ibidem,* Para. 64.

[13] Resolution adopted by the General Assembly on 25 September 2015, UN Doc. A/RES/70/1, Para. 7 and Goal 6.

A trojan horse for the introduction of the right to water in the EU legal order could perhaps be found in Article 6, Paragraph 3, of the Treaty on the European Union, according to which "[f]undamental rights, as guaranteed by the European Convention for the Protection of Human Rights and Fundamental Freedoms and as they result from the constitutional traditions common to the Member States, shall constitute general principles of the Union's law". Even though, as has been seen, the European Convention on Human Rights does not contain any reference to the right to water, the European Court of Human Rights has decided cases related to water supply contamination as well as deprivation of water and sanitation in detention adopting the well-known techniques of creative interpretation (Braig 2018). In principle, there is thus some room to say that the introduction of the right to water in the EU legal system could be brought about through the jurisprudence of the European Court of Human Rights. One should consider, however, that, although it became a legal obligation under Article 6, Paragraph 2, of the Treaty on the European Union, the process of accession of the EU to the European Convention on Human Rights has been stuck after the objections raised by the European Court of Justice.[14] Without an institutional arrangement, the prospects of the Court of Justice applying the principles elaborated by the European Court of Human Rights in its evolutive jurisprudence on the right to water seem negligible (Kuijer 2020). And when it comes to the other constitutive element of Article 6, Paragraph 3, that is, the constitutional traditions of Member States, it seems also difficult to claim that they are now sufficiently uniform in the recognition of the right to water. The international right to water has not been uniformly incorporated in the constitutional traditions of the EU Member States to become a general principle of EU law. For the time being, having recourse to Article 6 to introduce the right to water in the EU legal order does not seem a credible option.

The situation is not at all easier when it comes to secondary law. The Water Framework Directive (WFD), in particular, has been accused of adopting a neoliberal approach by conceptualising water as a "resource which can be transformed into an economic commodity" (De Lourdes Melo Zurita et al. 2015). Absent any explicit reference to the right to water, the WFD focuses on the concept of good-quality water and introduces the cost-recovery principle. Pursuant to Article 9, which applies also to households, Member States shall ensure that "water-pricing policies provide adequate incentives for users to use water resources efficiently". Article 9 then only briefly touches upon the wider social problems related to the allocation of water and the cost-recovery principle by introducing a very flexible *caveat*, which leaves the adoption of any social measure to the discretion of Member States: in devising a pricing policy, these may "have regard to the social, environmental and economic effects of the recovery" of the costs of water services.

The absence of the right to water in the EU legislation gave rise, however, to a civil society campaign led by a coalition of trade unions and NGOs (Van den Berge et al. 2020). The *right2water* movement launched an initiative titled "Water and

[14] European Court of Justice, Opinion no. 2/13 of 18 December 2014.

sanitation are a human right! Water is a public good, not a commodity!", which had the explicit objective of implementing the right to water and sanitation within the EU. The organisers effectively used the European Citizens' Initiative mechanism, which allows European citizens to propose an issue for legislation by collecting at least one million signatures in at least seven Member States. The operation was a huge success, collecting almost two million signatures and passing the required quorum in fourteen States, including Italy. More specifically, the organisers expressed their political demands as follows: 1. guaranteed water and sanitation services for all in the EU; 2. human rights above market interests and no liberalisation of water services; 3. global/universal access to water and sanitation for all.[15] The concrete results achieved by the *right2water* movement are remarkable. First of all, before the end of the campaign, the Commission withdrew its proposal of concession directive and the issue of water services was left out from the new concession directive (Van den Berge et al. 2020). After the conclusion of the initiative, the Commission gave a first interlocutory answer, which acknowledged the importance of water as a "public good of fundamental value", but also affirmed that the competence "for taking concrete support measures safeguarding disadvantaged people and tackling water-poverty issues" was of Member States.[16] Finally, after some pressure from the European Parliament, which adopted a resolution recognising the right to water,[17] the Commission reconsidered its position and initiated a process of revision of the Drinking Water Directive.[18] Significantly, the new directive proposal by the Commission affirms that Member States shall "take the necessary measures to improve or maintain access to water intended for human consumption for all, in particular for vulnerable and marginalised groups".[19]

11.3 The External Dimension of Italy's Policy on the Right to Water

Italy's foreign policy on the right to water has been somewhat ambivalent, oscillating between positions formally supporting the proclamation of the right to water at the international level and a more introverted attitude. On the one hand, the records

[15] The text of the European Consultation Initiative and the Political Demands of the campaign are available at: www.right2water.eu/about

[16] European Commission, Communication from the Commission on the European Citizens' Initiative "Water and sanitation are a human right! Water is a public good, not a commodity!", COM (2014) 177 final, p. 4.

[17] European Parliament resolution of 8 September 2015 on the follow-up to the European Citizens' Initiative Right2Water (2014/2239(INI)).

[18] Council Directive 98/83/EC of 3 November 1998 on the quality of water intended for human consumption.

[19] European Commission, Proposal for a Directive of the European Parliament and of the Council on the quality of water intended for human consumption (recast) COM (2017) 753 final, Art. 16.

show that Italy voted in favour or supported, when a vote was not needed, all of the resolutions on the right to water adopted by the General Assembly and the Human Rights Council mentioned in the previous section. On the other, a careful analysis of the statements of the Country shows that the Italian authorities generally took a low profile on the subject, without taking an active part in the debates or explaining their votes.

This lack of "enthusiasm" is perhaps more striking if one considers that the most important driving force behind the introduction of the right to water in UN debates has been a joint diplomatic initiative led by Germany and Spain, two European countries which presented a number of resolutions on the matter in an effort to clarify the content of the right. Italy generally aligned itself with the position of Germany and Spain, but did not participate actively in their initiative. The analysis of the summary records of the UN General Assembly and the UN Human Rights Council does not reveal significant statements by the Italian delegations.[20] Explicit statements by the Italian authorities affirming the binding nature of the right to water are rare.[21] The fact that the right to water is not a priority of the Italian foreign policy is confirmed by the analysis of the voluntary pledges presented by Italy for its candidature to the UN Human Rights Council.[22] The traditional coordinates of the Italian human rights policy include, for instance, the protection of the rights of children, the abolition of the death penalty, the protection and promotion of women rights and gender equality, and the protection of cultural heritage. The 2030 Agenda for Sustainable Development is also mentioned, underlining its "integrated approach" and mentioning food security, but explicit reference to the right to water is not made. Quite interesting is also the analysis of Italy's participation in the Universal Periodic Review (UPR) process of the Human Rights Council. Out of 1307 recommendations issued so far in scrutinising the human rights record of other countries, Italy referred to water only once, in a recommendation to Equatorial Guinea in 2010. Conversely, as a sign of commitment to the issue of water-related rights, it is worth noting that the Italian authorities diligently took into consideration the requests for inputs by the Special Rapporteur on the Right to Water, submitting detailed documents describing the water policies adopted by the State. Between 2016 and 2020, Italy responded to the Special Rapporteur six times, providing inputs on issues ranging from gender equality to the privatisation of water and sanitation services.

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[20] The following databases have been consulted and searched by keyword: https://documents.un.org; https://digitallibrary.un.org; www.esteri.it/mae/it/politica_estera

[21] Statement delivered by Italy at the High-Level Event to Launch the International Decade for Action, "Water For Sustainable Development", 2018–2028, 23 March 2018, available at: https://italyun.esteri.it/rappresentanza_onu/it/comunicazione/archivio-news/2018/03/assemblea-generale-evento-di-alto.html

[22] Candidature of Italy to the Human Rights Council, 2019–2021, Voluntary pledges and commitments pursuant to General Assembly resolution 60/251, UN Doc. A/73/72, 26 February 2018. The documents related to the UN human rights system are available at: https://uhri.ohchr.org/en/

The picture does not change significantly, however, when the human rights record of the Country is put under examination by the UN supervisory system. Neither Italy, nor the UN monitoring bodies and third States seem to consider the right to water a priority. The analysis of the human rights index database[23] reveals that issues connected to access to water in Italy were raised only twice, by the Committee for the Elimination of Racial Discrimination in 2008 and by the CESCR in 2019, respectively. In both cases the facts were related to the conditions of life of marginalised groups such as undocumented migrants living in overcrowded lodgings and Roma communities living in informal camps. Along the same lines, the examination of Italy by third States during the UPR does not include any reference to the right to water. Out of 356 recommendations addressed to Italy in two cycles of review (2008–2012 and 2012–2016) none of them included the word "water". Issues raised by third countries typically focus on the conditions of migrants, the efficiency of the judicial system, discrimination against LGBT people, the conditions of life of Roma communities and violence against women. Some problematic elements related to water were occasionally raised during the stakeholder consultations. In 2009, Amnesty International recommended that Italy adopt due diligence measures to tackle the behaviour of the subsidiaries of Italian oil companies who were allegedly responsible of grave human rights breaches including environmental pollution of water sources. In 2019, ASSO21 highlighted again that Italy had failed to meet its obligations towards the Roma and Sinti communities living in "authorised camps" and frequently lacking "adequate access to drinking water [and] sanitation facilities".

This short overview of the human rights record of Italy emerging from the UN supervisory system, seems to confirm the absence of serious problems, if not for marginalised groups, in the situation of access to water. This state of affairs might perhaps explain the lack of ardour by the Italian authorities in the struggle for the international recognition of the right to water at the international level. It is interesting to note, however, that a more meaningful connection to the issue emerges when one examines the Country's record in development cooperation. In this respect, access to water and sanitation is one of the traditional thematic areas for the Italian cooperation system. From 2016 to 2019, the data available on the website of the Italian Cooperation Development Agency show that the resources committed to projects on the matter increased from € 5,124,353 (on a total of € 419.49 mln) to € 17,153,225 (on a total of € 425.86 mln).[24] In 2015, the development cooperation department of the Ministry of Foreign Affairs also adopted some specific guidelines for the water sector which draw inspiration from the objectives of Sustainable Development Goal no. 6:

[23] The documents of the UN Monitoring System are available at the Universal Human Rights Index: https://uhri.ohchr.org/en. A searchable database on the UPR is also available at: www.upr-info.org/en

[24] The data are available at: https://openaid.aics.gov.it

- guarantee access to water as a fundamental element for human dignity and, therefore, for the health and hygiene of people;
- promote action in the irrigation sector for the reuse of treated waste waters, control of the water supply, erosion and the salinity of the soil, guaranteeing food and nutrition safety;
- ensure that water resources are safeguarded and restored via the transfer of knowledge about the management and monitoring of water resources at all levels, with multi-stakeholder partnership models […].

Moreover, it is of note that two bills currently before Parliament envisage the establishment of an international-solidarity fund financed through a levy of one eurocent per cubic meter of water supplied, in one case (Bill no. C.773 – Article 12), and also per bottle of mineral water put on the market, in the other (Bill no. C.52 – Article 16). In both cases, the aim of the Fund would be to finance projects of development cooperation fostering access to water and sanitation. In their Article 2, symmetrically, the bills qualify access to water and sanitation as a fundamental human right and make explicit reference to the UN General Assembly Resolution no. 64/292. The described model for the financing of cooperation projects has already been adopted by Regional legislation enacted by Lazio, which established a Region-based international-solidarity fund with the same purpose (Article 9 of Regional Law no. 5 of 4 April 2014).

Finally, one should acknowledge that the external dimension of Italy's foreign policy on the right to water has been influenced by an extremely active group of NGOs operating at the national and transnational level. Among them, the most representative one is probably the Italian Committee for a World Water Contract (CICMA), which began an international campaign for the recognition of the right to water already at the turn of the new millennium, with the adoption of the 1998 Water Manifesto and the 2003 Rome Declaration (Armeni 2008). The aims of the group include the recognition of the right to water in international legal documents, in the constitution of every State and at the local level. At the moment, the most innovative action of CICMA is the international campaign "Waterhumanrighttreaty", with which the movement, in cooperation with the University of Milano-Bicocca and a group led by professor Tullio Scovazzi, is lobbying for the adoption of a second additional protocol to the ICESCR recognising explicitly the right to water. In the same epoch, in 2003, the Alternative World Water Forum (FAME) met in Florence campaigning for the recognition of water as a common good and for the exclusion of any market principle in the management of water. Subsequently, in 2005, the network of the Italian Forum of Water Movements (*Forum italiano dei movimenti per l'acqua*) was established with the main aim of the re-municipalisation of water services.

Somewhat surprisingly, given their recognised pioneering importance at the European level, the Italian civil society movements did not play a major role in the subsequent *right2water* campaign. In 2013 "only" 65,223 statements of support were collected in Italy, compared to the 1,236,455 of Germany (this notwithstanding, Italy ranked second). A possible explanation is the occurrence of a gradual shift in the objectives of the Italian network, from the abstract proclamation of the right to water at the international level to the more practical objective of the reaffirmation of the role of the public sector in the management of water services. At the end of the 2000s, the mobilisation of the Italian civil society for the celebration of the 2011 referendum on water services was huge and probably became a monopolising objective for the movement.

11.4 The Right to Water in the Domestic Law and Policy of Italy

In Italy, as of late, several domestic measures aimed at limiting water poverty have been taken. They can certainly be traced back to the Country's willingness to make the human right to water truly effective. What has been happening in the background, in the international arena (as described in the previous sections), is without any doubt one of the reasons why such policies have gained momentum in Italy, too. However, the first two decades of the twenty-first century have been, for the Country, a period galvanised by civic movements and grassroot initiatives whose goals partly overlap with those of the transnational campaign for the recognition of the right to water but, at the same time, cannot just be reduced to the latter. Even if this societal effervescence largely fed on events such as the adoption of Resolution no. 64/292 by the UN General Assembly or other external developments, popular support was won and public participation fired up on battles indigenous to Italy, albeit consonant with values that are increasingly shared on the international plane.

In light of this, before addressing the internal rules that actualise the right to water, or that have somehow to do with it, we must now have a brief look at the context where such rules were born. As this chapter is written by lawyers rather than by sociologists, the next sub-section mainly describes some facts (also legal ones).

11.4.1 The Socio-Juridical Context of the Emergence of the Right to Water

The ideal marriage between, on the one hand, the affordability of services and, on the other, their public management seems to date back at least to the beginning of the last century, when Law no. 103/1903 (so-called "*Legge Giolitti*") was enacted in order to promote – as the full name of the law read – "the direct running of public services by Municipalities", including water services (De Girolamo 2013). Indeed, this piece of legislation was meant to establish a system that was "source of fair profits, to taxpayers' relief" (in the original, "*fonte di equi profitti, a sollievo dei contribuenti*"). However, good intentions did not really meet their objectives. Even though the presence of the State in the field of services has been significant throughout most of the twentieth century, the quality of the services provided by public entities has often left a lot to be desired: to taxpayer's dismay, as such a managerial approach contributed to raise the State's debt and to keep taxes high.

Thus, it is not surprising that, at the turn of the century, a new ideology was ripe, also thanks to its promotion by the competition-oriented EU.[25] The very long-lived Law no. 103/1903 was finally repealed by Decree-Law no. 112/2008 (so-called "*Decreto Brunetta*"), converted into law by Law no. 133/2008, whose Article 23 *bis* provided for the automatic termination at the end of 2010 of all concessions relating to the integrated water service that had been conferred to public bodies. Indeed, the objective of the provision was the establishment of private management as the rule, with public management as an exceptional way to run the service whose preferability in the concrete case had to be motivated with a market analysis. Article 23 *bis* was amended, albeit along the very same lines as before, by Decree-Law no. 135/2009 (so-called "*Decreto Ronchi*"). After many decades, the Italian system was decidedly veering towards the privatisation of the water service, and this triggered the protests of NGOs and segments of the civil society.

Voicing their discontent, these actors managed to get an achievement that turned out to be a true milestone of public participation in decision-making in Italy. In June 2011, more than 27 million Italians (about 55% of all eligible voters, by far the largest turnout since the mid-1990s) voted in a referendum to abolish parts of the legislative framework regulating water services. Thus, more than 95% of the actual voters decided to delete said Article 23 *bis* and also some words of Article 154, Paragraph 1, of Legislative Decree no. 152/2006 (so-called "*Codice dell'ambiente*"), which required the recovery through the water tariff of the capital invested by the company providing the service, by setting a fixed remuneration rate.[26] After all, when judging upon the admissibility of the question on the ban of such "financial bonus", the Constitutional Court had stated that "remuneration of capital through the tariff cannot be seen as an element characterising the notion of economic importance of the integrated water service".[27] That is, on that ground remuneration was dispensable.

However, what had seemed a sheer success of the proponents of the referendum soon became only a victorious battle in a war destined to be lost. As to the remuneration of invested capital, they had believed that the vote would have abolished it in every form, especially the remuneration for the resort to the managing company's own capital for investment as opposed to loaned capital. This was not the idea of the public body entrusted with the task of setting out the general rules for service providers to be able to determine the water tariff. With Decision no. 585/2012/R/IDR,

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[25] On the management models of water services and the influence of the European Union see, in this volume, Chap. 13 by Parisio.

[26] Actually, the same obligation was also present in Article 13, Paragraph 2, of Law no. 36/1994 (so-called "*Legge Galli*"), then repealed by Legislative Decree no. 152/2006, and it was detailed, as far as the fixed remuneration rate was concerned (7%), by Decree of the Minister of Public Works of 1 August 1996. On this see Council of State, Sect. II, opinion no. 267 of 19 December 2012, declaring the implicit abrogation of the latter decree after the referendum.

[27] Constitutional Court, judgment no. 26 of 12 January 2011.

the Authority for electricity and gas (*Autorità per l'energia elettrica e il gas* – AEEG, later to become ARERA) erased any reference to an "adequate remuneration" and concocted a formula for tariffs to include "the forms of return of investment". To the referendum's proponents this appeared only as a deceitful play on words. They appealed against the Decision, but the rulings rejected their thesis: as long as the remuneration rate of the capital is not pre-determined, it is legitimate.[28] In fact, under this condition, it is even mandatory, as demanded by the principle of full cost recovery applicable to water services pursuant to the EU Water Framework Directive.

The fight against the forceful privatisation of water services was no more rewarding for those who had endorsed the referendum. Before the voting, the Constitutional Court had already made clear that striking down Article 23 *bis* would not have revived the previous legal landscape (the one where public management was the rule rather than the exception), so that only the far-less-constraining rules of EU law would have applied to the service sector.[29] To fill this "void", just a couple of months after the referendum, Decree-Law no. 138/2011, converted into law by Law no. 148/2011, was adopted. Its Article 4 basically reproduced Article 23 *bis*, even though water services were left outside of the scope of the regulation. However, as the abrogated Article 23 *bis* had once covered all services, not just water provision, its resurgence was censured by the Constitutional Court itself as contrary to the outcome of the referendum.[30] So, the proponents of the voting lived happily ever after? Not really. In the meantime, the Government had enacted Decree-Law no. 1/2012, converted into law by Law no. 27/2012, that amended Decree-Law no. 138/2011 in order to set up a "prize system" (Article 25) whereby the State, when determining how to allocate its funds for public services, would privilege those local governmental bodies that entrusted their water services through calls for bids, or that could otherwise demonstrate that the service was managed efficiently. The resulting legal framework was one that, albeit not requiring private management, was inclined to it. The Veneto Region challenged Article 25 before the Constitutional Court, considering it as encroaching on the local governments' freedom of choice, but the *Consulta* (as the Court is also known) upheld the provision.[31]

From a merely legal point of view, the referendum was successful, since it changed a bit the course of action of Italy's post-2011 Governments, within the limits of the questions posed to voters. Here, however, lies the problem, as many voters intended those questions to be more far-reaching than they actually were. Indeed, the remarkable turnout was also a consequence of a campaign that had won the minds and hearts of people by concealing, in good faith, some legal technicalities behind a much more effective invocation of values. Many people thought they

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[28] Regional Administrative Tribunal – Lombardy (Milan), Sect. II, judgment no. 779 of 20 February 2014; confirmed by Council of State, judgment no. 2481 of 15 December 2016.

[29] Constitutional Court, judgment no. 24 of 12 January 2011.

[30] Constitutional Court, judgment no. 199 of 17 July 2012.

[31] Constitutional Court, judgment no. 46 of 13 March 2013.

were not just voting on the deletion of some abstruse-sounding provisions: they thought that they were voting to outright enforce public-only management of water services and to muscle the market logic out of this sector, which should be non-lucrative in character. Hence, afterwards they feel betrayed.

Before and after the referendum, the buzzword was "*acqua pubblica*" ("public water"). In fact, the reference was not to the property of water, as in Italy water resources are already owned by the State (as also stated by Article 144, Paragraph 1, of Legislative Decree no. 152/2006). Rather, the slogan had been forged having in mind two distinct ideas, conceived as going hand in hand: public management of water services and waters as common (public) goods. These ideas also conflated with that of the right to water, that coincidentally had just been recognised by the UN General Assembly. Evidence of this intermingling of ideas can be found in documents adopted, and stances taken, both before and after the referendum.[32] The authors of such a "discourse" compose a variegated galaxy of social actors (Carrozza and Fantini 2013; Fantini 2014).

Already at the end of the twentieth century, the World Water Contract, a mainly-Italian international NGO, had been promoting a new understanding of water resources: these had to be seen as commons and access to water as a human right, in contrast to a profit-driven and market-oriented approach to the governance of water. These principles, contained in the 1998 Lisbon Manifesto of Water (of which more than one edition exist), have since guided the action of the movement, that has also sponsored the Declaration of Rome of December 2003 (signed by politicians and other representatives of civil society and defining water a common good and access thereto a human right) and the Charter of the Cities. The latter, that has been drafted in November 2018 and then again in October 2020 and has been subscribed by a couple of non-governmental associations gathering some local governmental bodies (and, directly, by some such bodies[33]), adds to the commons and human rights discourse a reference to the promotion of public management of water services. The World Water Contract was a protagonist of the 2011 referendum campaign, together with the Italian Forum of the Movements for Water, that gathers more than 80 national associations and a thousand of local ones (most of them not focusing on water issues) and shares the very same operative words.

As it is evident, such initiatives have also seen the participation of institutional actors. At times it is hard to discern whether these figures or entities are adhering in their official capacity. This is the case, for example, of the Milan Charter, signed in

[32] Of course, this does not mean that each and every supporter of the campaign saw these concepts as intertwined, nor can this analysis be taken as a proof that all promoters of the right to water think that its recognition passes through the public management of water services. For instance – and unsurprisingly – the National Council of Lawyers (*Consiglio Nazionale Forense*) has repeatedly taken side with the recognition of the right to water (in 2015, it signed a manifesto and then it took similar initiatives, including the signing of a similar manifesto in Rabat in 2019), but it has paid attention not to link this right with the issues of management and communal property.

[33] For instance, at the end of October 2020 the Municipal Council of Fucecchio adopted a motion approving the Charter.

2015 (the year of the World Expo in Italy) by many Heads of State and Prime Ministers, including the Italian ones: in its very first lines, the document defines the lack of access to water a violation of human dignity. However, acceptance of these values is sometimes manifested by institutions themselves. In addition to several Municipal statutes referred to in the next sub-section, some true normative acts can be quoted, such as Regional Law no. 5/2014 of Lazio and Regional Law no. 19/2015 of Sicily: both of them express a preference for public management of water services (the former by setting up a fund for supporting the re-publicisation of such services, and the latter by establishing public management as the only available option), and both characterise access to water as a human right and water as a common good (Articles 2 and 1, respectively). Similar laws have been suggested in other Regions, too: at least two bills in Tuscany (presented in 2018) and one in Emilia-Romagna (put forth in 2019) promote the establishment of a fund to support the transition from private to public management and, as always, they embrace the discourse of water as a human right and a common good. Also not into force, but deposited at the Italian Parliament, are Bills nos. 52.C and 773.C. The former aims at setting public management as the sole mode of providing water services, whereas the latter sees such mode as the rule and considers private management as the exception. Again, both proposals speak the language of commons and human rights in dealing with water (Article 2 in each bill; for their differences in other respects, Berardi and Casarico 2018).

Two observations are stimulated by these facts. The first is a chronological and practical one: that the ten years after the 2011 referendum have been full of initiatives to foster a different, non-economic understanding of the governance of water services shows how that "mutilated victory" has left a mark on a part of civil society: perhaps, the conviction persists that the finish line has not been reached yet. The second observation is more of theoretical nature and is linked to the first one. As we have seen, in many stances and documents, some of them legally binding, the ideas of access to water as a human right, of water resources as common goods, and of public management as the only, or preferable, way to provide water services are present at the same time. The international lawyer cannot but wonder whether these positions reveal or not the belief (*opinio juris*) that the right to water is necessarily tied to waters being commons and, more importantly, to the duty to keep the market out of the sector of water services. This possibility is, in the view of the authors of the present chapter, implausible, but it is nonetheless a question worth being asked, as its answer – present and future – could feed back into the content of the right to water as an international customary norm.

The issue of the relationship of the right to water with other concepts has indeed been discussed by lawyers. Actually, in matters of water service management, no one seems to doubt that the running of such services by private companies is not at odds with the right to water. As it has been remarked, both public and private management are no guarantee, per se, of compliance with that right (Staiano 2011). The compatibility of the right to water with private management is precisely the reason why, according to some scholars, the more appropriate antonym of water as a "commodity" would be water as "commons", rather than as a "human right". This would be the only way to get rid of a tainted idea – the human right to water – whose uselessness would be demonstrated by it being championed by water industry representatives, libertarian think tanks such as the Cato Institute, temples of capitalism like the World Economic Forum of Davos, and financial institutions shepherded by the Washington consensus (Bakker 2007). However, many are those who dissent. The human right to water, in their view, is not to be seen in opposition to the idea of commons, as the two are mutually reinforcing: collective property of water is a bulwark against the appropriation of the resource by some, and thus a means to ensure the actual realisation of the right to water (Iannello 2012; Algostino 2013; Fantini 2019).

The latter position is more convincing, if only because the notion of commons, too, says nothing about the way the common good is managed, whether by public or private actors. Interestingly, the concept of "commonality" is not extraneous to the Italian legal system.[34] Even before such concept was formally codified in a law, a clue could be detected in the principle of public ownership of waters. According to the Court of Cassation, "the good is public less for its belonging to one of the abstract categories of the [Civil] Code than for its being a source of benefits for the whole society", so that the idea of "common" is not related to property titles but to the condition of being instrumental to the realisation of the welfare State.[35] This principle also applies to waters. In Italy, public sources of water are itemised in lists drafted by governmental bodies but, as it has been noted, such a registration is declaratory rather than constitutive, the public nature of these sources depending on their being able to serve the general interest (Camerlengo 2017). Moreover, the public or private nature of a water body is not determined by the property of its "container", be it the basin where it lies, the channel or pipeline through which it flows, or the terrain from which it springs out: what must primarily be taken into account is, instead, the usability of the water body for drinking purposes.[36] A consequence of this approach is that no right to redress arises for a loss of the water located under one's own estate, if such a loss is due to an abstraction carried on in the public interest; the landowner is only entitled to that water inasmuch as it serves to satisfy his or her domestic needs.[37]

This understanding of goods to be enjoyed by the public for the well-being of everyone echoes the notion of "common goods" devised by the Rodotà Commission some years before the referendum. In June 2007, a committee chaired by the renowned jurist Stefano Rodotà was entrusted by the Italian Ministry of Justice with the task of formulating a reform proposal of the rules of the Civil Code that govern public goods. In February 2008, the Commission handed to the Ministry a project, which saw the addition of the new category of common goods (*beni comuni*) to the

[34] On water as commons see also, in this volume, Chap. 5 by Boscolo.

[35] Court of Cassation, Joint Sects., judgment no. 3665 of 24 November 2010.

[36] Regional Tribunal for Public Waters – Court of Appeal of Florence, judgment of 8 January 1996; Higher Tribunal for Public Waters, judgment no. 147 of 5 October 2009. Both rulings are quoted in Camerlengo (2017).

[37] Higher Tribunal for Public Waters, judgment no. 77 of 21 June 2004. Again, the source is Camerlengo (2017).

classes already in existence: such goods were intended as "things expressing utilities that are functional to the exercise of fundamental rights as well as to the free development of the person".[38] This was not meant as a new category of property, as common goods could be owned by public or private subjects alike; rather, this typology of goods would work as an assurance of their collective enjoyment (also by future generations), for instance by setting limits to concessions awarded to private subjects. Although the proposal was not directly transposed into Civil Code provisions – so that later it became the object of a failed citizen's initiative[39] – after ten years, a contiguous field was successfully reformed. Law no. 168/2017 has introduced the notion of "collective domains" (*domini collettivi*), that is, communal property of goods, that per Article 3, Paragraph 1, letter (f), also include water bodies where civic uses are carried on. This very provision has already been quoted in a ruling. In 2020, the Commission for Civic Uses (*Commissariato agli usi civici*) of Rome recognised the collective property of a mountain community over a water source traditionally used by inhabitants for agricultural purposes. A private company selling bottled water was thus stripped of any legal title to the aquifer.[40]

However, a "collectivist" approach (so to say) is not necessarily to be understood as limited to the issues of property, management or purposes of goods. It can also be taken with respect to the costs of the enjoyment of such goods. Here, two different conceptions of the right to water – or any other economic right – can be expounded. Either it may be seen as a social right, to be ensured universally through the public purse; or it may be construed as a fundamental right, so as to grant its justiciability (e.g., through judicial scrutiny of laws undermining the right, possibility of submitting claims for actions or omissions of governmental bodies, and monitoring by independent authorities on issues such as tariffs). The former option can be unfair, as the true costs of realising the right are hidden, lost as they are in the meanders of governmental bookkeeping (Sileoni 2016). Of course, intermediate choices exist – but this aspect will be addressed in greater detail in the subsequent sub-section. This one is devoted to social considerations, so it may be interesting to conclude with a couple of such points. Apparently, one-third of Italians favour the idea of implementing the right to water by means of a collective financial effort. A survey published in June 2020 asked "how should the human right to water [quantified as a *pro capite* amount of 50 litres per day] be ensured?", and interviewees said that this should be done through a low political price of water set by an agency (46.9% of the

[38] Article 1 of the proposal quotes waters as the first example of common goods. Interestingly, in 2014 the Constitutional Court defined waters "a common good", as a justification for the awarding of concessions to private companies only upon payment, as society must be compensated for such a personal use of a public resource: judgment no. 64 of 26 March 2014.

[39] The text of the initiative was deposited in December 2018 at the Court of Cassation. The website of the Chamber of Deputies states that the text was deposited in November 2019 at the Parliament (Bill no. C.2237), but that the proponents failed to collect the 50,000 signatures needed for the Parliament to discuss the bill.

[40] Commission for Civic Uses – Lazio, Umbria and Tuscany, judgment no. 18 of 7 February 2020. See also, of the same court, judgment no. 2 of 18 January 2021.

sample), general taxation (32.9%), and the water tariff (20.2%).[41] The approach whereby water is supplied to low-income people by recovering the costs outside of the water tariff system can perhaps manifest itself in the setting up of water kiosks. These have mushroomed in Italy (where they are known as *case dell'acqua* – "water houses"), growing ten times in the period 2010–2017, from 200 to more than 2000. Some of them dispense water for free, meaning that it is paid by a Municipality. Their distribution across the Country, however, is uneven, as they are more present in Northern Italy.[42] As hinted at above, this, too, can be said to embody the idea of collective use of public goods: as these belong to the whole community, they can only be commodified provided that either their free use continues to be possible (in the case of water, through public fountains), or some mechanism is put in place to make the commodity affordable to all (Cavallo Perin 2018), as we will see next.

11.4.2 The Legal Recognition of the Right to Water

Above, reference has been made to the fact that many countries in the world have welcomed the emergence of the right to water by incorporating it in their own constitutions, thereby sanctioning it in the most valuable way from the legal point of view. Therefore, the first aspect to be addressed here is how the Italian constitutional system deals with this matter.

11.4.2.1 The Constitution's Silence as to the Right to Water

Italy's 1946 Constitution, still in force despite some more or less impactful amendments, does not cite the right to water. This is not surprising at all: much like its fellow European post-World War II constitutions, and unlike some of its younger sisters guarding extra-European legal systems, the Italian Constitution does not provide for a detailed list of all rights to which human beings are entitled to, and of course cannot make express reference to recently-born rights such as the right to a clean environment or the right not to be discriminated based on one's sexual orientation.

However, the absence of an explicit mention of the right to water cannot be read as a lack of protection thereof, as recognition of such a right can well be both

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[41] The survey, conducted by Cittadinanzattiva with the support of many fellow NGOs, is titled "Le percezioni e le abitudini dei cittadini nell'uso della risorsa e del servizio idrico" (5 June 2020) www.cittadinanzattiva.it/files/notizie/consumatori/Presentazione_dati_Consultazione_acqua.pdf. A sample of 2574 people was surveyed.

[42] L. Tadini, *La situazione delle Case dell'Acqua in Italia* (11 October 2017) http://docplayer.it/69185431-La-situazione-delle-case-dell-acqua-in-italia.html. An (amateurish) attempt at mapping water kiosks has also been made: https://gwsonline.it/case-dell-acqua-italia/#:~:text=Le%20case%20dell'acqua%20in,Kg)%20per%20ogni%20chiosco%20installato

implicit and indirect. It is implicit if the rights enshrined in the legal instrument at issue can be said to contain other rights. So, the right to water has been deemed to be (possibly) included in several provisions of the Constitution, mainly Articles 2 (a general recognition of "inviolable human rights") and 3 (recognition of the "equal social dignity" of all people and establishment of the "State's duty to remove social and economic obstacles to the attainment of human liberty and equality") (Briganti 2012, pp. 46–47), but also Articles 32 (right to health, which as seen in Sect. 11.2 is strictly linked to the right to water, as this is married to the right to sanitation) (Sileoni 2016; De Martino 2017; Toresini 2019), 9 (protection of landscape), 44 (promotion of land reclamation by the State) and 117, letter (s) (protection of the environment and the ecosystem, although this is not phrased as a human right but as an exclusive competence of the State as opposed to Regions[43]) (Frosini 2010a, b; Nicotra 2016). Finally, other constitutional norms that have been associated to the right to water are Articles 14 (inviolability of domicile) and 36 (right of the worker to a wage whereby she can ensure a free and dignified life) (Louvin 2018, p. 219), and even 27 (prohibition of the death penalty) (Staiano 2011) and 53 (tax progressivity) (Crismani 2016, who, perhaps a bit oddly, cites also Article 34 on the right to education).

Article 2 is, for obvious reasons, of particular interest. It is a provision affirming that all human rights are defended by the State, so that it appears to be the perfect frame where the right to water can be put. However, the open-ended character of any norm is a matter of interpretation only, and if this can be true for rules it is even more true for principles such as Article 2, which are generally thought of as being open to legal as well as factual developments (Guastini 2011, p. 177). Although, over the years, Article 2 has been construed by both legal doctrine and the case law of the Constitutional Court as a "closed" and an "open" provision, alternately (Mangiameli 2006), today it seems that the latter interpretation is to be preferred. Thus, for instance, the right to life has been defined a fundamental right by the Constitutional Court even though, strange as it may sound, it is not listed among the rights protected by the Italian Constitution[44]: in this case, too, it is almost unnecessary to stress the link between the right to water and the right to life, from which the former has been often derived (the 2010 UN Resolution itself declared the right to water a right "that is essential for the full enjoyment of life and all human rights"). Moreover, as it has been aptly pointed out, it would be sensible to open the reading

[43] Of course, an individual and collective right to a healthy environment has been singled out and refined over the years by the Constitutional Court in its case law (Della Giustina 2020). However – as a demonstration of the advantages of clear and straightforward choices – the option of amending the Constitution so as to include such a right has surfaced many times in doctrinal and political debates. As of 2020, no less than seven legislative proposals have been deposited at the Senate, and five at the Chamber of Deputies (the two houses of the Italian Parliament).

[44] Constitutional Court, judgment no. 54 of 15 June 1979. The judgment, that was about the extradition of a person to a country where the death penalty existed for the crime he was accused of, also extended Art. 3 of the Constitution to foreigners – although the text of such provision grants the right to equality before the law to Italian citizens only – as a fundamental right was at stake.

of Article 2 so as to include the right to water, in light of the fact that Italy voted in favour of the 2010 Resolution (Nicotra 2016).

This observation brings us further. As said, the protection that the Italian Constitution bestows upon the right to water can also be indirect, that is, it can be granted by other legal sources to which Italy is bound by means of constitutional provisions. Three are the ways through which this right may enter the Italian legal system. If the right to water stemmed from a treaty Italy is bound to – meaning with this either an explicit or implicit recognition – then it would become one of Italy's norms by virtue of Article 117 of the Constitution. If such a right where to be found in a legal instrument of the European Union, be this source of first- or second-level, the relevant constitutional provision would be Article 11 (though coverage, *par ricochet*, of the European Convention on Human Rights as well must be excluded).[45] Finally, should the customary nature of the right to water be established, this would be part of Italy's catalogue of rights thanks to Article 10 of the Constitution. As all these routes lead to slightly different legal outcomes, the unclear basis of the right to water is not devoid of consequences in the Italian legal order.

The first such consequences, and most important one, affects the rank of the norm of external origin in the Italian hierarchy of norms. Treaty-based rules and principles have the rank of the legal instrument to which the legislator resorted in order to implement the treaty in Italy: although such instrument will almost invariably be a mere law, Article 117 will confer to it special resistance to modification or abrogation by a subsequent, conflicting law, in spite of the *lex posterior* principle. In other words, the law enacted to incorporate a treaty norm ranks between "ordinary" laws and the Constitution (so-called *norma interposta*). Customs accessing the Italian legal system via Article 10, instead, gain constitutional value and must be reconciled with norms of equal rank at variance with them, unless one such norms is displaced by the other according to the *lex specialis* principle. Lastly, norms entered through Article 11 (EU norms) have supra-constitutional status, albeit they will still succumb if at odds with the fundamental rights enshrined in the Constitution. The rank of norms having multiple legal origin is the highest they are entitled to, that is, a constitutional or even supra-constitutional level.

Norms passing into Italy's legal system by way of Articles 10 and 11 *de facto* share a common rank, but differ in how a conflict with other norms is managed. A contrast with a norm of customary derivation is always dealt with by the Constitutional Court, which expunges from the legal system norms having lower level, or prevents the custom from entering the legal system if incompatible with a constitutional fundamental right. In case Article 11 is the doorway, the lower-ranking domestic norm in conflict with the norm of EU origin can be directly

[45] Even though, by means of Article 6 of the Treaty on European Union and Article 52(3) of the Charter of Fundamental Rights of the European Union, EU law kind of "absorbs" the rights of the European Convention, among which the right to water can be read (see *supra* Sect. 11.2.3), the Constitutional Court traced the protection of the Convention's rights back to Article 117: judgments nos. 348 and 349 of 22 October 2007 and, after the entry into force of the Lisbon Treaty, no. 80 of 7 March 2011.

disapplied by the judge in the case at hand (who, however, cannot struck it down permanently), whereas if a clash with the EU norm involves the basic rights protected by the Constitution, the *Consulta* becomes protagonist again. The Court is also judge of all tensions between "pure" domestic law and norms stemming from treaties pursuant to Article 117. If a norm has multiple legal bases and one such bases is European, the procedure *ex* Article 11 is followed.

Procedural issues are perhaps more likely to arise than those relating to hierarchy. Since the part of the Italian Constitution that is not devoted to fundamental rights can hardly be afoul of any international norm (as it deals with organisational aspects of the State), the right to water will be put at risk only by a conflicting constitutional right. This, too, is quite implausible, although it cannot be excluded categorically. For instance, should the right to water develop in the direction that some hope for and foreclose the possibility of privatising water services[46] – something it is not advisable to bet on – a clash with the freedom of enterprise could occur (but Article 41 of the Italian Constitution, which recognises this freedom, also states that economic liberty cannot go against the social interest and human dignity). Perhaps a bit more probable is the event of a conflict with the preservation of nature, as the environment could suffer, in principle, from unsustainable water abstraction aimed at fulfilling the right to water. At any rate, even in the unlikely case of a contrast, the right to water would not necessarily be trumped by the constitutional right at variance with it, as it might be granted the same level by virtue of it being a fundamental right itself. Thus, the *Consulta* would have to find a way to harmoniously blend the two rights, based on the principle of the "maximum expansion of rights" (*massima espansione delle garanzie*).[47] This would allow the Court to impede, on the one hand, that a higher domestic protection be diminished by means of external law, and on the other, that a higher international protection be precluded due to the application of domestic law. The latter effect, in particular, can be ensured by "expanding the potentialities of the constitutional norms that concern the same rights" as those granted by external sources, an idea that is arguable capable of accommodating also rights not explicitly mentioned in the Constitution, provided that a form of kinship can be detected.[48]

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[46] See *supra* Sect. 11.4.1.

[47] See Constitutional Court, judgment no. 317 of 4 December 2009, referring to the protection offered by the European Convention of Human Rights. A position that could be traced back to more or less the same principle, but in relation to Article 11 rather than Article 117 sources, is in Constitutional Court, judgment no. 227 of 24 June 2010, where EU law was said to find a limit in the basic tenets of the Italian constitutional order, as well as in the "greater protection" (*maggior tutela*) of human rights. Neither judgment, though, provides a conflict rule whereby clashes of different constitutional rights can be solved. This is, however, what the Court is interested in, from a systemic point of view: Constitutional Court, judgment no. 264 of 19 November 2012. Anyway, the Court partly distanced itself from this approach with judgment no. 49 of 14 January 2015, where it declared the "axiological prevalence" of the Italian Constitution with respect to other sources of human rights. These and other judgments are discussed in Colacino (2018).

[48] For the possibility that an unexpressed right is spoken of as if it were a fundamental right, see, e.g., Constitutional Court, judgment no. 93 of 8 March 2010.

In light of these complex juridical technicalities, the express inclusion of the right to water in the Italian Constitution would be providential. Actually, some proposals were put forth in Parliament – in July 2002,[49] May[50] and October 2006,[51] July 2009,[52] and March 2013[53] – to recognise water as a human right or access to water as a fundamental right by amending Article 2,[54] but none of them made its way to the discussion stage. Apparently, it seems that after 2013 similar proposals ceased to be presented, which is somewhat curious given the far greater attention that water issues have drawn in the wake of the 2011 referendum.

The other straightforward option available to dispel the problem of the lack of a constitutional encapsulation of the right to water would be the sanctioning of such a right by the constitutional judge. Unfortunately, thus far the *Consulta* has never uttered unequivocal and definitive words about this. Up till the end of the 2000s, on the very few occasions when the Court had spoken about water using the language of human rights, it had defined water as a "primary good" and a "resource to be safeguarded" in the context of the fundamental right of people (including future generations) to the integrity of the environmental heritage.[55] Put differently, the Court had carved out a sort of collective right to clean water, without touching upon other aspects such as universal accessibility and affordability. In more recent times, the constitutional judges went as far as characterising water as a "good of everyone" – which is in fact a mere description of the status of water resources in Italy – to be utilised "according to solidarity criteria" and distributed based on principles of "rationality", "impartiality" and "fairness" to be established by the law. They also said that all people have the right to access to water, so that this resource cannot be used in a way that advantages some users to the expense of others.[56] However, albeit important, this stance has had no bearing on the qualification of water for the purpose of the partition of competences between State and Regions.

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49 Atto Senato no. 1593 (11 July 2002) www.senato.it/leg/14/BGT/Schede/Ddliter/18002.htm

50 Atto Senato no. 237 (4 May 2006) www.senato.it/leg/15/BGT/Schede/Ddliter/24564.htm

51 Atto Camera no. 1776 (4 October 2006) http://leg15.camera.it/_dati/leg15/lavori/schedela/trovaschedacamera_wai.asp?Pdl=1776

52 Atto Camera no. 2628 (22 July 2009) https://leg16.camera.it/126?pdl=2628

53 Atto Camera no. 174 (15 March 2013) www.camera.it/leg17/126?pdl=174

54 On this regard, it can be noted that such an addition would be legitimate, as it would not "undermine or modify the essential content" of the "highest principles" on which the Italian Constitution is based – an intransgressible limit that the Constitutional Court has put forth in its case law: see Constitutional Court, judgment no. 1146 of 15 December 1988.

55 Constitutional Court, judgment no. 259 of 10 July 1996. Along the same lines, Constitutional Court, judgment no. 419 of 12 December 1996.

56 Constitutional Court, judgment no. 273 of 7 July 2010. The reference to solidarity was also present in judgment no. 259 quoted in the previous footnote, if only because a solidarity-driven use of water was mandated by Law no. 36/1994 – and now by Legislative Decree no. 152/2006.

11.4.2.2 The Characterisation of Water Services and the Ensuing Allocation of Competences

Although, in the opinion of the Constitutional Court,[57] the powers of Italian Regions in environmental matters have not been totally erased by the 2001 constitutional reform that has attributed exclusive competence in this field to the central Government (the abovementioned Article 117, letter (s)), when asked to decide on Regional legislation on water services the Court has taken an anti-devolutionary approach that led it to consistently reject any attempt at bringing such services outside of the State's competence.[58] The *Consulta* did so by putting the integrated water management system into the spheres of protection of the environment and, also, promotion of competition (Article 117, letter (e), of the Constitution)[59] – in this latter case, too, retracting the idea that Regions could legislate in matters of competition notwithstanding the clearly-stated attribution of such ambit to the State.[60] By conceiving water services as part of the State's policy to safeguard the quality of water resources (environment) and furthering economic efficiency in the management of an expensive public activity (competition), the Court has so far renounced to underscore the human rights dimension of both water provision and sanitation. A different message could have been sent by placing water services (also) under Article 117, letter (m), relating to the "setting of the basic levels of the performances in the implementation of civil and social right that must be ensured over the whole Italian territory", a solution some scholars have advocated for (Staiano 2011; Nicotra 2016; Toresini 2019).

The effects of such an apportionment of competences did not remain on paper. In 2010, with Regional Law no. 2/2010, Campania chose to define its water service as a service of non-economic importance (Article 1, Paragraph 1); the same did Marche with Article 40, Paragraph 2, of Regional Law no. 16/2010.[61] This could have

[57] Constitutional Court, judgment no. 407 of 10 July 2002 (re-affirming its pre-2001 reform case law).

[58] This was in fact part of a broader institutional conflict on water governance between State and Regions, on which see, in this volume, Chap. 15 by Alberton.

[59] See, recently, Constitutional Court, judgment no. 173 of 6 June 2017.

[60] Constitutional Court, judgment no. 14 of 18 December 2003.

[61] The qualification of public services as non-economic in nature would move them outside the sphere of exclusive competence of the State: see Constitutional Court, judgment no. 272 of 13 July 2004. As to water services in particular, this might not be enough to confer some legislative power to Regions, given that such services belong to the reserved domain of the State also for their environmental purpose. In the same judgment the Court also tied, as it will eventually do in judgment no. 325 cited in the subsequent footnote, the domestic notion of "economic importance" (*rilevanza economica*) in with the EU concept of "service of general economic interest": to the purpose of this chapter, it is interesting to note that under Article 36 of the EU Charter of Fundamental Rights (Title IV – Solidarity), "[t]he Union recognises and respects access to services of general economic interest as provided for in national laws and practices, in accordance with the Treaties, in order to promote the social and territorial cohesion of the Union". However, for the EU Charter Explanations this sentence "does not create any new right" and adds nothing to Article 14 of the Treaty on the Functioning of the European Union (OJ C 303, 14 December 2007, p. 27). The EU Court of

opened the door to a non-efficiency-oriented management of the service based on social values rather than market concerns (on this kind of services, Midiri 2017). The Constitutional Court struck down those provisions, deeming them in violation of the exclusive competence of the State in the field of competition.[62] Indeed, water companies must break even and this must primarily happen through the users' fees, that is, water tariffs:[63] that these, just like any other issue relating to the provision of water services, fall within the scope of action of the State in matters of competition and the environment, is a well-established principle in the case law of the *Consulta*.[64]

But other Regions bore the brunt of this approach. Through Article 8 of Regional Law no. 1/2009, Lombardy provided for the determination of the water tariff "in accordance with Regional norms, which also take into account the need to […] articulate the tariff based on territorial areas and disadvantaged users". Such article was abolished by the Constitutional Court.[65] Parts of Regional Law no. 17/2012, too, with which Veneto set the criteria to define the tariff (one such criterion being based on the income of the user), was deemed to be illegitimate by the Court for the very same reasons.[66] Also, with Regional Law no. 19/2015 Sicily reformed its water service by introducing several elements inspired by social considerations. Article 4

Justice, in turn, becomes quite elusive any time Article 36 is invoked: see Court of Justice of the European Union, judgment of 7 September 2016 in case no. C-121/15; judgment of 3 October 2019 in case no. C-285/18; judgment of 30 April 2020 in case no. C-5/19 (in any case, such decisions are still of some relevance as they expand the Court's case law on the "dos and don'ts" in matters of provisions of services of general economic interest – thus comprising, in Italy, water services). More explicit is Protocol no. 26 attached to the Treaty on the Functioning of the European Union, according to which the "shared values" evoked by Article 14 of the Treaty include "a high level of quality, safety and affordability, equal treatment and the promotion of universal access and of user rights" (OJ C 115, 9 May 2008, p. 308).

[62] Constitutional Court, judgments nos. 325 of 3 November 2010 (Campania) and 187 of 8 June 2011 (Marche).

[63] Under EU law, services of general economic interest are understood as services provided in return for payment unless competition rules prevent them from accomplishing their tasks in the general interest. The principle of integral coverage of costs says nothing on the way such expenses can be apportioned between private users and the State (whose support can be scrutinised in the light of EU State aid law): as to water services in particular, the WFD, in setting out the principle of the full recovery of costs, requires that all categories of users (including households) pay an "adequate contribution", but also clarifies that Member States may "have regard to the social […] and economic effects" of the resulting allocation of costs (Article 9). It should be recalled that, in spite of Article 154 of Legislative Decree no. 152/2006, mentioned below, the *Consulta* clarified that water service revenues "may have any origin, including public funds": Constitutional Court, judgments nos. 325 of 3 November 2010 and 26 of 12 January 2011. Such an approach is capable of sheltering the right to water from any unbridled application of free market logic.

[64] Constitutional Court, judgments no. 246 of 16 July 2009; no. 29 of 27 January 2010; and no. 117 of 12 May 2015.

[65] Constitutional Court, judgment no. 142 of 14 April 2010. For the sake of precision, Regional Law no. 19/2015 referred to "*zone territoriali e soggetti svantaggiati*", which could also be translated as "disadvantaged territorial areas and users" (which would have implemented social concerns in both an individual dimension and a collective one).

[66] Constitutional Court, judgment no. 67 of 8 April 2013.

of the law set out that, in the event of disruption of the service, the provider had to be subjected to hefty penalties (Paragraph 4), and the users would have benefitted from a reduction of tariffs (Paragraph 6); other discounts (50%) were to be granted to users who were not provided with potable water (Article 11). Article 4, Paragraph 12, set up a solidarity fund for people having difficulties in paying the water bills, to be financed through the collecting of tariffs. Above all, Article 10 recognised the human right to water, which translated into the right to get 50 litres daily under any circumstances, with no disconnection for people being in arrears. Some (though not all) of these provisions, too, were quashed by the Court.[67]

This attitude of the *Consulta* appears to be somewhat in contrast with the activism shown by local governments, especially in the aftermath of the 2011 referendum. Even though their deeds are basically devoid of any practical consequences, many such entities have made the symbolic decision of recognising the right to water in their charters. For instance, Article 8, Paragraph 2, of the Regional Statute of Veneto (*Legge regionale statutaria* no. 1/2012) grants "every individual the right to a daily minimum quantity of water as part of the right to life", a step also taken by Umbria (Article 11 *bis* of *Legge regionale statutaria* no. 21/2005, as subsequently modified). Municipalities, too, amended their statutes along the same lines, starting from Italy's capital, Rome (Article 2); but also other important cities like Turin (Article 2), Milan (Article 79), Bologna (Article 2) and Florence (Article 11), together with a number of medium-to-small towns, Reggio Emilia (Article 13) and Faenza (Article 1) being just two examples. In these provisions, several adjectives are attached to this right (e.g., both "individual" and "collective", or "inviolable") and, as also remarked in the previous sub-section, its recognition is often combined with the idea of water being a common good.[68]

All these legal instruments, however, have no actual effects on citizens' rights and cannot trump the existing legislation or case law. The qualification of water provision as a service of economic character[69] and the collocation of this activity in the context of competition must be considered a given. Consistently, the Italian legislator sees the management of the integrated water service as a commercial transaction where fees are conceived as the payment (*corrispettivo*) for a service (Article 154, Paragraph 1, of Legislative Decree no. 152/2006). This understanding impacts the right to water in two different, albeit symmetrical, ways.[70] On the one

[67] Constitutional Court, judgment no. 93 of 7 March 2017. The case is of particular interest because Sicily is, together with other four Regions, a so-called *Regione a statuto speciale*, enjoying a certain degree of legislative autonomy (Sparacino 2017; Basile 2018).

[68] To the Municipalities that took this step – more than those named in the text – other ones should be added were such a recognition was proposed by members of the Municipal Council or even voted as a motion by the Council's majority. In many such documents water was defined a common good devoid of economic importance (a further demonstration that all these concepts are usually seen as intertwined).

[69] See *supra* Sect. 11.4.1.

[70] Irrespective of such impacts, it has been maintained in a more principled way that this commercial characterisation of the water service naturally conflicts with the human right to water, which should be inspired by social considerations. Still unfriendly to this right would thus be the choice,

hand, the notion of "*corrispettivo*" entails the possibility for the water service manager to suspend the provision of water to people who do not pay their bills (especially if this does not occur because of lack of financial means). Occasionally, public officials have issued ordinances suspending the suspension of the service – this has been the case for several mayors, who, as we have just seen, are quite active in safeguarding the right to water of their fellow citizens – but almost invariably such moves have been stopped by courts. For instance, the Regional Administrative Tribunals (TARs) of Tuscany,[71] Lazio,[72] Campania,[73] Apulia,[74] Sicily[75] and Sardinia[76] have repeatedly declared illegitimate some Municipal orders imposing the continuation of water provision to non-paying users, despite the absence of demonstrated risks to public health and hygiene, and sometimes because of the lack of any indication of the date of cessation of the Municipal measure. This because, in the eyes of the judges, the right to water does not mean that provision must be ensured irrespective of the payment for the service (on the logic of such rulings, and their possible shortcomings, Cauduro 2017). Judicial decisions by TARs to the contrary are hard to find, and they tend to reiterate rather than defy the logic of the abovementioned judgments. Thus, for example, the TAR of Calabria sided with a Municipality that, despite being unable to pay the water service provider, ordered the latter to go on carrying out the service. The reason was that the company had threatened to interrupt the water provision without clarifying the modalities and timing of the suspension, so that the ordinance was the only option available to the mayor to guarantee that crucial activities like those of hospitals, schools and fire stations be preserved.[77]

On the other hand, the idea of "*corrispettivo*" also implies that users only pay for what they get. This was stated by the Constitutional Court itself, that erased some provisions requiring the payment to the service provider of a fee relating to the

also hinted at here below, of differentiating the conditions of water provision according to the types of users, e.g., first homes and touristic resorts (Urbinati 2015, pp. 588–590). We do not share this view, for the simple reason that, as currently understood, the right to water does not imply that water services be removed from the orbit of economic services. The mere fact that no one is left without water is enough for declaring the right to water fulfilled, provided that the payment for water supply does not weigh too much on the user's budget. In other words, fulfilment of the right is construed less as a means than as an end.

[71] Regional Administrative Tribunal – Tuscany (Florence), Sect. I, judgment no. 712 of 22 May 2018.

[72] Regional Administrative Tribunal – Lazio (Latina), Sect. I, judgments no. 711 of 8 October 2015 and no. 773 of 19 November 2015.

[73] Regional Administrative Tribunal – Campania (Naples), Sect. V, judgment no. 5482 of 8 October 2015.

[74] Regional Administrative Tribunal – Apulia (Lecce), Sect. I, judgment no. 1189 of 6 July 2016 (quoting previous judgments along the same lines).

[75] Regional Administrative Tribunal – Sicily (Palermo), Sect. III, judgment no. 290 of 25 January 2013.

[76] Regional Administrative Tribunal – Sardinia (Cagliari), Sect. I, judgment no. 855 of 10 June 2015.

[77] Regional Administrative Tribunal – Calabria (Catanzaro), Sect. II, judgment no. 358 of 22 March 2012.

purification of water even when no treatment plant existed or it was not working.[78] Moreover, the principle, which has then been confirmed by case law dealing with similar real-life cases,[79] does not only entail that no payment is due for the part of the service that is not actually performed, as it also means that the amount of the payment for the service that is carried out must be commensurate with the quality of such service.[80] This assumption, too, has been systematically validated by Italian courts at least in the last twenty-five years.[81] Although the details of the principle are perhaps still to be consolidated in a coherent picture, it can be said that users who are not provided with drinkable water do not owe the full price to the providing company, something that can take the form of a discount on that price (usually, an equitable 50% decrease of it),[82] of a forfeiture of the payment of the fee for the (malfunctioning) water treatment service, or of a waiver of water charges for the period covered by a Municipal ordinance of non-potability of tap water. If users incurred in additional expenditures for supplying themselves with the water needed for domestic purposes, the service manager may be required to reimburse these costs, too. After all, non-provision of decent-quality water is a contractual breach, responsibility of which is carried by the service provider even if non-compliance is mainly attributable to third parties. In other words, in order not to be found guilty the provider must demonstrate its due-diligence commitment to finding alternatives to circumvent the problem.[83]

The principle underlying these examples, and that has found application to similar cases such as the relationship between landlord and tenant (where the former does not ensure the latter clean tap water),[84] reveals the limits of thinking of these

[78] Constitutional Court, judgment no. 335 of 8 October 2008.

[79] See, *inter alia*, Council of State, judgment no. 3920 of 31 May 2011; Court of Cassation, III Civil Sect., judgment no. 8318 of 15 February 2011; Court of Cassation, VI Civil Sect., judgment no. 25112 of 12 November 2015; Court of Cassation, III Civil Sect., judgment no. 3314 of 16 October 2019; Justice of the Peace of Pozzuoli, judgment no. 2652 of 17 July 2013. In the last judgment, albeit referring to the contract at issue, the judge identified three distinct services: water provision, collection and removal of wastewater, and purification of wastewater. More generally, it seems that the payment for the water treatment service is not due even if it is bound to flow into a fund aimed at financing the building of a treatment plant.

[80] Incidentally, the threshold beyond which water is to be considered "flawed" can be debated, and the limit values set by the law for potability are not necessarily the only parameter. On this aspect, a judge has recently rejected the thesis of a Municipality that no contractual breach had occurred because of the difference between the notions of water for domestic use and drinking water (Tribunal of Viterbo, Sect. I, judgment no. 699 of 29 May 2019).

[81] Justice of the Peace of Reggio Calabria, judgment of 2 January 1997 (see *Il Foro Italiano, 120*(5), 1658–1663).

[82] *Ibidem*; most recently, Tribunal of Viterbo, Sect. I, judgment no. 699 of 29 May 2019 (but, in between, other judges have taken this approach based on equity, like the Justice of the Peace of Civita Castellana in 2013). An alternative option is the application of the tariff for "raw" (i.e., non-purified) water: see Justice of the Peace of Cagliari, judgment no. 1453 of 31 December 2018.

[83] Court of Cassation, judgment no. 2182 of 13 October 2015.

[84] Tribunal of Mantua, judgment of 11 February 2014. On this, cf. Art. 5, Para. 2, of Legislative Decree no. 31/2001.

user's guarantees as a (market-informed) manifestation of the right to clean water. Even if the rulings hinted at above have generally been hailed by lawyers and consumer rights groups as progressive, they actually hinge on torts law and, as such, they see the right to clean water just as one end of the commercial relation inherent in a contract. Therefore, all technicalities and constraints of liability cases are of potential application.[85]

11.4.2.3 The Many-Sided Implementation of the Right to Water

It appears that the right to water must be sought after elsewhere. Speaking of clean water, for instance, one can note that the duty of the State to ensure the salubrity of water reaching consumers through any distribution system (aqueducts and pipelines, tankers, and bottles) is set and detailed at the European level by Directive no. 98/83/CE (implemented in Italy with Legislative Decree no. 31/2001), lastly amended by Directive no. 2015/1787 (implemented in Italy with the Decree of 14 June 2017 of the Ministry of Health and the Ministry of the Environment). Although – as documented in another chapter of this volume, dealing with pollution[86] – defilement of water resources is an issue in Italy, from a normative point of view the Country's efforts must be recalled to keep its legislation in line with EU rules. An interesting example is represented by Article 7 of the WFD, which requires Member States to protect aquifers destined to the abstraction of drinking water and, if needed, establish safeguard zones. Italy complied with this requirement through Article 94 of Legislative Decree no. 152/2006: even if good water status is seldom attained, Italy is one of the EU countries that set up the largest number of protected areas (Scheidleder and Visser 2012). Noteworthy is also the new Drinking Water Directive that will replace Directive no. 98/83/CE, since, as hinted at previously, the former will likely mention access to water as a right.

The multifaceted right to water, however, has different components, or manifestations. One of them is the principle of priority of uses, which ultimately aims at preserving the quantity as well as quality of water used for domestic purposes. Article 2, Paragraph 1, of Law no. 36/1994 established that human consumption of water takes precedence over all other uses, which are admitted insofar as the resource is enough and they do not impinge on the safety of drinking water. Eventually, the law was *de facto* repealed and the content of that provision was passed into Article 144, Paragraph 4, of Legislative Decree no. 152/2006. Moreover, under Article 167, Paragraph 1, of the same decree, the hierarchy of water uses sees the addition of a further layer, as it is stated that "during droughts or, more generally, whenever water resources are scarce, when access to these is restricted, priority is to be ensured, after human consumption, to agricultural uses". Interestingly, the

[85] For instance, in a case the water company was not found liable for the scarce quality of water as the problem depended on a part of the distribution network that was not covered by the concession: Regional Administrative Tribunal – Tuscany (Florence), Sect. I, judgment no. 712 of 22 May 2018.

[86] See, in this volume, Chap. 7 by De Santis and Fermeglia.

word "consumption" appears in both the decree and the law that preceded it: even though the water used for other domestic purposes (such as sanitation) is not, *stricto sensu*, consumed, it is likely that such uses are comprised in that notion. Perhaps for the sake of clarity, one of the two abovementioned bills deposited at the Italian Parliament makes explicit that priority uses are those related to "nutrition and human hygiene" (Article 3, Paragraph 3, of Bill no. C.52); the same was also true for two previous bills, no. C.2212 (Article 3, Paragraph 3)[87] and no. S.1845 (Article 2, Paragraph 3).[88] The other standing legislative proposal – Bill no. C.773 – sticks with the idea of consumption (Article 2, Paragraph 4) but, as it considers water supply for drinking and sanitation purposes a human right, then it is reasonable that both uses take precedence over other ones. Industrial or agricultural uses that can be linked to nutrition and human hygiene, such as the washing of food for mass distribution, might be covered as well by the priority principle (this is, in fact, the only theoretically problematic application of it).[89]

Prioritising human consumption, whatever this idea may cover, entails major consequences. Here we stress just one, the non-intangibility of concessions, which, if the resource is claimed back for reasons related to the protection of water flows or the satisfaction of basic human needs, can be amended or extinguished with no redress for the concession-holder.[90] One of the first cases where a judge ruled to this effect saw the Regional Tribunal for Public Waters in Rome reject the complaint of a hydroelectric powerplant against a decision aimed at curbing the volume of water written down in the concession agreement[91] (for a comment, also recapping the traditional threefold category of water uses under Italian law, Di Dio 2008). Interestingly, the Tribunal made reference to the Italian Constitution, to international law in matters of the right to health and, more generally, basic human needs. This is now a standard outcome. The most recent example (at the time of writing) concerned, again, a hydropower plant challenged by a Municipality that was experiencing a water deficit: the Court of Cassation allowed the latter to feed its aqueduct by reducing the water previously allocated to the former. No indemnity was

[87] Atto Camera no. 2212 (20 March 2014) www.camera.it/leg17/126?tab=1&leg=17&idDocumento=2212. The bill's first signatory was the same MP who is also first signatory of Bill no. C.52, which has been proposed as an updated and expanded version of Bill no. C.2212. This had indeed been discussed and amended by the only house of the Parliament (the Chamber of Deputies) that approved it. While it was being discussed by the Senate (under the new name of Bill no. S.2343), the legislature ended.

[88] Atto Senato no. 1845 (2 November 2009) www.senato.it/leg/16/BGT/Schede/Ddliter/34420.htm

[89] It might be useful to know that agricultural and industrial uses do not correspond to agricultural and industrial users as for the integrated water service. If water used to cool down a machine in a production plant is an industrial use for sure, the water service only provides water to, say, the restrooms for office workers, or the showers for workmen. The factory (that stipulated the service contract) is an industrial user only in respect of the latter uses.

[90] On this possibility see again, in this volume, Chap. 5 by Boscolo. For a similar case, see *supra* n. 37.

[91] Regional Tribunal for Public Waters – Court of Appeal of Rome, judgment no. 12 of 4 February 2008.

awarded to the plaintiff; at best, it might be entitled to a renegotiation of the terms of the concession agreement.[92]

The Right to Water as a Negative Right

The right of domestic users not to be deprived of the water required to meet their vital needs can take another form, individual rather than collective. Actually, the former kind can be both positive and negative in nature. It is negative if someone is prevented from taking water away from someone else (this corresponds to the obligation to fulfil or the obligation to protect under human rights law, depending on whether water is provided directly by the State or not). This is another typical feature of the right to water: the prohibition of disconnection of a user from the water network. As with other components of the right to water, Italy has done a remarkable leap forward in this regard in the second half of the 2010s.

With Article 61 of Law no. 221/2015 (so-called "*Collegato ambientale*"), the legislator required the Government to enact rules with a view to limiting default by water service users, while respecting these people's right to the amount of water required to satisfy their vital needs. This was done through the Decree of the President of the Council of Ministers of 29 August 2016, whereby the Government distinguished between vulnerable and non-vulnerable households and prohibited the disconnection of the former from the water network. As demanded by Law no. 221/2015, the decree also entrusted the Regulatory Authority for Energy, Networks and the Environment (*Autorità di Regolazione Energia Reti Ambiente* – ARERA)[93] with the task of detailing the rules concerning modalities and timing in the management of cases of payment default. For a few years, ARERA worked on a regulation, which was eventually approved in 2019 with Decision no. 311/2019/R/IDR,[94] in force starting from the beginning of the subsequent year.

Decision no. 311/2019/R/IDR sets out quite a complex framework. In essence, it reiterates that households[95] experiencing socio-economic hardships (whose

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[92] Court of Cassation, Joint Civil Sects., judgment no. 11126 of 14 January 2020.

[93] The important role of ARERA in the water policy of Italy is discussed in many other chapters of this volume: see the Index for learning all references.

[94] The Decision, made in July 2019 but modified later that year, is to be read together with its Attachment, which contains the actual rules on default. The attachment, too, has been repeatedly amended, through Decisions nos. 547/2019/R/IDR, 186/2020/R/IDR and 221/2020/R/IDR (www.arera.it/allegati/docs/19/311-19remsi.pdf)

[95] In Article 7, Paragraphs 6 to 8, the Decision explicitly addresses the case of blocks of flats, which, despite hosting multiple households, usually stipulate a common contract of service with the managing company. This serves the purpose of protecting the majority of residents against the minority – possibly only one household – that defaults on its water bills. Before ARERA stated clear rules on this circumstance, case law – which in the 2010s had been abundant – was mixed. Some tribunals had ruled that turning off the tap of the defaulting resident was prohibited as it would have been in breach of the right to health enshrined in Article 32 of the Constitution; many other courts, however, had stated the opposite, by saying that the paying residents' right not to be

definition is provided)[96] cannot, under any circumstances, be denied water supply; to such a class of users another one is added, related to "public uses": examples being hospitals, rest homes, schools and prisons. All other users can see their service contract terminated (meaning complete deactivation of the service), but only if certain strict conditions are all met: the water bill debt must have reached a given, non-negligible threshold; the service provider must have urged the payment of the amount overdue, also offering the defaulting user the possibility of paying the arrears in instalments; the provider must have notified the user of the start of a period during which the service is first restricted (by limiting water provision to the supply of a minimum daily amount, on which we return below) and then, after a relatively short time span, suspended. The contract with the user may finally be rescinded if he/she, who still has not honoured the debt, breaks the devices installed by the service manager to limit or suspend the provision of water.

Breaking such devices, by the way, is also a crime. For doing so, in 2014 a couple was convicted for larceny and, despite the unfortunate situation they were going through (the pair had two children, one of them a toddler, the women was pregnant, and the family was in economic distress), the Court of Cassation said the action of the parents could not be justified by invoking the state of necessity: the reason for this was the existence of a public fountain in the vicinity of the couple's home, which could have provided the water needed for basic domestic purposes.[97] Given the criminal nature of such a conduct, it is not surprising that breaking a device for limiting or interrupting the supply of water may lead to extinguishing the contractual relationship between user and providing company. It should be noted, however, that it does not take the commission of a crime for having one's service suspended for an indefinite period of time, that is, for being inflicted a "penalty" that is analogous to disconnection. As seen few lines above, defaulting on water bills suffices to this end, if the arrears become too large. As people who cannot afford to pay cannot be refused water provision, suspension serves the purpose of discouraging free-riding by those who are deemed to be able to pay. There are many such people, unfortunately: in Southern Italy (including the islands), as many as those who are

disadvantaged be the presence of another resident unwilling or unable to pay was overriding. The latter approach had also manifested itself with a particular slant: according to some judges, a resident could be legitimately suspended the supply of water even if his/her debt did not concern the water bill, as in an apartment complex the default on a payment (e.g., of the rent) can be "fined" with the interruption of a service unrelated to the object of the (non-)payment.

[96] Although there are other private users who cannot be denied water provision, the main category of such users is that of the recipients of the so-called "water bonus". In 2020, being entitled to such a bonus required an ISEE (*Indicatore della situazione economica equivalente* – Index of Equivalent Economic Condition) amounting to less than ca. €8.200 (as per Decision no. 499/2019/R/COM). Just as a term of comparison with no real statistical value, in 2017 the average ISEE equalled ca. €11.400, whereas the median one (that is, the figure dividing in half the group of Italian households that communicated their own ISEE to the State for social purposes) was slightly less than €7.900 – which, in turn, is slightly less than the ISEE needed to benefit from the water bonus. See Ministero del Lavoro e delle Politiche sociali (2019).

[97] Court of Cassation, Criminal Sect. VI, judgment no. 41069 of 2 October 2014.

needed to cause to water companies a loss of income of 14%, with peaks of 27% in some areas. In this fact lies the reason why, according to some authors, the treatment granted to water service users is too indulgent, and certainly more lenient than that accorded to these people when they are users of other services such as gas and energy (Berardi et al. 2019a, commenting on the provisional Document no. 158/2019/R/IDR, which invited stakeholders to express their opinions). Apparently, this view is not shared by the two bills on the integrated water service deposited at the Italian Parliament. Bill no. C.773 – the more "moderate" of the two – does not change the current scenario, as the minimum daily amount of water can only be granted on a continuous basis to people whose default is "non-culpable" (Article 7), whereas Bill no. C.52 even extends to all users the impossibility of suspending (albeit not limiting) water supply (Article 14).

It is worth recalling that the regulatory work done through Decision no. 311/2019/R/IDR – whose rules are more detailed than those reported here – although mandated by the Government, must be in conformity with the legislation, and with the way the laws have been interpreted by judges. In fact, it is hard to make sense of the composite jurisprudential mosaic in matter of suspension of water services or disconnection therefrom. Before ARERA's clarifying and gap-filling intervention, these options had been the object of many rulings, with several courts deciding in favour of the possibility of resorting to such penalties, and several other judges taking the opposite stance (also by invoking constitutional provisions like Articles 2 or 32).[98] Of interest is, however, also the "chisel work" done by some courts on a number of aspects of the contractual relationship between the user and the service provider, including on the suspension of the service. For instance, in 2000 the Tribunal of Palermo declared unfair, and thus provisionally inhibited from working (pending a judgment on the merit of the controversy), many kinds of clauses: *inter alia*, a clause whereby the defaulting user is negated the right to claim damages for the interruption of the service; a (mirror-like) clause whereby the providing company

[98] These rulings seem to be too many to be quoted here and, moreover, the original text of most of them is really hard to find, so that listing them here would border with recounting anecdotes *de relato*. A lot of observations could be done on the issue: of chronological nature (many judgments referred to – but not all of them! – predate the series of rulings by TARs that, as stated above, recognise the legitimacy of the suspension of the water service: the scenario has changed a lot in recent years, so that the judgment no. 2148 of 21 February 1992 of the Court of Cassation, where the interruption of the water service by a Municipality was deemed to entitle the user to a swift restoration of water provision, unless the Municipal decision had been taken in the public interest, would appear to come out from prehistory, had something similar not been restated by the same Court (Civil Sect. III) more recently, with judgment no. 16894 of 10 August 2016); of organisational nature (the jurisdiction of ordinary tribunals and of TARs runs in parallel, but with points of contact); and of more specific nature. Indeed, innumerable are the differences among the cases: e.g., related to the subject who interrupts the provision of water (a water company, a Municipality, or, as in judgment no. 16894, a landlord), to the user (a single household or a block of flats under a common service contract: see *supra* n. 95), or to other particularities of the facts (for instance, if it can be ascertained that the debt only concerns an appurtenance of the house, such as a garage, the supply of water cannot be suspended for the whole building: Tribunal of Fermo, warrant no. 703 of 23 March 2016). The issue is too complex to be dealt with here in greater detail.

disclaims responsibility for damages caused by such an interruption; a clause bestowing on the water company the right to terminate the contract upon commission by the user of any violation of the service contract.[99] At any rate, it is never advisable to deem a single ruling as a trustworthy expression of the entire legal system.

The Right to Water as a Positive Right

As mentioned above, the individual right not to be left without water has also a positive version, that entails the duty of a government to provide, or ensure the provision of, water to each and every of its citizens (obligation to fulfil). In this respect, too, Italy has recently taken progressive measures that are by and large consistent with the right to water. Before describing them, however, a weak spot of the Italian legislation in the matters of the right to water is worth being hinted at. It is Article 5 of Decree-Law no. 47/2014 (so-called "*Piano casa 2014*") that, with a view to discouraging squatting, makes void any formal request by illegitimate tenants, and any consequences thereof, to obtain the connection of the building to public service networks, including the water service. Housing rights activists have been protesting against this norm since its passing, but it has never been repealed. In July 2020, the Regional Council of Lazio voted a motion to commit the Regional Government to open a dialogue with its national counterpart with the purpose of deleting Article 5. The problem would remain, however, for other people living in precarious conditions, such as Roma frequently dwelling in irregular camps.

Squatters apart, the State has taken steps to ensure that residents can effectively enjoy their right to water. This right can be conceived as an entitlement to free water and/or water sold at an affordable price. The latter is, in fact, the standard condition. Although Italy is one of the European countries were tap water is less expensive, its provision at an acceptable cost has been a concern of the legislator at least since the enactment of Legislative Decree no. 152/2006. Two paragraphs of its Article 154 are worth being quoted at length:

6. In modulating the water tariff, benefits for essential domestic uses shall be ensured, also by offsetting these aids against other kinds of uses. Benefits for water consumption by certain categories of users, on the basis of their respective income class, shall also be ensured. In order to pursue the objective of a fair reallocation of costs, tariff increases for non-primary homes, resorts subject to seasonality, and artisan, commercial and industrial businesses are permitted.
7. The modulation of the tariff among different Municipalities shall take into account per capita investments to the advantage of residents possibly made by Municipalities with a view to organising the integrated water service.

[99] Tribunal of Palermo, judgment of 10 January 2000 (see *Il Foro Italiano, 123*(6), 2052–2056). Such an inhibition was anchored not on the damage that the application of the clauses might have caused to the user, but on the nature of the right to be fulfilled, or the need to be met, through the contract.

As it can be seen, that even poorer households can access the water service, especially to satisfy fundamental needs, is a primary interest of the Italian legislator. Since this must be attained without breaching the full-cost-recovery principle, a re-distribution of the overall financial burdens of running the service has to occur. Moreover, as the water tariff has the nature of payment (*corrispettivo*) for a service, expenses incurred in bringing the service to users should be mainly charged to those of them benefitting from the investment measure.

Now, an important question must be answered: how are water services managed in Italy? The integrated water service[100] is entrusted to a service manager (which can be a private company, an in-house public company, or a company based on a public-private partnership) that is chosen by optimal-size-area governments (*Enti di governo d'ambito* – EGAs) superintending "optimal-size" territorial units (*Ambiti territoriali ottimali* – ATOs). ATOs are established by Regions so as to cover a number of Municipalities, which take part in the respective EGAs. Thus, except for a few particular cases, water services are managed by a company selected by all the Municipalities located within the same ATO, according to the principle of the only manager (*principio di unicità della gestione*). But other principles are applicable to the issue. Pursuant to Article 15, Paragraph 1 *ter*, of Legislative Decree no. 135/2009, as converted into law by Law no. 166/2009, and also to Article 1, Paragraph 2, of Decree of the President of the Republic no. 168/2010, the company providing the water service enjoys managerial autonomy, which, however, must be exercised in accordance with the State's property of water resources and right to govern them.[101] This water governance – as Law no. 166/2009 adds – concerns in particular the quality and the price of the integrated water service, in relation to which universality and accessibility must be guaranteed. Article 2, Paragraph 461, of Law no. 244/2007 elaborates on this idea, by stating that "in order to safeguard the rights of consumers as well as users of local public services and to ensure the quality, universality and affordability of such services", when stipulating the service agreement with the managing company, EGAs must set the quantity and quality standards of the service, which must also be included in the service quality charter (*Carta della qualità dei servizi*) that the company must publish and make available to users. Such charter, which should be drafted with the contribution of consumer rights associations – participation in decision-making is part of the right to water, after all – can also include further quality standards in addition to those agreed upon by the managing company and the competent EGA, and the latter has a monitoring duty with respect to the former's compliance with the charter.

In the picture just sketched, an important actor is missing. In Italy's current water governance scheme, a protagonist role is played by ARERA, the independent regulatory body mentioned above. This entity, too, has put forth standards relating to the

[100] On the notion of integrated water service and the legal framework governing it see, in this volume, Chap. 13 by Parisio.

[101] One of the questions proposed in the context of the already mentioned 2011 referendum – a question that, however, was declared to be inadmissible by the Constitutional Court with judgment no. 27 of 12 January 2011 – aimed at the deletion of this part of Article 15, Paragraph 1 *ter*.

quality of the water service (see Decision no. 655/2015/R/IDR), and EGAs can provide for different standards in their service agreements only if such standards improve those set out by ARERA or concern aspects of the water service other than those covered by the Authority's regulations (Article 69 of Attachment A to the quoted Decision). But the responsibility of ARERA goes beyond that. According to Article 60 of Law no. 221/2015, the Authority, "in order to ensure universal access to water, grants households experiencing economic hardships access to water provision as required to fulfil those users' basic needs, under favourable conditions". Indeed, ARERA also has a regulatory function in matters of price-setting. Despite the general stress on competition recurring in the legislation and courts' judgments, water services are a natural monopoly and it is just very sensible for the State to claim a role in controlling prices, especially if important social interests are at stake.

By means of Decree of the President of the Council of Ministers of 13 October 2016, the Italian Government has taken two different but complementary paths in order to ensure the right to water of its citizens. On the one hand, the Government established that a concessional tariff rate must be accorded to all households for their domestic uses of water, up to a certain threshold (Article 2). On the other hand, all households in socio-economic distress must be granted a certain amount of free water for domestic purposes – the so-called "water bonus" (Article 3). For the application of such financial benefits, which are briefly illustrated below, both provisions take as a reference the notion of "minimum vital quantity" of water. Article 1 of the Decree of 13 October 2016 sets this quantity at 50 litres per capita per day, that is, the same amount identified by Article 3 of the abovementioned Decree of 29 August 2016 as the amount of water that must be ensured in any case to those users who cannot be disconnected from the service (and that, according to Decision no. 311/2019/R/IDR, must be provisionally granted to all other users before suspending the service). Interestingly, this is also the same figure that is most commonly quoted in international soft-law documents and grey literature detailing the obligations stemming from the right to water.[102]

Here again, ARERA has been vested by the State with the power – and duty – to implement the social measures launched by the Decree of 13 October 2016. With Decision no. 665/2017/R/IDR, the Authority put forth some rules binding all relevant actors in the determination of the water tariff. Such a tariff is composed of two parts: one fixed that, as per Article 3, Paragraph 1, of the attachment to the just mentioned decision, must mirror the costs incurred in making water supply certain; and a variable part, linked to the amount of water actually used domestically. This

[102] On the features of the right to water according to these documents see *supra* Sect. 11.2. Also of some interest is the fact that, well before international campaigns on the recognition of the right to water led to identifying and then popularising such a figure, Italy had already reached a somewhat similar conclusion. Indeed, Paragraph 8.2 of the Attachment to Decree of the President of the Council of Ministers of 4 March 1996 states that an amount not inferior to 150 litres per capita per day must be guaranteed by the service provider to all users, and that, of this quantity, no less than 50 litres must be potable. These numbers only referred to the minimum amount of water to be provided, irrespective of its price.

latter part is calculated based on growing consumption brackets, according to a progressive approach to tariffs. The number of classes must include a concessional tariff rate, a basic tariff rate, and up to three further rates. The first such tariffs, which is accorded to residential households only but, as already said, to all of them, corresponds to the basic tariffs discounted by 20% to 50% – EGAs are free to choose the percentage that fits their situation best – and covers at least the consumption of the minimum vital quantity. In other words, all domestic users are entitled, in their place of residence, to pay a reduced price for an amount of water that is at least equal to 50 litres per capita per day. The whole fixed component of the tariff, as well as the variable part of it referring to costs for water purification and the sewage system, are not affected by such a reduction in price. However, EGAs are entitled to raise the amount of water above the lower threshold of the minimum vital quantity. Also as a result of the application of the billing system here briefly described, a re-allocation of costs has occurred, as singles now pay more, and family with more than two members less than before (Berardi et al. 2019b). Moreover, as a further means to protect large families, pending the acquisition of the necessary information by managing companies, these are obliged to accept as valid the declaration of a family about the number of its components (which is important as the concessional tariff is calculated on a per-capita basis).

The second strategy to guarantee the right to water is, as said a few lines above, the free supply of the minimum vital quantity of water to people experiencing economic hardships.[103] Recognition of this benefit has been regulated by ARERA by means of Decision no. 897/2017/R/IDR. Managing companies are required to provide, free of charge, 50 litres of water per person; however, EGAs can extend the water bonus by enlarging both the pool of beneficiaries (by increasing the cap establishing the economic conditions of recipients) and/or the amount of the monetary benefit (either as a fixed allowance or as a subsidy varying based on factors such as income, number of family members or water consumption) (Article 6). Such additional bonuses can be made contingent upon the existence of further conditions beyond financial incapacity, for instance, the presence of a handicapped person in the household. All these solutions have been put in place by EGAs, so that now one third of Italy's population can be granted the bonus under economic parameters laxer than those established at the national level. However, its size varies greatly across different ATOs, which sometimes results in a relationship of inversed proportionality between the magnitude of the bonus and the width of the class of recipients. This, together with the fact that the local bonus is not necessarily accorded by default to people entitled to it, makes the effectiveness of such grants in alleviating critical situations uneven in different parts of Italy (Berardi et al. 2019a).

This, of course, is the crux of the matter. After all, we should always wonder about the adequacy of a measure in achieving the social goals it aims at. In this specific case, data show that, in 2019, slightly less than 450,000 households benefitted from the water bonus and, thus, did not pay for their minimum vital quantity of

[103] For the requirement whose fulfilment entitles users to claim the bonus, see *supra* n. 96.

water (ARERA 2020). Given that most households are composed of two or more people, this figure does not seem to be negligible when read against Italy's population of 60 million. At the same time, the number of beneficiaries is not astonishing either. This reveals a first problem, that is, the fact that in 2019 the actual recipients of the bonus have been approximately one-third of those entitled to it according to the definition of "socio-economic hardships" (ARERA 2020). Being aware of this, in the same year the Authority prompted the Parliament and the Government to address the issue. This led to the enactment of Decree Law no. 124/2019, then converted into law by Law no. 157/2019, whose Article 57 *bis* has rendered the recognition of the water bonus automatic, starting from 2021, with no need for potential beneficiaries to explicitly ask for it by sending a request to Municipalities – as it happened before. The actualisation of this mechanism has been set in motion by ARERA through Decision no. 14/2020/R/COM.

Article 57 *bis* of the law also tackles a second major issue that has impaired the effectiveness of the water bonus. Indeed, until the end of 2019 such relief measure only covered the variable part, not the fixed one, of the tariff, and only the part relating to water supply (the aqueduct component, as it is described by ARERA). Thus, the bonus – which only erases the price of the minimum vital quantity of water and not of the resource used in excess of that amount – applied to a part of the tariff that in 2019 equalled the 40% of the average bill.[104] As a result, up to recently the grant has reduced by only 10% or so the average expenditure for water of a family with economic difficulties (Berardi and Signori 2018; Berardi et al. 2019a). In order to give effect to Article 57 *bis*, ARERA issued Decision no. 3/2020/R/IDR, which extended the bonus to costs related to sewage management and depuration of water, which add up to another 40% of the bill. The Authority estimates that this reform will allow the bonus to cover on average one-third of the bill.[105]

Due to all the reforms illustrated above, the full normative picture of Italy as to the fulfilment of the right to water of the Country's inhabitants is definitely improved. This does not mean that no problematic aspect is present anymore. Issues still exists and other proposals to fix them have been put forth, for instance, the possibility for all users to pay the water bill by instalments and the active promotion of a reduction in water consumption by families through campaigns aimed at raising people's awareness about the individual and social costs of overuse (Berardi and Signori 2018). But the most far-reaching of such options is, for sure, the idea of supplying 50 litres of free water to each and every person in Italy. This is provided for by Bill no. C.52 (Article 3, Paragraph 4), whereas Bill no. C.773 also aims at granting everybody a certain amount of free water but entrusts the Government with the task of determining the precise quantity, which however cannot exceed 50 litres per day (Article 7, Paragraph 1). Critics have pointed out that such an "extreme" understanding of the right to water – which, by the way, would go well beyond what is

[104] ARERA, "I numeri dei servizi pubblici", Press Release www.arera.it/allegati/relaz_ann/20/ra20_numeri.pdf

[105] ARERA, "Acqua: rafforzato il valore del Bonus sociale idrico, esteso anche ai titolari di reddito di cittadinanza", Press Release (16 January 2020) www.arera.it/it/com_stampa/20/200115.htm

demanded by international law – would cost 2 billion euro, while a more modest provision of the minimum vital quantity to a larger number of people in economic distress than those currently covered would require a more acceptable sum of 225 million euro (Berardi and Casarico 2016). Other analysts, convinced that the human-right nature of access to water translates into the obligation to grant everyone a vital amount of water, irrespective of the economic conditions of beneficiaries, challenged these estimations and said that a generalised provision of 50 litres per day would cost 557 million euro (Forum italiano dei movimenti per l'acqua 2019). Without taking side with one of the two factions, we stress that a more pressing need than expanding the number of addressees of what is now known as the water bonus, would be an increase in the quantity of water accorded freely as a bonus. Indeed, 50 litres are just the lower threshold of daily human basic needs, and the World Health Organisation clarified that, for instance, breastfeeding mothers, pregnant women and persons living with HIV/AIDS would require 100 litres every day or even more.

11.4.2.4 Distributive Aspects of the Right to Water

One last aspect deserves consideration. The assumption underlying the idea of the right to water is that, whenever a person cannot afford to pay for an adequate amount of water for drinking and sanitation purposes, the State must take action to ensure that the right to water of that person is not hampered. Basically, this means that society must pay for that "free" amount of water. In Italy, this mechanism has to comply with two principles stemming from EU law: on the one hand, the principle of full cost recovery, which implies that the water service is primarily funded by its users and, on the other hand, the polluter-pays principle, which demands that every user bears the environmental and resource costs of his/her use of water. A third principle hinges on the other two, according to which money is given in return for a service, so that when no payment is made, no right to enjoy the service arises (the notion of "*corrispettivo*"). However – provided that this is the exception rather than the rule – such principles can hardly be considered to prevent a user from paying the costs of water supply to another user, or even a non-user from bearing such costs instead of a user. The former possibility materialises in the case of the water bonus, which is paid by a national fund which, in turn, is financed through the bills of all domestic users of the water service, except for the households benefitting from the bonus; similarly, the additional bonus that EGAs might be willing to recognise on a local basis is funded by all users living in the ATO where the managing company operates (thus including the beneficiaries of the supplemental bonus). In the same vein, Bill no. C.773 would require the service provider (that is, the users through their bills) to pay for extending to all domestic users the supply of the minimum vital quantity of water, in accordance with the principle of full cost recovery; a different stance, however, is taken by Bill no. C.52, which would fund the measure by drawing from the public purse (that is, through general taxation).

Unsurprisingly, a more "statist" approach has been taken in erecting the somewhat fragmentary legal framework that deals with the renovation of Italy's water network, whose relevance to the fulfilment of the right to water is almost self-evident. The principle of full cost recovery inspired the establishment of a Guarantee Fund for investment measures aimed at improving water infrastructures for the collection, distribution and purification of water, which indeed is financed through a dedicated component of the water tariff (Article 58, Paragraph 1, of Law no. 221/2015, implemented by means of Decree of the President of the Council of Ministers of 30 May 2019, which identified the State as the ultimate guarantor). But other similar instruments are (or have been) funded by the Government with taxes. In order to bring Italy's performance in line with the requirements of EU Directive no. 91/271/EEC on urban wastewater treatment, Article 1, Paragraph 112, of Law no. 147/2013 set up a plan, and a fund, whose financial endowment comes from the State's treasury. The procedures for spending such resources were amended by Decree-Law no. 133/2014 (so-called "*Decreto Sblocca Italia*" – that is, "Unblock-Italy Decree" – as converted into law by Law no. 164/2014 and further modified by Law no. 113/2016), whose Article 7, Paragraph 6, created another fund to support actions in matters of water purification and sewage system improvement, co-financed by the general public through taxes and by water service users through their bills. Less focused on wastewater treatment – which, in any case, can be largely brought under the umbrella of the right to water and sanitation – is the Investment Fund established by Article 1, Paragraph 140, of Law no. 232/2016 (the provision is to be read in conjunction with Article 1, Paragraphs 1072–1075, of Law no. 205/2017). This Fund makes some tens of billions of euro available for a wide array of purposes, including infrastructural works relating to the water network *lato sensu*, from the distribution of freshwater to the collection of wastewaters (the allocation of funds was decided with the Decrees of the President of the Council of Ministers of 21 July 2017 and of 28 November 2018). All such financial interventions by the State may be interpreted as part of the collective efforts to realise the right to water and sanitation of those who, without the aid of the whole society, would risk being left behind.

11.5 Conclusions

Sometimes international human rights law arrives before domestic law, so that the latter is given shape by the former, rather than the other way around. This is perhaps the case of the right to water. Solemnly recognised by the UN General Assembly in 2010, this right has immediately attracted the enthusiastic support of civil society and NGOs all over the globe. People everywhere began to invoke it against their own governments, demanding affordable access to water. Something along these lines has occurred also in Italy, where the references to the right to water have multiplied in the course of the 2010s.

The result is that this chapter would have been very different, had it been written in 2010. In fact, it would have been quite different even if it had been written in 2015. Things have moved quite fast in this field in Italy, and even if the Constitution, unlike the constitutions of other countries, does not cite the right to water, nor does Italy's primary legislation (at least, not explicitly), many measures have been taken in the last few years to make this right effective. This is not to say, of course, that the right to water of everyone has been fulfilled in Italy: marginalised people still do not benefit from these measures, and this might also be true for some middle-class households (although the low price of water in Italy hardly makes the latter case an emergency). Moreover, even the recipients of the so-called water bonus are not necessarily granted their right to water in full, as the cap to the provision of free water is set at 50 litres – a rather scarce amount if seen against Western standards of living. Again, the current price of water entails that, in most cases, this does not represent a pressing social issue. This might change in the future, if, as expected, prices will rise.[106]

This observation prompts another one of some interest. It is undeniable that the attention people have devoted to water issues in the last decade or so is not only unprecedented in Italian history, but is also unmatched by other everyday-life questions, such as, for instance, other services. It is true that ARERA accords bonuses also in relation to the gas and electricity bills, but the fact remains that no lively activists' movement seems to have invoked those bonuses and spurred to fight for rights related to those sectors – even if, on average, the impact of gas and electricity bills on a household's budget is greater that that of the water bill.[107] Similarly, no sizeable movement has ever coagulated around campaigns for the right to housing, despite this being well-established in the human rights discourse. In our view, this depends on the concurrence of two interrelated factors: on the one hand, the great symbolic value of water, seen as the source of life (access to which is threatened by private companies in some areas of the world); on the other, the advent of the right to water on the international plane.

Looking at the case of Italy, one may wonder whether the emergence of such a right at the supra-national level has given momentum to a specular birth in the Italian domestic system. As a minimum, it seems safe to maintain that the former acted as a catalyst. The anti-privatisation "crusade" of the 2000s has certainly unfolded its effects both within and beyond State boundaries. However, it appears that the 2010 UN Resolution, together with similar international declarations, helped bring under the umbrella of human rights a battle whose Italian "soldiers", till the 2011 referendum, had primarily – although not exclusively – spoken another language, that of water as a public good. References to international instruments are now rather common in Italian laws and regulations that have to do with water issues. It cannot be excluded that this will feed back to the international level, by consolidating the shaky legal grounds of the right to water.

[106] On this see, in this volume, Chap. 17 by Massarutto.

[107] Although conducted by distinct consumer organisations and thus not necessarily homogeneous from a statistical point of view, it may be interesting to know that, in 2019, the water bill of the average family totalled about 430 euro, whereas the electricity bill and the gas bill amounted to 560 euro and 1100 euro, respectively.

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Chapter 12
The Permanent (De-)Institutionalisation of Multi-level Governance of Water Services in Italy

Giulio Citroni and Andrea Lippi

Abstract Regulatory governance in Italy underwent a process of institutionalisation over more than 25 years and at the same time it faced the de-institutionalisation of the same design. The resulting multi-level governance is piecemeal and weakly coordinated. The chapter reconstructs the long and undefined process whereby the Italian water system underwent a deep transformation from Municipal management toward regulatory governance through an incremental and incoherent trajectory. This process is described as a combination of institutionalisation and de-institutionalization. Evidence is presented on three aspects: (i) the permanent re-design of the water system over 25 years; (ii) the state of implementation and the role of the protests by the water movement against regulatory governance; and (iii) the state of the awarding of concessions and the market of private companies. All three sets of evidence are interpreted as pointing towards a case of incremental unprotection and fall of public attention as to the destiny of the water system. Similarly, it is also a failure of the design and of State coordination. The conclusion is that the centre is unable to hold and that fragmentation is still strong, although reshaped by different factors. As a result, the water system in the Italian policy agenda is now marginalised and "ungarrisoned".

Keywords Regulatory governance · Water service · Institutionalisation · De-institutionalisation · Re-design of water governance

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12.1 Hybrid Water Governance Between Institutionalisation and De-Institutionalisation

The issue of water governance in Italy is tightly interwoven in a wider global process of change (Pahl-Wostl and Ross 2010). A wide variety of arrangements worldwide have modelled emergent patterns for governing the water resource, and especially water service system (WSS) governance, i.e., “the interconnected ensemble of political, social, economic and administrative elements that performs the function of water service system” (Pahl-Wostl 2015, p. 26). At the national level, this fact has been scrutinised by scholars looking at the high variability and the combinations which affected institutional, political and cultural dimensions in each country. A very differentiated set of formulas are witnessed, ranging from concentration to unbundling and “from completely public to completely private water services, with all sorts of hybrid arrangements in between” (Barraqué et al. 2015, p. 37).

As described by many authors, since the beginning of the 1990s, the WSS has moved away from hierarchy toward unbundled networks. The institutionalisation of these new arrangements became pivotal (Domènech 2011, p. 302), since it called into question the strategies whereby each national WSS passed from vertical to horizontal integration through decentralised management. The emerging regulatory governance was directly and indirectly shaped by formal (legal and organisational) aspects, as well as informal ones (cultural, economic and political) (Reinhardt and Guérin-Schneider 2015).

Obviously, regulatory governance is not a monolith, but a modular arrangement where specific dimensions (e.g., scale, ownership, controls, cost-sharing and capacity) are situationally settled according to national constraints and political strategies (Daniell et al. 2015). The focus is on how the new water governance operates and to what extent the dimensions of unbundling (competitive awarding, regulatory agencies, public-private partnership, etc.) are implemented.

As a matter of fact, the strength and the political importance of emerging water governance depend on the national capacity to make it durable and fitting into the institutional, economic, cultural and political environment. This process has been described in policy-making studies as institutionalisation (Selznick 1949; Powell and DiMaggio 1991). Institutionalisation describes two phenomena at the same time. The first one is how (and why) a certain (formal or informal) political practice becomes stable and is taken for granted over time. The second one concerns the stability of its original morphology in specific milieus. In both cases, it refers to the degree to which an emerging pattern becomes actual and operating.

In the case of Italy, as for other countries, the issue is whether the water governance system stabilised into a pattern for the Country or not, and how, to what extent and why; this poses further questions of stability and variability at the same time (Lieberherr and Odom Greene 2018). Stability means that the pattern of governance can be durable or provisional and fleeting. Variability means that it can be shaped in different ways and undergo different tendencies towards retrenchment, readjustment or dismantling (Pakizer and Lieberherr 2018). As a result, institutionalisation and de-institutionalisation take part in the same dynamics.

More relevant, as indicated by most studies, water governance has been highly influenced by national factors, although under the wide umbrella of the neoliberal stream of reforms that called for privatisation in terms of transfer of operational management with varying degrees of private capital investment (Lieberherr and Fuenfschilling 2016, p. 1544).

As described, a common ideational background produced heterogeneous outputs (Barraqué and Laigneau 2017; Barraqué et al. 2018): far from being a mere process of de-regulation, water privatisation has implied the institutionalisation of new (re-)regulation instruments. Consequently, each country implemented regulation and created authorities according to its specific policy capacity, institutional frame and political culture (Barbier et al. 2016).

The process of creation and institutionalisation of innovative forms of regulation involved some emerging challenges (Lieberherr and Fuenfschilling 2016) for the new system: (i) the partition of power and the creation of capable authorities; (ii) the accountability of the system as a whole; (iii) the quality of competition by tenders (Massarutto et al. 2013); (iv) the information asymmetry between authorities and service providers; (v) the nature of ownership of service providers (public, private and public-private partnership); (iv) the role of politics and the influence by local authorities in shaping and maintaining the regulatory governance in multi-level settings (Citroni et al. 2015; Aars and Ringkjoeb 2011). All these challenges have been tackled through different policy capacities.

For this reason, institutionalisation has proven to be incisively influenced by the socio-economic and political milieu where governance was embedded. As argued by Mukhtarov and Daniell (2016), the institutionalisation of water governance is a matter of policy transfer, adaptation and translation. The degree of success of the translation is consequently claimed to be subjected to specific conditions that can favour or hinder the output. On the contrary, a partial or intermittent consolidation can be attributed to the same factors. As a matter of fact, water governance can undergo fragmentary institutionalisation or can be destabilised, readjusted or partially abandoned (de-institutionalision).

Some countries, including France, Australia, the United Kingdom and Germany (Grafton et al. 2015) have been investigated by looking into the high variability and the different degrees of institutionalisation and de-institutionalisation of the regulatory governance. Some countries experienced greater uncertainty and showed ambiguity and contradictory trends. Italy is a case in point: as described by scholars (Lippi et al. 2008; Asquer 2014; Carrozza 2011; Massarutto et al. 2013), institutionalisation was depicted as problematic and contradictory. The combination of all abovementioned factors produced an “embedded governance” strongly conditioned by the socio-economic and political milieu.

More generally, apart from national cases, the literature converges on some recurrent evidence about the outcomes of the implementation of a water governance regime.

A first issue concerns the variety of modes of governance. Pahl-Wostl (2015, pp. 32–36) described water governance as multi-stakeholder arenas where institution, firms, societal actors and representative bodies interact across administrative boundaries and vertical integration. Hence, the interdependent system can be institutionalised according to the limits and resources provided by the ecological milieu that hosted the rise and the consolidation of such system. Looking at the institutionalisation of the different modes of governance, Pahl-Wostl pointed out some recurrent dimensions of such phenomenon: the vertical and horizontal integration, the societal and institutional learning of the new neoliberal frame, the interaction and mutual influence among societal, institutional and business actors. Lastly, she identified four critical turning points for the institutionalisation of water governance as complex system: the problems of legitimacy, comprehensiveness, representativeness and leadership.

A second issue concerns the intrinsic hybridisation of current water governance arrangements (Hysing 2009). The landscape of the implemented regulatory governance has been described as a "world of hybrids" (Barraqué et al. 2015): some elements of the hierarchy have been contaminated and integrated by innovative instruments by the market. As stated by the same authors, neither full privatisation nor entirely public management can be found, while a range of combinations is the current state. The hybrid nature of governance is consequently framed by some relevant empirical couples of drivers: (i) integration/unbundling; (ii) concentration/decentralisation and (iii) upscaling/downscaling. All three dimensions ideally form a map to locate empirical cases according to more conservative or managerial national adjustments. As investigated by Pakizer and Lieberherr (2018) while reviewing the literature on the modes of governance in eleven cases of implementation of regulatory governance, there are commonalities in policy instruments and mechanisms that display how decentralisation and unbundling prevail in most cases.

The last issue concerns the multi-stakeholder approach. It means that water governance is a pluralist arena that combines a heterogeneous set of stakeholders: (i) institutional and societal players, (ii) political and economic players, (iii) private and public players. Again, Pakizer and Lieberherr (2018) show how actors and organisational forms are strongly shaped by local factors and how the central level is residual without common specific management styles. As a result, a strong accountability challenge affects all the documented case studies with respect to institutions and citizens.

All three aspects (variety of modes of governance, hybridisation and multi-stakeholder approach) are relevant to the Italian case, and to the uncertain and ambiguous path toward consolidation: namely, the missed institutionalisation and the emerging de-institutionalization of water governance in the Country.

12.2 Between Consolidation and Crisis: The Permanent Re-design of Water Service Policy

The field of water management in Italy was extensively and deeply reformed over the early 1990s, and was a testing ground for regulatory policy reform to be applied also in other fields of local utilities. Later reforms in the fields of urban waste management (1997), local transport (1997), and energy and gas (1999–2000) followed most of the principles set out by the earlier norms on land use and water basin protection (1989) and especially on water and sanitation services (the so-called Galli Law of 1994): most notably, compulsory cooperation between Municipalities in planning and monitoring, full-cost recovery through tariffs, and clearer separation between service regulation and service delivery – implying clearer separation between politics and management, and/or between public and private.

This set of innovative principles, pushed forward by centre-left and "technical" cabinets, were in line with the dominant new public management (NPM) agenda, which benefited in the same years in Italy from the outbreak of the corruption scandals and the financial and political crises (Ongaro 2009): these contributed to delegitimising reliance on public budgets, direct engagement of the Government in service delivery, excessive politicisation of regulation, and more generally the *partitocrazia* which had until then ruled over large areas of economic and social life well beyond the scope of the modern concept of party government (Rose 1974).

Altogether, as summarised by Cassese (1996), these innovations contributed to a shift from an "old regime" of local utilities – characterised by public monopoly, public ownership, and political representation – to a "new regime" based on liberalisation, privatisation, and consumer protection. Three processes envisaged by these three keywords were (1) the establishment of competition in markets and *for* markets (i.e., competitive awarding of concessions), (2) the gradual corporatisation and privatisation of Municipal enterprises, and (3) the weakening of political patronage and political influence on service delivery, in favour of stronger corporate accountability and consumer rights protection.

Indeed, the implementation of reforms over the 1990s and early 2000s was somewhat limited and incremental on all three fronts, and largely dependent on local contexts (Lippi et al. 2008): full liberalisation was mostly limited to national services (energy, telecommunications), while at the local level competitive tendering was experimented in a small number of municipalities. Privatisation took place in the form of mere formal corporatisation, or of public-private partnerships in which the engagement of local authorities in the ownership and management of service enterprises was still the norm. Finally, the tools of consumer protection and engagement (most notably, citizens charters) were rather weakly implemented.

Notwithstanding the complex and inconsistent patterns of implementation, for about a decade there seemed to be ample, bipartisan consensus in institutional and academic circles on a set of principles, which, indeed, were later embodied in a number of bills discussed in Parliament between 1997 and 2008, all based on the institutionalisation of inter-Municipal regulation, compulsory competitive tendering, and the pursuit of economies of scale through the merger (and sale) of (formerly) public-owned enterprises. The march to modernisation and industrialisation set by the 1994 reform seemed to be slow, but steady (Massarutto 2005), and the virtually unanimous consensus which had brought about the 1994 reform in the first place was replaced by a certain disappointment which still appeared to demand "more of the same": stronger regulation, clearer legislation, wider privatisation and modernisation (Massarutto and Ermano 2013).

The design and its implementation were weakened rather significantly by the centre-right cabinets led by Berlusconi (2001–2006), when the localistic and conservative tendencies of two parties of the governing coalition, *Lega Nord* and *Forza Italia*, imposed a rather cautious approach to compulsive competitive tendering in spite of strong liberal rhetoric. Similarly, centre-left coalitions (2006–2008) were pressured by minority partners of the left (*Rifondazione Comunista*) to limit the recourse to compulsive competitive tendering, in local utilities generally and more strongly in the field of water and sanitation services (Citroni et al. 2018).

Political uncertainty, faulty institutional design and the lack of expertise in independent regulation also determined very weak institutionalisation of the regulatory bodies (Massarutto and Ermano 2013): CONVIRI (*Commissione nazionale di vigilanza sulle risorse idriche*), the national regulator in charge of defining the tariff system, drafting model contracts, and monitoring the standards, was permanently understaffed and largely dependent on ministerial politics; local regulators (AATOs, that is, authorities superintending territorial units known as ATOs, "optimal-sized" areas) were again largely political and composed of the same mayors who owned the regulated service companies – thus generating a conflict of interests or, at least, a conflict of logics in action between mayor-owners and mayor-regulators.

The rhetoric and design of water sector reforms, however, were not openly challenged until 2009–2010, when two factors converged to redefine the agenda and deconstruct the consensus on NPM-modernisation: on the one hand, an ample and articulate movement against the privatisation of water services gathered increasing momentum and built up massive mobilisation towards a national referendum initiative (Bersani 2011; Tarditi 2020); on the other hand, the "rhetoric of rationalisation" swept over a number of policy fields and legitimised cuts and reforms which significantly diverged from existing policy tracks (Bolgherini and Dallara 2016). An intervening variable, a catalyst, and a source of legitimation for both phenomena was of course the financial and economic crisis of 2008–2009 (Citroni et al. 2018).

The anti-privatisation movement and the 2011 referendum determined the (legal, more than political) impossibility for government to impose compulsory competitive tendering on Municipalities. The policy agenda and discourse were rapidly redefined according to (only apparently contradictory) austerity and anti-establishment rhetorical and policy frameworks (Tarditi 2020). A first wave of austerity/rationalisation measures were undertaken in 2010 and 2011 (in the late, critical phase of the last Berlusconi cabinet):

- in a rather unexpected move, AATOs were abolished, leaving the local regulatory system in chaos; Regions, however, were asked to devise new regulatory authorities, which, however, widely replicated the AATO model (Citroni et al. 2015);
- the national regulator was also dismantled and its competences were transferred to the Authority for energy (see Sect. 12.3);
- Municipal companies were also hit by "spending review" measures, which limited the wages of managers, curbed the possibility of establishing new companies, and imposed increasing (bureaucratic-type) obligations on the companies themselves.

The "technocratic" cabinet led by Monti introduced more norms limiting the possibility for Municipalities to establish, or even maintain, companies. These limits were eventually made stricter – at least on paper – by the Renzi cabinet in 2014–2015, with a strong populist turn in the rhetoric: abolishing the strongholds of political patronage and of pointless waste of public money was the new mantra. The norms introduced by the Renzi cabinet (mostly through the so-called Madia Reform of public administration, which started with Law no. 124/2015) imposed, among other things, on Municipalities the duty to report and justify the companies they hold, and to regularly report on the efforts made to dismantle them.

Three phases can thus be identified in the institutionalisation and legitimation of water service governance reform policies. Over the 1990s, a clear "modernisation" design was pursued and the corresponding institutions were designed and set up. Over the 2000s, this design was not challenged, but its implementation was not consistent and witnessed a "backwash" in political salience and legitimisation. In the wake of the 2010s, austerity and anti-establishment strategies implied a delegitimisation of the regulatory institutions and redefined the agenda towards the dismantling of existing bodies with no apparent design for new institutions. The next section will show the results of such process in national and local regulation, and in the strategies of municipal and private water companies.

12.3 Water Service Governance in Practice: The Recent Developments

12.3.1 The Multi-level Regulatory Governance Design Between National and Local Authorities

The multi-level regulatory governance design in Italy was characterised by two phases: from 1994 to 2011 and from 2012 to 2020.

Pursuant to the regulatory design for water service outlined by the Galli Law of 1994, a two-level governance system was put in place: operational regulatory tasks were delegated to local authorities, while supervision was assigned to a central board. This design immediately appeared ambitious, fragmented and incremental. This was due to the absence of a tradition of regulation in the Country. Water services was the first policy sector that underwent such an arrangement. Even more problematic was the absence of a political culture supporting regulatory governance at the local level, which significantly undermined the implementation of the arrangement. Concretely, as displayed by evidence (Lippi et al. 2008; Citroni et al. 2008), the development of a multi-level system of regulation faced the resistance by Municipalities and the pre-existing players, which testified to the prevalence of longstanding logic of ownership control over the logic of regulatory control.

The regulatory governance arrangement therefore had to go through a pioneering path of trial and errors in the following years. Firstly, the implementation of the two-level regulatory governance was excessively slow and scattered on the national territory due to local resistance and lack of expertise. In particular, Regions and other local authorities were uncoordinated and spent years in designing territorial units for water management and delivery, on the one hand, and in defining structures and powers of the regulating authorities, on the other. Secondly, the creation of local authorities (AATOs) in charge of the regulation was uncertain and not homogeneous. The new regulatory authorities were underfinanced and lacked expertise and power. Finally, the policy capacity of the new authorities in planning and in controlling the players immediately proved weak. Local regulatory authorities suffered from informational asymmetry and revolving doors problems. Also the national supervisor lacked resources, legal power, and support by the central Government and the public opinion, thus playing a very marginal role.

All in all, two political problems arose. First and foremost, the local context was decisive to allow or hinder the implementation. Secondly, the implementation was influenced by specific local factors that incisively shaped the emerging patterns, so that the implemented water governance was deeply embedded in regional path-dependences toward success or failure, and depended strongly on cultural, economic and political legacies.

The implementation of the first regulatory design lasted from 1994 until 2006, when it became clear that some reform was needed. The following steps tried to increase the power, skills and institutional design of the regulatory agencies both at the national and local levels. The initial design was substantially preserved and partially reshaped. In 2006, the Parliament abrogated the Galli Law and drafted a new legislation promoting a stronger regulatory capacity. The two-level regulatory governance was still valid, but the role of the Regions was strengthened. National and local regulatory authorities were reshaped separately.

At the national level, the regulatory body underwent an incremental change, turning from a committee into an authority through many steps. The national Committee entrusted with the task of monitoring water services (COVIRI – *Comitato per la vigilanza sull'uso delle risorse idriche*) turned into a national Commission (the abovementioned CONVIRI) for monitoring water resources. The main regulatory goal was supervision over tariffs and over the governance and service models adopted locally. The main goal of the new Commission was now less generic: protection of users' interests, supervision and updating of tariffs, efficiency and transparency of water management at national level. A specific monitoring system (SIVIRI – *Sistema informativo per la vigilanza sulle risorse idriche*) was set up by the Commission for this purpose. Like the Committee, also the new Commission was not an independent authority, but only an advisory body established within the Ministry of the Environment. As such, it was not really capable of supervising the national water system (Massarutto et al. 2013).

For this reason, in 2011 the Government established the national Agency for Monitoring and Regulating Water Resources. Nevertheless, after the referendum of 2011, the same Government immediately abolished the new agency and transferred all the competence to the pre-existing national Authority for Regulating Energy and Gas (AEEG – *Autorità per l'Energia Elettrica e il Gas*). Thus, this pre-existing authority included water among its tasks and, at a later time (2013), it tuned its acronym into AEEGSI (*Autorità per l'Energia Elettrica, il Gas e il Sistema Idrico*), adding "water service" to its name. AEEGSI acted as a national regulatory board for tariffs and service integration. Water was included in a wider vision of regulation together with more strategic, competitive and profitable sectors, like energy and gas, and assumed marginal importance in this context. At the same time, the inclusion within AEEGSI ensured that the water system was subjected to a real regulatory function, after a long and uncertain process of institutionalisation. As stated by Massarutto and Ermano (2013, p. 30): "together with the consolidation of incumbents' position, fostered by the popular vote, in our opinion this evolution marks the progressive drift from a regulatory model pivoted on contracts toward a model centred on regulated corporate monopoly".

The last step of this evolution occurred when in 2017 the Government turned AEEGSI into a new authority for the regulation of energy, networks and the environment (ARERA – *Autorità di Regolazione Energia Reti Ambiente*). It was not merely a nominal change, but a substantial one. The task of regulation turned from service to competition. ARERA's mission is wider and further from water services than the former authorities. The new agency entails a different approach to water regulation: finance and competition in place of service. At the same time, water is now rather marginal in a regulatory system which was designed for the energy sector.

At the local level, the regulatory model entitled the Regions to shape a number of territorial units to provide water services. In the 1990s, 91 ATOs were consequently defined by the 20 Italian Regions on the national territory according to different criteria. The resulting map of water management was accordingly referred to local factors. Some ATOs were delimited by Provincial boundaries, other by Regional ones while other ATOs were shaped on hydrographic geography. Each territorial district was in turn ruled by an authority called AATO, in practice, a consortium among all the Municipalities located inside the ATO. Such authorities were in charge of planning, awarding to a company the service management and provision, and then controlling the output and outcomes. As described, the capacity of AATOs was extremely weak. Territorial fragmentation and incoherence, on the one hand, and low capacity to regulate, on the other, pushed the central Government towards a change.

In 2010, ATOs were abolished by the Government and the Regions were required to create new territorial units according to three new principles (adequacy, subsidiarity and differentiation) by 2012. Thus, a new design emerged which envisaged a three-level governance system aimed at rationalising the fragmented arrangement resulted from the previous one. The new regulatory framework required Municipalities to be included in the new Regional entities so as to reduce fragmentation. According to ARERA (2019), this was meant to eliminate fragmentation and incoherence in search of uniformity and a wider and more homogeneous territorial arrangement. The new arrangement was supported by the creation of new regulators (called EGATOs, that is, Governing Bodies of ATOs) at Regional level, vested with greater legal power and tools for programming and controlling water service management and delivery. However, the implementation again was very slow.

The subsequent incremental rationalisation favoured the reduction in the total number of ATOs: from 91 in 2011 to 71 in 2015 and 62 in 2020. The establishment of EGATOs was, again, difficult and scattered. In 2015, the EGATOs of 9 out of 20 Regions were not operating or they were only partially operating; still in 2020, Calabria, Lazio, Molise and Sicily have not completed the implementation yet. Moreover, the delimitation of EGATOs is still heterogeneous and determined by three different trends in the 19 Regions involved in the reform:[1]

(i) a single Regional EGATO authority was established in 6 out of 19 Regions;
(ii) a single Regional authority was established in 7 Regions out of 19, with sub-Regional entities coordinated by the Regional one;
(iii) sub-Regional authorities were designed, like in the past, in 6 out of 19 Regions, approximately fitting to Provincial boundaries.

Also the creation of such Regional authorities has been fragmented and heterogeneous. These have different legal power and tasks. Legal names are also very different and rather imaginative (entity, agency, authority, council, conference, assembly). This is not only a nominal issue, but a substantial one. In some Regions (Veneto, Sicily, Piedmont and Marche), the new EGATOs are only advisory boards inside the administrative staff of the Region, while the one in Liguria is part of the Provincial administration. Again, in some Regions (Umbria, Emilia-Romagna, Basilicata and Friuli-Venezia Giulia), the new authorities are not entirely devoted to regulating water, as they regulate both water and waste at the same time. Fragmentation and heterogeneity are still widespread.

Another point concerns the entrusting of the service to providers by the authorities. As reported by ARERA (2020), there is a deep lack of coherence in the renewed water governance: the entrusting of the water service to a single provider occurred only for a limited number of authorities, while a significant number of other players continues to manage services. More specifically, in some Regions the number of providers is still large, especially in those were the implementation resulted slow and difficult. This scattered and inconsistent arrangement brought about a number of infringement procedures by the European Union and, so far, two decisions by the European Court of Justice, in 2012 and 2014. Most infringements

[1] The total number of Regions is 19 as one of them, Trentino-Alto Adige, is not compelled to create a regional authority by virtue of its special statute under Italian law.

have been registered in Southern Italy (Calabria and Sicily) and in Northern Italy (Liguria, Lombardy and Friuli-Venezia Giulia).[2]

All in all, the general landscape is still fragmented, even if a slow convergence by trial and error is taking place. More significantly, this occurred through a weakening of the importance of water management in the Country: firstly, at national level there is no more a central authority explicitly and uniquely focused on water services, as the focus is on infrastructure, and prominently influenced by energy; secondly, local authorities have very different legal statutes, they are uncoordinated and partially inefficient, and sometimes their attention is shared with waste management.

In conclusion, two phases in regulatory governance can be identified, before and after 2011. The two-level governance from 1994 to 2011 was extremely fragmented and highly dependent on local factors, while the three-level governance from 2012 to 2020 looked oriented to rationalisation and territorial upscaling. In both cases, the water system design appeared as undefined and not sufficiently coherent. Lack of coordination and ambiguities persist and the system has achieved only limited capacity and control. Looking at the evidence, the water system design seems piecemeal and unclear. Further, the uncertainties of implementation together with the permanent redefinition of power, territories and functions has contributed to making the overall landscape of water governance incoherent and unstable.

12.3.2 The "Public Water" Movement in Local and National Politics

Besides the changes in the regulatory system, the original design of the WSS governance model was faced with a second, and rather radical challenge: a strong movement for "public water" not only promoted a referendum – which limited the recourse to privatisation in 2011 – but also contributed to raise and polarise the issue of public ownership and public legal forms in local campaigns and in Parliament.[3]

In 2007, the movement collected over 400,000 signatures for a people's initiative to have the Parliament discuss a text which effectively qualified water and sanitation services as a non-economic service of general interest, in order to exclude it from the market regulation policy; instituted a minimal quantity of water to be guaranteed for free to each individual, namely 50 litres/day/person; and declared the immediate cessation of all existing concessions and the gradual transformation of all public water companies into public-law bodies. The discussion in Parliament started in

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[2] See: www.acqua.gov.it/index.php?id=27&a=3

[3] The chronology that follows is based on the Authors' original analysis of Parliamentary documents. On the referendum and the "public water" movement see also, in this volume, Chap. 11 by Turrini and Pertile.

October 2007 in the Environment Commission, but was soon suspended and finally interrupted with the early end of the legislature in April 2008.

With the new legislature (2008–2013), the parties of the radical left were no longer represented in Parliament; the people's initiative was thus left with no sponsors other than a rather marginal Italia dei Valori and some members of the Partito Democratico (PD). The initiative was again discussed in the Environment Commission of the Chamber of Deputies, and a slow but steady debate was accompanied by a wide enquiry with extended hearings of companies, movements, and local governments. At the end of the enquiry, however, no final vote was made and then the legislature terminated.

When the Movimento 5 Stelle (M5S) entered the Parliament in 2013 with a staggering 25% of votes, the issue of "public water" – albeit absent from its official manifesto – was prominent in the party's agenda. The bill brought forward by the people's initiative was again deposited in Parliament by radical-left MPs, but a new text was in fact drafted by M5S MP Federica Daga with an "intergroup" of almost 200 MPs from different parties, also modelled on the people's initiative of 2007. Back then, the M5S was in the opposition to large-coalition cabinets (led, successively, by Letta, Renzi and Gentiloni), and a hard battle was fought in the Environment Commission of the Chamber of Deputies: a new round of hearings was held, but when amendments were voted on, the PD majority in the Commission changed the text to a much more "conservative", competition-friendly bill. This new text was ultimately approved by the Chamber of Deputy in April 2016, and its discussion started in the Senate with new hearings, but then the legislature terminated again with no final decision.

After the 2018 elections, a cabinet was nominated by a coalition between Lega Nord and M5S. Two bills were under scrutiny again in the Environment Commission of the Chamber of Deputies: the bill by M5S MP Daga (modelled after the people's initiative), and the bill by PD MP Braga, based on the text approved in the previous legislature. Yet another round of hearings was held, with much the same guests as the previous rounds, but the discussion came to a halt when M5S and PD – which supported opposing views on the re-municipalisation of water services – entered a coalition cabinet together in August 2019.

The M5S-PD majority in Parliament is thus now confronted with two drafts which are radically alternative on some of the most controversial issues that have fuelled the debate between movements and parties in the past two decades:

- the ownership and legal form of service-delivery organisations: M5S is proposing compulsory public-law (and public-ownership) agencies, PD proposes (public, private or mixed-ownership) joint-stock companies;
- the obligation for Municipalities to join intermunicipal delivery contracts: M5S aims to safeguard freedom for Municipalities to coordinate service delivery with other Municipalities without contracting to the same company, while PD is proposing compulsory "single delivery" arrangements;
- the roles of the Ministry of the Environment and the independent regulator: M5S proposes to re-internalise within the Ministry a number of competences now

assigned to ARERA, while PD proposes to safeguard the autonomy and powers of ARERA;
- the role of the water tariff: M5S proposes to abolish the "full-cost recovery" principle and make larger use of general tax revenue funds to finance investment in water infrastructure.

The impact of the "public water" movement and of the people's initiative of 2007 is not limited to the discussion of new piece of water-related legislation in Parliament: a number of cities are also challenging the privatisation governance model through more or less successful attempts at re-municipalisation.

The first city which decided to re-municipalise the water service was Naples: a new mayor, Luigi de Magistris, was elected in May 2011, only weeks before the "public water" referendum and at the climax of the public water campaign of which he was an active part. Along with a number of other mayors (most notably, Giuliano Pisapia in Milan), he was identified as belonging to an "orange" movement which supported progressive, environmentally-friendly policies and worked in close connection with civic organisations and the public water movement. As one of his first moves in power, he started the process to transform the ARIN SpA – a joint-stock company fully owned by the Municipality – into "*azienda speciale*" ABC Napoli, a public-law Municipal enterprise.[4]

While on the one hand the formal transition was rather simple – indeed, no partners had to be bought out – later developments proved that managing the Municipal enterprise was more complicated than expected; suffice it to say that four different presidents have been leading it since 2013; the two with closer connections to the public water movements (Ugo Mattei and Maurizio Montalto) were both dismissed by the mayor and denounced his failure to deliver on the democratic and participatory promises of the re-municipalisation.[5] Like in several other Regions, and as reflected in the debate in Parliament (see infra in this section), the conflict later exploded also between the Municipality and the Regional government, when a Regional law was passed in 2015 that centralised decision-making into a Regional water agency (Ente Idrico Campano – see also above, Sect. 12.3.1).[6]

[4] This was meant to be a highly symbolic and effective step: "Water services will never be sold out again; the whole water cycle will be governed in a democratic, environmentally-friendly and social way and not for profit; ABC will never again be the prey or property of politicians of the day (whatever the political side) or of a small, powerful managerial team: rather, it will be governed and controlled directly by the best energies of the Neapolitan people": these are words by Ugo Mattei, first President of ABC Napoli and prominent activist of the water movement (*Abc, un modello per il Paese*, in *La Repubblica – Napoli*, 2 March 2013).

[5] *Comune, silurato Mattei, presidente dell'Abc, la reazione: "Atto ostile e incivile",* in *La Repubblica – Napoli*, 29 October 2014; *Abc, salta il presidente Montalto*, in *La Repubblica – Napoli*, 16 September 2016.

[6] Regional Law no. 15/2015 ("*Riordino del servizio idrico integrato ed istituzione dell'Ente Idrico Campano*").

Decisions and attempts at re-municipalisation have occurred in a number of other cities all over Italy.[7] Turin and Palermo both decided in 2013 to turn their public-owned joint-stock companies into aziende speciali – like Naples – but never implemented such decisions. Turin again discussed re-municipalisation in 2020, but while the M5S-led government of the city was in favour, the PD-led partner Municipalities blocked the decision. The ATO of Florence (1.3 million inhabitants, 45 Municipalities mostly led by PD mayors) decided in July 2018 that the service will be delivered in-house after the expiry in December 2021 of the existing twenty-year contract with Publiacqua – a mixed public-private company; later that year, however, an extension of the existing contract to 2024 was also approved (Laboratorio REF Ricerche 2019); in the meantime, the Regional Council of Tuscany has rejected a bill proposed by the left which supported re-municipalisation. Similarly, in November 2017 the ATO of Rome (112 Municipalities, 3.5 million inhabitants) set up a technical committee to discuss the options for re-municipalisation, spurred by the M5S majority of the Rome Municipal assembly. A similar decision was taken in Agrigento (Sicily) in September 2019, after the private company in charge of water services was judicially dissolved on grounds of mafia infiltration.

Between 2012 and 2015 also Reggio Emilia, Termoli, Varese, and Imperia chose to abandon public-private partnerships and switch to in-house provision. In Reggio Emilia and Termoli the process was stopped, while in Varese a public-owned company was created but an agreement was reached that it will only take over the service when the existing contracts with the public-private company will expire – which will happen progressively between 2019 and 2036 in the 34 Municipalities involved. Finally, the transition was successful in Imperia, where a public consortium was created among 70 Municipalities (220 thousand inhabitants); however, the consortium is now undergoing major financial restructuring to be saved from bankruptcy.

12.3.3 The State of the Market

A significant aspect of the reform agendas of the 1990s was the expectation that intermunicipal service delivery, vertical integration and corporatisation/privatisation would create the conditions for a process of industrialisation of the water service sector: the status quo was characterised by as many as 8000 service providers, including approximately 6500 Municipalities delivering services directly (Citroni 2007). A number of *aziende municipalizzate* (Municipal corporations), especially in the North of the Country, were expected to proceed to mergers and acquisitions, consolidating service delivery on a Provincial, Regional or inter-Regional level; private capital would flow in, either through mixed public-private companies, or through the listing on the stock exchange (Citroni et al. 2008).

[7] On this issue, the most updated collections of news and reports (in Italian) can be found online at www.gruppo183.org; www.acquabenecomune.org; and www.federicadaga.net. In English, see Kishimoto et al. (2015).

At present, the result of 25 years of permanent transition are visible under several respects, but rather limited under others. First of all, a significant drop in direct Municipal delivery has led to "only" 2200 such cases – a reduction by two-thirds (Utilitatis 2019). The Municipalities which still deliver services directly are mainly located in the South (Sicily, Campania and Calabria) and in the autonomous Regions of Trentino-Alto Adige and Aosta Valley. *Aziende municipalizzate* have virtually disappeared, mostly to be transformed into public-owned joint-stock companies. A significant process of consolidation is also witnessed by the increase in the average number of Municipalities which are served by each service-providing company: this has increased from 10 to 30 between 1999 and 2019 (Utilitatis 2019): extensive processes of merger and acquisition have historically been driven by the "big four" companies listed on the stock exchange (Hera, A2A, ACEA, and IREN) (Galanti 2016) and are still ongoing, as testified most recently by the creation of "Veritas" in the Venice area.

The overall number of service providers has dropped from 8000 to 2500. However, such decrease fell far short of expectations, considering that an overall number below 100 was the goal since the 1990s when the "single delivery" in ATO districts was pursued, and that such goal has consistently been on the agenda ever since; in 2016 the think-tank of water companies was still forecasting "no more than 60–70 companies" by 2019 (Laboratorio REF Ricerche 2019).

Official data from the Court of Auditors (Corte dei Conti 2016, 2019) report the evolution of the attempt by a number of successive cabinets to reduce the number of companies owned fully or partly by local governmental bodies: the decrease from 2014 to 2019 is a mere −5.6% (from 4397 to 4148); in the field of water services the number of public-owned companies has in fact increased from 598 to 658. This might signal a shift from other, public-law forms to the company model, but still it is far from the ultimate goal of the policy as designed. One last remark based on the Court of Auditors' data concerns tenders: out of 7662 Municipality-water provider relationships observed in 2019, 7059 (92%) were still based on contracts awarded without competitive procedures; the recourse to market efficiency through competition appears to be still very limited.

Recent data (Utilitatis 2019) also show that the process of privatisation has only developed to a limited extent: it is widespread in central Regions, where 75% of the population is served by a mixed company and only 19% by public-owned companies; on the contrary, in-house provision by public-owned companies covers 73% of the population in the north-western Regions, and 56% in the north-eastern Regions. This is in line with data from the mid-2000s (Citroni et al. 2008), which proved that private investors were not engaging in the field as much as had been expected and politics was still pivotal in brokering investments; most notably, a large part of public-private partnerships in local water companies saw large Municipal enterprises storm in as investors, which appeared to contradict the declared goal of recruiting fresh capital from the market.

The reasons for the limited interest of investors in the water sector are also strikingly similar across decades. The same think-tank (Laboratorio REF Ricerche 2017) has pointed to relevant risks posed by uncertainty in legislation, lack of (local as well as national) regulatory capability, and political pressures exerted at the local level by Municipalities.

12.4 Concluding Remarks: "The Centre Cannot Hold"

The evidence collected and described in this chapter brings forward a number of elements of continuity and discontinuity with respect to previous knowledge in the field of water service governance in Italy.

Continuity is clear in the inability by policy-makers and by their programme theory to capture the complexities of implementation and the dynamics of power at the local level. A pendulum between strategies of uniform application of central diktats (compulsory competitive tendering, compulsory amalgamation of service delivery, etc.) and strategies of incremental, bottom-up reform (redefinition of ATO districts and ATO authorities), has led to an unclear understanding of the goals and tools of water sector reform policy (Jordan et al. 2005). The same uncertainty has left local actors (Municipalities, movements, companies) in search of contingent strategies which rely on a very diverse range of resources: financial, political, technological, and institutional resources which have built up power relationships completely unaccounted for by the original design.

A second element of continuity lies in the lack of a coordinating effort which might have mitigated the inconsistence of design and implementation and the tension between top-down and bottom-up implementation strategies (Thomann et al. 2018). The role of COVIRI-AEEGSI-ARERA as national regulator was permanently challenged both by peripheral stakeholders and by the national policy-maker, and could never reach the necessary stability and credibility to even monitor and report effectively on the state of reforms. At the same time, the Ministry of the Environment and the Ministry of Infrastructures were exonerated from exerting effective control and regulation by the rhetoric of regulation encapsulated in the creation of COVIRI and its successors.

Over a period of two and a half decades, on the other hand, a new element has come to the fore: the incremental process of patching up norms and institutions in a permanent search of the perfect model at the central level has contributed to the alienation of key players, that is, to the loss of a sense of meaningful purpose of the whole reform process by communities, Municipal and Regional political actors, and – to a lesser extent – companies. This element is confirmed by the state of the debate in Parliament, where the contentious issues between M5S and PD are the legacy of a conflict which emerged in 2007 (the people's initiative) and has been replicating almost exactly its terms while norms, strategies and the context have changed significantly.

The system of water service governance appears in brief to be "ungarrisoned": unguarded, unprotected, unguided. While local actors devise contingent tactics to hold positions and make marginal advancements, the centre no longer has the policy capacity to draw them to action with a meaningful proposal for change.

All in all, the hybrid destiny of water governance in Italy is still shaped on a variety of local practices and located in the traditional fragmentation of intergovernmental relationships. This multi-stakeholder and multi-level governance is permanently confused and in search for a solution. The incremental path only partially favoured the reinforcement of regulation and the concentration of players. The general landscape is still scattered and ambiguous, the institutionalisation is permanently ongoing, while a creeping de-institutionalisation is taking place through the loss of salience and public attention and through the shift toward "other" definitions, other institutions, other arrangements. Water is slowly being absorbed by other fields of policy.

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Chapter 13
The Integrated Water Service in the Italian Legal System Between Solidarity and Competition: An Overview

Vera Parisio

Abstract This chapter analyses the complex evolution of the Italian regulatory framework on water supply, which is a so-called integrated public service, since it concerns as a whole the public services of catchment, intake and supply of water for all kinds of uses, for sewerage purposes, and for the depuration of waste waters. The integrated water service, a local public network service with economic relevance, shall be managed in compliance with the principles enshrined in European Union law, which maintains a neutral position (the free administration principle) with respect to private or public models of management of SGEIs. Both models present pros and cons, so every municipality, within the European legal framework, has to choose the best management form for water service supply, prioritising the needs of its population and the socio-economic characteristics of its territory, also in light of water access being conceived as a human right. The chapter concludes by considering that, irrespective of the management model chosen by local governmental bodies to run the integrated water service, of great importance is the necessity to guarantee the modernisation of the water network, in order to avoid the loss of a resource which is (and must remain) public, as it is bound to be bequeathed intact to future generations.

Keywords Services of general economic interest · European law · Integrated water service · Water service management models

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13.1 Introduction: The Water Supply Service Between National and European Rules

In the Italian legal system the water supply service, regarded as a local public service, must be analysed by keeping it distinct from water resources considered as a public good, even if the two are connected. Indeed, the different models of management of the water supply service may be influenced by the approach taken towards the right to water.

In this chapter, the different possible models of water management will be analysed, especially the basic choice between private or public water supply service management, provided that such a choice occurs in a legal system where water is understood as a human right (on the right to water in Italy see, in addition to Chap. 11 by Turrini & Pertile in the present volume, Louvin 2018; Cauduro 2017; De Martino 2017; for a comparative perspective, Frosini and Montanari 2012). The challenge is to understand if, under public as opposed to private management, a better access to water, good quality water, lower prices and the public nature of the water resources can all be ensured.

It is worth stating now, in a preliminary way, that public management is a wide concept that refers to the management carried on by entities (State, regions, provinces, municipalities and also other subjects with no territorial base), which are public themselves, publicly owned or totally controlled by public entities. Water providers work to satisfy the public interest, that is, to provide essential services to the population in a fair and sustainable way. All the revenues deriving from the water cycle, in a long-term perspective, should be reinvested into the water cycle to ensure efficiency, rather than increasing the profits of private shareholders. As to the different management models that can currently be chosen by municipalities, the concept of "public management" of water supply services – this will be dealt with in greater detail in the following pages – corresponds to the following cases. The local administration may decide to manage the service using its own means and resources,[1] or it may decide to set up an in-house providing company to whom the service is assigned directly (which is a more frequent choice). In this latter case, however, the company has to meet the conditions set by European Union (EU) law, that will be illustrated later.

Today we are seeing a trend aimed at strengthening the outsourcing of water services in the name of competition and with the hope to obtain better quality at lower prices. The system seems to be oriented towards a general "privatisation" of the services. Nevertheless, if compared to other sectors, the water sector seems still relatively unaffected by the competition logic, as it is inevitably influenced by the territorial aspect, the limited availability of the resource, as well as by the non-duplicability of the network. To demonstrate this, it is worth noting that the water

[1] For this approach, see Council of State, Sect. VI, judgment of 11 February 2013 no. 762; Council of State, Sect. V, judgment of 27 May 2014 no. 2716 (judgments are available at www.giustizia-amministrativa.it).

service fell outside the scope of a draft legislative decree dedicated to services (*Testo unico dei servizi pubblici locali di interesse economico generale*) that was never published in the Official Journal, so that the authorisation for its issuing, contained in Law no. 124 of 2015, expired.

As it is well known, the United Nations General Assembly voted Resolution 64/292/20110 to recognise access to clean water as a human right. In accordance with it, the "Right2Water" movement is acting to obtain a similar declaration at the European level; in response to such European citizens' initiative, the revision of the EU Drinking Water Directive (Directive 98/83/EC) was proposed by the European Commission in February 2018 with the aim of obliging all Member States to take measures to ensure that all people, especially vulnerable and marginalised ones, be connected to the water distribution network, especially through the construction of public water dispensers available to all citizens. In this context, some governments are also banning the disconnection from the water service in addition to the electricity and gas services (in Italy, in compliance with Law no. 221/2015, 50 litres of water per day are free for poor people, as they are payed through general taxation). This stems from the recognition that water is an indispensable human right.

As to the public nature of water resources, it has been established in Italy since Royal Decree no. 1775/1933 (*Testo unico delle disposizioni di legge sulle acque e sugli impianti elettrici*), and then in the so-called "Legge Galli" (Law no. 36/1994). In the latter, which aimed at rationalising the use of the resource, the *ex lege* qualification of water had as a consequence that its special status did not need to be proven on a case-by-case basis depending on the physical and contextual features of the resource concerned.

In addition to the principle that all surface and ground waters, even though not yet extracted, are public, the Galli Law also sets the one demanding for the safeguard of water for future generations, in advance with respect to EU Directive 2000/60 (the Water Framework Directive). In the latter, the first recital of the preamble warns that "water is not a commercial product like any other, rather, a heritage which must be protected, defended and treated as such", whereas Article 1(e) cites, among the purposes of the directive, "the provision of the sufficient supply of good quality surface water and groundwater as needed for sustainable, balanced and equitable water use". In the same vein, the Goal no. 6 ("clean water and sanitation") of the United Nations Sustainable Development Goals stresses the importance of conserving water resources for future generations.

Legislative Decree no. 152/2006 (the "Environmental Code") currently in force, in turn, in its Article 144 recalls Article 1, Paragraph 1, of the Galli Law and provides that, in addition to water resources, also aqueducts and water infrastructures are considered public, and are part of the so-called incidental domain. They are goods which can belong to local entities or other public bodies by virtue of an assessment carried out by the legislator and not for their intrinsic nature.[2]

[2] On the subject of networks and their separate management from the service, see Constitutional Court, judgment of 30 November 2011 no. 320 (judgments are available at www.cortecostituzionale.it).

The Italian Civil Code, too, attributes waters – public waters – to the necessary public domain (Article 822), so that they are inalienable and cannot be the object of rights in favour of third parties (Article 823), except for the cases established by law, and they are subject to the monitoring of the State or of the Regions, which must ensure their correct use. The public nature of water resources is strongly stressed also in recent bills being discussed by the Parliament.[3] At any rate, it is worth noting that the fact that all waters are public has not as a necessary consequence that the management of the water service can only be public, as it will be better developed later (see, on this point, Massarutto 2011).

The water supply service, or better, the integrated water service (IWS), has undergone significant legislative interventions over the last 40 years (Andreis 2016; Bercelli 2001; Bercelli 2006; Boscolo 2012; Caporale 2017; Cerulli Irelli 2012; Fioritto 2003; Fracchia et al. 2019; Parisio 2007; Parisio 2010; Parisio 2011; Sandulli 2011), which can be explained with the endless tension between public and private management of local public services, especially in light of EU law.

The implementation of European law has, in particular, emphasised the conflict between the growth of competition and the maintenance of monopolies especially in the water sector (that can be considered a sort of natural monopoly by its nature), also in light of the important relation existing between the environmental protection of resources and the supply of the water service. Last but not least, the enforcement of EU law (including Directive 2000/60), of Article 106 of the Treaty on the Functioning of the European Union (TFEU), and of all the principles put forth by the EU Court of Justice in its case law, has re-sparked off in Italy the bitter conflict between State and Regions, caused by the unclear content of Article 117 of the Italian Constitution. Pursuant to such provision, Regions have residual legislative powers in all the matters that are listed neither among the State's exclusive competences nor among the State-regional shared competences. This would be exactly the case of local public services, although these are strictly connected to the ambit of competition as well.[4]

The Italian Constitutional Court has played an essential role in stating the principles that govern the sharing of competences between State and Regions in the field of public supply of water, especially because the Italian Constitution does not contain any specific regulation on water resources and does not mention water as a fundamental right (for the concept of the right to water and its relationships with other fundamental rights, Drobenko 2012). However, such a right can find an implicit protection in some provisions of the Constitution, such as Article 2 or Article 32. At any rate, there is no doubt that the water supply service management is heavily influenced by the conception that a legal system has of the nature of the right to water.

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[3] See Camera dei Deputati, XVIII legislatura, A.C. 52 and A.C. 773 (*Disposizioni in materia di gestione pubblica e partecipativa del ciclo integrale delle acque*), available at www.parlamento.it.

[4] See Constitutional Court, judgments of 23 November 2017 no. 401 and of 9 July 2014 no. 199.

The Italian Constitutional Court has made special reference to the economic importance of local public services in order to establish the exclusive State competence with regard to the “competition” subject, also with reference to the IWS, as it will be better explained later. Needless to say, it is difficult to establish a clear border between the exclusive powers of the State and those – of residual character – of the Regions; such difficulty is proven, for example, by the harsh constitutional controversy regarding the suppression of authorities superintending the so-called Optimal Territorial Areas (*Autorità d’ambito territoriale ottimale* – AATO).[5]

13.1.1 The Water Supply Service and the Services of General Economic Interest

In a judgment[6] that attracted criticisms (e.g., Cecchetti 2012), the Italian Constitutional Court has qualified the water supply service as a “local public service of economic importance”, therefore falling within the definition of “service of general economic interest” (SGEI) pursuant to Article 106 of the TFEU. Article 4 and Article 106, Paragraph 2, of the TFEU provide for specific protection for SGEIs, while Article 36 of the EU Charter of Fundamental Rights states that access to SGEIs is a fundamental right, albeit without giving a definition of them. Therefore, except from the rare cases where the legislator directly qualifies a service as a SGEI, in all the others, the presence of different elements must be verified (i.e., activity regarded as necessary by the public body for the welfare of citizens, and carried out in a real or potential market and managed in compliance with the principles listed below) in order for an activity to be considered a SGEI. The result of this qualification would be the necessary application of the rules developed at the European level for the management of SGEIs.

These are, therefore, activities which each EU Member State decides – and it is a political, discretionary decision – to provide to its citizens, to ensure the social cohesion among them. These services are delivered in compliance with the EU principles of equality, transparency, continuity, quality, safety, non-discrimination, proportionality, and last but not least, competition.[7] The services are provided or likely to be provided in a market, in return for a payment, and are such that they would not be ensured without public intervention or, in any case, would be provided in different forms in terms of physical properties and affordability.

It should be noted that the Concessions Directive (EU Directive 2014/23), in Article 4, Paragraph 1, does not limit the discretion of Member States, which is

[5] See Constitutional Court, judgment of 20 April 2011 no. 128.

[6] See Constitutional Court, judgment of 7 March 2012 no. 62. See also Constitutional Court, judgment of 15 June 2011 no. 187 and Council of State, Sect. V, judgment of 10 September 2010 no. 6529.

[7] See Council of State, Sect. I, judgment of 7 May 2019 no. 1389; Regional Administrative Tribunal – Lombardy (Milan), Sect. III, judgment of 3 July 2020 no. 1274.

actually wide, to give a service the qualification as SGEI, in compliance with EU law. The assessment carried out by each Member State cannot be scrutinised by the EU, unless it is clearly illogical or there is a manifest error of assessment.

The distinction between SGEIs and services without economic interest is still fluid. Only SGEIs can create a market (which may thus be only potential), which means that it is not so much the intrinsic content of the activity, but rather the modes of its management that determine its belonging to one or the other category, as also pointed out by the Italian Constitutional Court in a judgment of 2010.[8] There, the Court has stated the equivalence of the notion of "*servizio pubblico locale di rilevanza economica*" and that of "service of general economic interest", as both show an objective character, consisting in the economic method used to manage the service, i.e. in order to strike a balance between costs and profits.[9] In both cases, the service is provided through an economic activity, by a public or private enterprise.

Unlike any other economic activities carried out by the public administration, the SGEI is deemed to be necessary for the welfare, and the economic and social development of an area.[10] These traits of a public service as opposed to other economic activities carried out by the public administration, have as a consequence that the public authority is responsible for the regular provision of the service even if it does not provide it directly. In any case, the service is offered to an undifferentiated mass of users, even if it is enjoyed individually, and it is subject to obligations set out by the public authority, including some relating to its pricing in the form of fees and tariffs.

This said, having SGEIs an economic character, the qualification of an activity as a public service entails the respect of specific rules, both European and domestic, on the different approaches to its management, aimed at protecting competition.

In the past, some Italian Regions and some Municipalities claimed the possibility of inserting the IWS in the class of services without economic relevance[11] – a matter that went beyond mere formal categories.[12] This was considered a way to place the person and not the market at the centre of the service management,[13] thus better ensuring the right to water of everyone, at lower prices.

These Regions and Municipalities had provided in their regulations (*statuti*) that the IWS had to be managed to ensuring solidarity rather than profit, in order to avoid that water could become a merchandise and the service tariffs could rise uncontrolled (Santucci, Simonati & Cortese 2011; in particular, Cortese 2011 therein). In doing so, they claimed their freedom of not outsourcing the service and thus to

[8] See Constitutional Court, judgment of 17 November 2010 no. 325.

[9] See also the Court's judgment no. 187 quoted above, fn. 7.

[10] See European Court of Justice, *Albany International BV v Stichting Bedrijfspensioenfonds Textielindustrie*, C-67/96, judgement of 21 September 1999.

[11] See Constitutional Court, judgment of 27 July 2004 no. 272. See also, *ex multis*, Regional Administrative Tribunal – Lombardy (Milan), Sect. IV, judgment of 15 October 2015 no. 2176; Council of State, Sect. VI, judgment of 18 February 2012 no. 5268.

[12] See Constitutional Court, judgment of 7 March 2012 no. 62. See also Sandulli (2012).

[13] On social services in particular, see Finocchi Ghersi (2006).

manage it by means of a special undertaking (*azienda speciale*) or by an "in-house providing company" – without all the limitations established in the previous legislation – or even to manage the service directly by resorting to their own resources. In their view, the choice of a form of direct management made it easier to link the supervisory responsibility to elected officials, who must be accountable to citizens, as they would not respond to private shareholders and pursue the drive for profits. The objective was to ease the establishment and work of public water providers, so as to offer, in the general interest, essential services of good quality, in a continuous way, and respecting the principle of equality (Morzenti Pellegrini and Monzani 2015).

However, as we have already noted, the Constitutional Court has clearly denied the possibility of qualifying the IWS in an autonomous way, other than a SGEI. Moreover, domestic law can provide for economic incentives to Municipalities which outsourced their SGEIs, as this is considered the most efficient way of managing those services, in full respect of the law. All this undoubtedly proves a trend aimed at strengthening outsourcing, to increase competition, allegedly ensuring a better quality at lower prices. This is why the system seems to be oriented towards a "privatisation" of water services (which, however, does not mean a privatisation of water resources, as already pointed out).

13.2 The Management of the Integrated Water Service: General Outlines

Law no. 36/1994 – the already mentioned Galli Law – was the first systematic law on the organisation and management of water services, which treated the entire sector as an industry and gathered all the production segments that had been managed separately until that moment (Caporale 2017, pp. 213 ff.). In this way, that plurality of water services became the "integrated water service". Therefore, since the approval of Law no. 36/1994, the definition of water supply service covers the public services of catchment, intake and supply of water for all kinds of uses, sewerage and depuration of waste water. Indeed, an integrated water service (*servizio idrico integrato*).

As we have already noted, the management of the water supply service is carried out in a condition of natural or factual monopoly, influenced by the territorial structure and by the limited availability of the resource, as well as by the non-duplicability of the network. Thus, the dialectic between the protection of competition and the conservation of monopolies seems very strong in such a field that, unlike the electricity or the gas sectors, is certainly still not completely open to the liberalisation process.

Even though the Galli Law was formally repealed by Legislative Decree no. 152/2006, its fundamental principles are still valuable.

13.2.1 The Starting Point: Law no. 36/1994

As already noted, the Galli Law had introduced a sectoral regulation aiming, in the first place, at reorganising the administrative functions through the unification of the various water services and their redistribution over super-municipal districts called Optimal Territorial Areas (*ambiti territoriali ottimal*i – ATOs). Normally, inside the ATOs a sole provider was allowed to work; for the whole cycle a sole tariff was established, calculated in such a way to ensure the complete recovery of the operating costs as well as the remuneration of the invested capital. The entire "production chain" necessary for the water service management was therefore subjected to an industrial logic, with capital remuneration allowing the provider to reach economic self-sufficiency, in the end identifying the economic nature of the service.

The ATOs had been designed inside the hydrographic catchments, in compliance with the restrictions set by the soil rehabilitation plans (approved pursuant to Law no. 183/1989), with the Regional plans for aqueducts and with the various exploitation restrictions relating to the territory. Indeed, the Galli Law represented, without any doubts, the first systematic attempt at harmonising the management of the water service with the protection of the territory, with a view to better preserving water resources for future generations.

Another important achievement of the Galli Law was the unification of the various phases of the water service, that were once distinct, thereby restating the compulsory nature of the service, whose supply had to be inspired by the principles of efficacy, efficiency and cost-effectiveness. All those principles were very modern for its times: interestingly, they were established in advance of the EU Water Framework Directive.

The activities of catchment, intake, supply and disposal, considered together, gave life *ex lege* to a public service with economic relevance and intended for the population's fundamental needs. The territorial entity (Municipality or Province) was entrusted with a monitoring duty that consisted in enacting local regulations and, through the contract for services, which is formally a private sector act, controlling the provider's activity.

As to the management of the IWS, Law no. 36/1994, complemented by the Prime Minister's Decree of 4 March 1996 (*Disposizioni in materia di risorse idriche*), established that Municipalities and Provinces – as Basin Authorities – manage the IWS in the modalities, even compulsory, set forth by Law no. 142/1990, as complemented by Article 12 of Law no. 498/1992. Permitted modalities were the following: direct management (*gestione in economia*) carried out by the departments and the staff of the Municipality itself; management through the constitution of a special Municipal agency with legal personality (*azienda speciale*), or of an agency without legal personality (*istituzione*) but only for activities with no economic interest. The award (*concessione*) to third parties or to a public-private partnership company (with either a minority or majority public participation) was possible as well.

13.2.2 The Integrated Water Service and the Environmental Code

As already said, the Galli Law has been repealed by the Environmental Code, which, however, has maintained most of the former's provisions (that was fortunate, as the Galli Law was a very well written and broadminded piece of legislation). Legislative Decree no. 152/2006 has provided for, as will be said also later, an autonomous regulation of the water service which took inspiration from the general one applicable to SGEIs set out in Article 113 ff. of Legislative Decree no. 267/2000 (the Consolidated Law on Local Governments, *Testo unico degli enti locali* – TUEL), which had been modified a lot of times. With the Code, therefore, the specificities of the water service have been taken into account with the aim of further improving its regulation.

In Legislative Decree no. 152/2006, modified in 2008, Articles 147 to 158 concern the IWS. They define in the first place its territorial organisation – which must be necessarily based on the ATOs, designed by the Regional governments – that today corresponds to the Provincial districts' borders, on the grounds of a mere principle of administrative efficiency.

Moreover, the Environmental Code has established basin authorities, the AATOs (Autorità di Ambito Territoriale Ottimale), as the apical organisational and managing body of the ATOs, provided with legal personality and set up in every ATO. The local governments are obliged to participate in the AATO, to which they delegate all their powers in matter of management of water resources. This function is exercised through the adoption of the basin plan (*piano di bacino*), an instrument whereby the infrastructural interventions, the management and organisational model of the service and the business plan are set out.

The different methods of managing the water service supply (Piperata 2011, 2016; Parisio 2013) were provided for in Article 150. This was repealed by Law no. 164/2014, which was approved in light of the results of the referendum of June 2011. In its original version, Article 150 (in compliance with no-longer-in-force Article 113 of the TUEL) established that the service had to be awarded on the basis of a public tender, governed by EU principles and regulations; or to a public-private partnership company whose private partners had to be chosen through a public tender (with either a minority or majority public participation). On a residual basis, the model of the in-house providing company could be used, under the conditions that the capital of the company destined to manage the service was owned only by the public body (or bodies) that was (were) part of the ATO, that the participation was direct and, finally, that there was a particularly detailed motivation intended to justify such a choice on the grounds of technical and economic reasons.

13.2.3 The Current Situation

Currently, the management of the IWS – a local public network service with economic importance – is regulated only by principles stemming from EU law, which must be transposed into the Regional legislation, and for some aspects by Law no. 164/2014 (Fracchia and Pantalone 2018). The EU principles are set forth in Articles 14 and 106 of the TFEU. European law maintains a neutral position with respect to the private or public methods of management of SGEIs, and this is known as the free administration principle (Lucarelli 2010).[14] Therefore, all the following methods are allowed (Dugato 2016): outsourcing of the service; direct assignment to mixed companies where the private partner has been chosen through a double-object tender and without any predetermination of its minimum shareholding; "self-production" by public bodies, that is, direct assignment to in-house providing companies or, for small-entity services, direct management (Ibba 2012).

Article 34, Paragraph 20, of Decree-Law no. 179/2012, converted into Law no. 221/2012, has also to be applied for the IWS. Thus, the choice of one of the different managerial approaches must be motivated by making reference to a "techno-economic" report (Sorrentino 2016), i.e. a technical and economic assessment to be conducted prior to any decision on the assignment of the service (Caia 2018), and made public through the website of the Municipality. In the report, it is necessary to include a detailed comparative analysis of the various costs associated with the different management models of the service that can theoretically be proposed, in order to make clear that the chosen model is the most appropriate.

If outsourcing is chosen – a minority choice up to now in the IWS field – the EU principles concerning tenders will find application, which have been transposed into the Italian legal system by the so-called "Contracts Code" (Legislative Decree no. 163/2006, modified several times since its enactment). At the EU level, recital no. 40 of the preamble of EU Directive 2014/23 places the water sector outside the scope of the Directive itself; nevertheless, if public authorities decide to outsource a water service with a cross-border interest, they will award it through a public tender, in compliance with the European principles of transparency, equal treatment, non-discrimination and proportionality. It is significant that this Directive (on which see Parisio 2016) is taken as a reference by Law no. 11/2016 under the letters hhh), which, in addition to the aims of harmonisation and simplification of the existing provisions, promotes the adoption of an organic framework for the water sector concessions which takes into account the outcome of the abovementioned 2011 referendum.

[14] In the opinion of Lucarelli (2010), the model of the special agency (*azienda speciale*) is applicable as it is allowed by EU law, which, moreover, would prevail in case of conflict with domestic rules. In keeping with this approach see Longhi (2012). On the characteristics of the special agency, which is the "successor" of the previous Municipality agency (*azienda municipalizzata*), see Parisio (2003).

If the establishment of an in-house providing company is chosen, only compliance with EU principles will be required.[15] Before the adoption of EU Directives 2014/23, 2014/24 and 2014/25, the basic elements of the in-house providing company model were to be found in the case law of the EU Court of Justice and of Italian administrative courts. However, the interpretative work of the former is carried on with a case-by-case technique and by general clauses, such that it does not always allow a clear identification of the applicable legal categories.

Now this state of uncertainty is reduced, as Article 17 of Directive 2014/23 and Article 12 of Directive 2014/24 codify the in-house company requirements, which have been transposed by Italy in Articles 5, 192 and 193 of Legislative Decree no. 50/2016 (and subsequent amendments and addenda), in Article 16 of Legislative Decree no. 175/2016, and finally in the Guidelines no. 7 of the Italian Anti-corruption Authority (*Autorità nazionale anticorruzione* – ANAC).[16] In compliance with these Guidelines, the fundamental requirements for the in-house management model of SGEIs are three.[17]

The first requirement is that the capital of the in-house company must be totally public. Private capitals are admitted only if their participation is made compulsory by national laws in conformity with the EU Treaties, as long as such participation is non-controlling and non-blocking and does not confer a decisive influence on the decisions of the controlled legal person, as also stated in recital no. 46 of Directive 2014/23. Thus, it is quite unusual for a private actor to be willing to buy shares of an in-house company for the management of the water service, in light of, on the one hand, the actual (non-)possibility of impacting the governance of the company and, on the other hand, the real perspective of investing huge amount of money for the modernisation of the water network.

Article 149 *bis* of Legislative Decree no. 152/2006 establishes that the public shareholders have to belong to the same ATO, in light of the IWS specific shape. This provision, therefore, does not undermine the general model of the in-house company based on Directive 2014/23 and the laws transposing it (Miccù and Francaviglia 2018); on the contrary, such Directive and laws are one of the possible legal reference for this model for the IWS. Article 149 *bis* is considered *lex specialis*, thus it prevails over more general provisions, such as Article 5 of Legislative Decree no. 50/2016 and Article 16 of Legislative Decree no. 175/2016. The Council of State has stated that a private partner cannot join an in-house providing company, as in our legal system there is no law (except for the just mentioned Articles 5 and 16) which expressly admits this and regulates the possibility for the private partner of joining the company, its role inside the company itself and the mutual relationship between the two.[18]

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[15] See, very recently, Court of Cassation, Unified Sects., judgment of 20 February 2020 no. 4316 (judgments are available at www.cortedicassazione.it).

[16] These guidelines are available at www.anticorruzione.it/portal/public/classic/Attivitadocumentazione/ContrattiPubblici/LineeGuida/_lineeGuida7

[17] See Council of State, Sect. I, judgment of 7 May 2019, no. 1389.

[18] See Council of State, Sect. I, judgment of 7 May 2019 no. 1389.

The second requirement which characterises the in-house providing company model is the existence of a control similar to the one that the authority that sets up the company exercises over its own departments.[19] The notion of "similar control" is met when the contracting entity has not merely a strong influence, but a decisive one over the strategic objectives and significant decisions of the controlled legal person. Furthermore, the control can be exercised by a different legal person, which is controlled in the same way by the contracting authority or entity.

The case law of both the EU Court of Justice and the Italian courts has a very important role in specifying, case by case, the presence of the "similar control". The requirement is met, for instance, when the decision-making bodies of the controlled legal person are composed of representatives of all the participating contracting authorities or entities, in order to exert a decisive influence on the strategic objectives and most important decisions of the controlled legal person. In addition to this, the controlled person cannot pursue any interests which are contrary to those of the controlling authorities or contracting entities (Miccù and Francaviglia 2018).

The third requirement that characterises the in-house providing company model is that the main activity must be carried out with the contracting authority (or authorities). The notion of "main activity" is quantified, meaning that the company must carry out a percentage of its activities exceeding 80% in favour of the contracting authority or with the authority controlled by the contracting authority.

Directive 2014/23 helps identify the elements to be assessed to determine the mentioned percentage: the total average turnover, or a suitable alternative measure based on the activity, such as the costs incurred by the contracting legal person concerning works, services and supplies covered by the concession, during the 3 years preceding the award of the concession. Moreover, with Article 16, Paragraph 3 *bis*, of Legislative Decree no. 100/2017, an additional requirement has been added in the Italian system, which is not provided for by the European framework (therefore, in line with the tightening of the European legislation), to the effect that the production in excess of the 80% turnover limit is only permitted if this allows to achieve economies of scale or efficiency gains on the whole of the company's main activity.

Article 192 of Legislative Decree no. 50/2016, as already mentioned, legitimately "tightens" the provisions of EU Directive 2014/23, as the former falls within an ambit of national discretion, and establishes that in the case of services available on the market and thus open to competition, the contracting authorities must verify the benefits – more precisely, the cost effectiveness – of the "in-house" option, assessing the object and the value of the service to be provided, and always motivate the act of entrustment with particular regard to the reasons for the non-recourse to the market and the universal socio-economic objectives of the service.[20]

The issue on the management of the IWS through a special agency (the "*azienda speciale*", which in the Italian system is as a subsidiary body of the local entity, as per Article 114 of the TUEL) remains open. The agency is a public-law subject

[19] See Council of State, Sect. V, judgment of 30 April 2018 no. 2599.

[20] See Council of State, Sect. V, judgment of 20 January 2020 no. 444.

which carries out an entrepreneurial activity and whose aims are tightly connected to the activities carried out by the entity that established it. Since the principles of EU law regulating the management of the IWS do not preclude the use of such an organisational model, it must be considered that, even in the absence of a specific *ad hoc* domestic regulation, the establishment of special agencies is acceptable (but such an option is discarded by Caia 2012).

13.3 The Water Service Tariff and ARERA: An Overview

The Galli Law had set out, in its Article 13, that the tariff, representing the amount due for the water service, had to be calculated by considering the quality of the water resource, the service supplied, the necessary infrastructural works, the management costs and the remuneration of the invested capital, so that the investment and running costs would be entirely covered. Moreover, according to Article 14 the whole service cost had to be the sum of the costs of the aqueduct, sewerage and purification services. The cost of the sewerage service, in turn, had to be calculated on the basis of the quantity of drained water. Article 154 of the Environmental Code accurately reproduced the text of Article 13 of the Galli Law. The referendum held on 12 and 13 June 2011 erased (only) the reference to the remuneration of the invested capital contained in Article 154. The elimination of that reference caused some problems.

Article 9 of the Water Framework Directive reads: “Member States shall take account of the principle of recovery of the costs of water services, including environmental and resource costs, having regard to the economic analysis conducted according to Annex III, and in accordance in particular with the polluter pays principle”.[21] This link between the principle of full recovery of the costs of the water service and the general polluter-pays principle is also established by recital no. 38 in the preamble of the Directive. The tariff for the water service, therefore, must be such as to cover the costs to restore the resource in case it was polluted. In exchange for the tariff, the user should receive a range of services, consisting in the administration of the resource, the supply of services of sewerage and depuration, and a guarantee that a part of the tariff is saved for the upkeep of the network and the preservation of the quality of water.

The Italian Constitutional Court stated that the elimination of the reference to the remuneration of the invested capital does not imply the transformation of the water service from a service with to a service without an economic importance, as for the former the running of the activity with an economic method is only required.[22] That means that such an activity must be managed at least with a view to covering, over

[21] On the full-recovery-of-costs requirement set out in Art. 9, see Chap. 17 by Massarutto in this volume.

[22] See Constitutional Court, judgment of 26 January 2011 no. 26.

a given time, the costs with the proceeds, of any nature whatsoever, including public funds. The elimination of the reference to the remuneration of capital only means that the logic of money must be irrelevant to the management of water (for a different perspective, Morzenti Pellegrini and Monzani 2015).

Furthermore, the scenario has become even more complicated following the elimination of the AATOs, that were in charge of setting the tariffs, and of the National Agency for the Regulation and Vigilance in the Field of Water (*Agenzia nazionale per la regolazione e la vigilanza in materia di acqua*), a sort of independent authority abolished with Law no. 214/2011 just a few months after its constitution.

The Prime Minister's Decree of 20 July 2012 has then devolved to the Regulatory Authority for Electricity and Gas (*Autorità per l'energia elettrica e il gas* – AEEG, later the *Autorità per l'energia elettrica, il gas e il sistema idrico* – AEEGSI), which in 2017 became the Regulatory Authority for Energy, Networks and Environment (*Autorità di regolazione per energia, reti e ambiente* – ARERA), the powers that had initially been exercised by the Basin Authorities and later by the already mentioned National Agency for the Regulation and Vigilance in the Field of Water.

ARERA carries out regulatory and supervisory activities in the sectors of electricity, natural gas, district heating, water services and the waste cycle. This independent administrative authority, established as AEEG by Law no. 481/1995, promotes competition and efficiency in the field of public utility services and protects the interests of users and consumers. It aims at harmonising economic and financial objectives with general social objectives, like environmental protection and the efficient use of resources. The Authority's activity has been focusing on the identification of regulatory standards for water services, with the purpose of improving the quality of such services and a special attention to their end-users, in light of the general principles of transparency, consistency, convergence, efficiency and effectiveness. In matters within its competence, with a view to better implementing EU law, it provides consulting (e.g., in the form of recommendation papers) to the Government and the Parliament. In compliance with its nature as independent authority, ARERA acts in full autonomy and neutrality within the framework provided by the general policy guidelines formulated by the Government and the Parliament, as well as the regulations of the EU. The running costs of ARERA are paid through contributions from the revenues of regulated operators.

ARERA plays a very important role in setting the water service tariff. It has the function of defining and maintaining a reliable and transparent tariff system, again reconciling the economic goals of operators with general social objectives, and promoting environmental protection and the efficient use of energy. During the last years, ARERA has been working on the implementation of the tariff method and the consolidation of information about the water sector, and it has aimed at completing the regulation in order to reduce any asymmetry and promote the investments. This has really been the objective of the action of ARERA since the beginning. Within its area of competence, the Authority has started to lay out an innovative regulatory framework, which takes into account all the differences existing in the various territorial areas, to create a homogeneous method of setting the tariff which is not related to the nature (public or private) of the IWS management.

The regulatory framework introduced by the Authority has received important endorsements from a Regional Administrative Court of first instance (*Tribunale amministrativo regionale* – TAR), which has rejected all the petitions against the new tariff method, submitted by some individuals and companies claiming that the method violated the result of the 2011 referendum.[23] In particular, the Court confirmed the power of the Authority to regulate ongoing service agreements, as well as the validity of the full-cost-recovery principle underlying the new regulatory framework, including operating costs and the costs of assets.

ARERA has now arranged an approach based on the constant consultation with the interested parties, with the aim of setting the standards most apt to guarantee the quality of the water service, intended as technical, environmental and commercial quality,[24] as well as ensuring the affordability of the same service, in light of the principle of solidarity.[25]

13.4 Conclusions

Currently, Italy still lacks a law able to provide for a specific regulation for the water service supply, taking in due consideration all the specificities of the sector and the importance of ensuring access to water for everyone, (which is considered a fundamental right), and to help the collection of funding for the management and improvement of the water network, which is essential in order to reduce the huge water leaks Italy suffers from. The modernisation of the network, indeed, entails such a big investment, that local entities cannot afford it at the moment, and that sometimes discourages private capital-owners from entering mixed companies.

If public administration of the water service is chosen (i.e., management through a special agency with legal personality – *azienda speciale* – or through an in-house providing company, or very rarely by direct management), water tariffs could be maintained artificially low for political reasons, which however would impede a farsighted management of the network and the conservation of water as a good for future generations. Furthermore, not even private management could surely lead to an effective modernisation of the networks.

In the bills now being discussed in Parliament, the public-management model (by an *azienda speciale* or by an in-house providing company) is chosen, as it is

[23] See Regional Administrative Tribunal – Lombardy (Milan), Sect. II, judgment of 26 March 2014 no. 779; Regional Administrative Tribunal – Lombardy (Milan), Sect. II, judgment of 9 April 2014, no. 938; Regional Administrative Tribunal – Lombardy (Milan), Sect. II, judgment of 15 May 2014 no. 1275; Council of State, Sect. IV, judgment of 20 January 2014 no. 255. See also Tessarolo (2014) and Micalizzi (2015).

[24] On the water service quality see also, in this volume, Chap. 14 by Berardi, Casarico and Traini.

[25] On the role of ARERA in ensuring solidarity see, in this volume, Chap. 11 by Turrini and Pertile.

considered the most adequate to ensure the public nature of water resources and access to water as a fundamental right (on the important topic of the exclusion of bottled water from the debate on water management, Bonetto 2017).

Public and private management models present pros and cons, so every Municipality, within the European legal framework, has to choose the best management form for the water service supply, prioritising the needs of its population and the real socio-economic characteristics of its territory, in light of the human right to water access. The population is interested in having clean water of good quality at an affordable good price, without renouncing to the protection of water resources for future generations, so the subject that manages the IWS, both private or public, must invest to improve the efficiency of the water network.

What is crucial is the possibility of changing easily the chosen form of management if it does not work, and the certainty that investments in the network are done. This latter is a very important matter: an increase in the investments aimed at repairing the network implies an increase in water tariffs for users and/or in taxes for the general public. Public entities, with budgetary constraints, are not very keen on increasing the tariffs of the water service, also for political reasons, and private investors, in turn, are reluctant to set up a company or to participate in it if no remuneration of capital is granted, especially as a consequence of the 2011 referendum which has removed remuneration of capital from the water service tariff. (Morzenti Pellegrini and Monzani 2015). This is proved by the fact that in Italy the water service is run almost everywhere by the public, while private management is very rare. Public management usually takes the form of the in-house providing company, which quite often does not meet all the requirements set out by European and national law. Municipalities directly managing the IWS through their own offices are few and only govern small villages. The mixed company model, too, is uncommon, except for the case of Tuscany, Lazio and Umbria[26] In the other Italian regions, as we have already pointed out, the private partner bringing its know-how is reluctant to participate in the company with its own capital without having any real advantage.

In the end, one thing is certain: regardless of the model, whether public or private, that every local entity may choose, water resources remain public and destined to be bequeathed as intact as possible to future generations. Nevertheless, to attain this goal, the efficiency of water infrastructures must be ensured.

[26] See the Blue Book 2019 by Utilitalia (the federation gathering the companies working in the field of gas, electricity, water and environmental services), an overview of which is available at www.utilitalia.it/dms/file/open/?e78f6abe-73ac-40e9-a945-b6abb9a19cd9

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Chapter 14
The Evolution of the Italian Water and Wastewater Industry in the Period 1994–2018

Donato Berardi, Francesca Casarico, and Samir Traini

Abstract In 1994, a far-reaching reform of water and sanitation utilities was launched. Integration, industrialisation, self-sufficiency and cost-recovery were its keywords. Initially welcomed by an overwhelming consensus, the reform soon met implementation difficulties and experienced piecemeal application. In 2011, following a popular referendum, fundamental innovations in the regulatory system were introduced. This chapter reviews the industrial development (governance, arrangements, price regulations) through legislation, the establishment of an independent regulatory authority, and the impact of all these factors on prices, performance, investment and quality improvements.

Keywords Water and wastewater industry · Water governance · Tariff methods · Service quality · Infrastructural investment

14.1 The Water and Wastewater Industry in Italy Prior to 1994 and the Far-Reaching Reform Introduced by the Galli Law

At the beginning of the 1990s, the Italian water and wastewater industry was delivering unsatisfactory results. Water management was primarily carried out directly by Municipal authorities or via licenses granted to public companies and, more rarely, private companies. As a consequence, the industry was characterised by a highly fragmented service, both vertically and horizontally, with more than 7000 operators across the various stages of the supply chain. In the vast majority of cases, these water operators were in a deficit situation or even bankrupt, with low levels of efficiency and investment, and a poor service quality. The tariffs applied were not

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adequate to cover even just the running costs, and the consequent losses were borne by taxpayers. The infrastructure was in a shoddy state and huge investments were needed, which could not be funded via general taxation alone. Over that period, the financial resources for investments came from public funds, non-repayable grants, such as the "*Cassa per il Mezzogiorno*", or from favourable mortgages issued by credit institutions with an infrastructure mandate, such as the "*Cassa Depositi e Prestiti*". These resources were, at the time, becoming increasingly scarce. Moreover, the know-how necessary to design and build the infrastructure was limited, and a strong governance, a "chain of command", was lacking too (INDIS-Unioncamere & REF Ricerche 2004).

Thus, the water industry was in a general state of negligence. This situation was fertile ground for a system of patronage and favours, to the detriment of service quality. This is the historical phase in which fragmentation became an opportunity to continue this unsatisfactory state of affairs, where the difficulty in sourcing funds was used to justify the inability to solve problems; and it is where the roots of today's infrastructural emergencies can be found, with approximately 1000 urban agglomerations currently subject to sanctions or infringement proceedings by the European Court of Justice due to the lack of sewerage and purification systems compliant with the 1991 Urban Wastewater Treatment Directive.[1] The direct management by Municipal authorities, as carried on by local public administration, had scant examples of excellence, which were located in areas that had a longer tradition of efficient public administration.

Against this background, the so-called Galli Law (Law no. 36/1994) was passed in 1994, which still today represents a cornerstone legislation in the industry, as it began a long reform process that redefined the organisational and regulatory structure of the water service. The goal of this law was to regain efficiency in water resource management through the introduction of an industrial-type logic. The reform was anchored to the integration of the water cycle: vertically, with the creation of a single entity as the operator for the aqueduct, sewerage and purification segments; and horizontally, via the single management of the service within supra-Municipal optimal-size areas (ATOs – *Ambiti territoriali ottimali*) – with the aims of resolving the issue of fragmentation, and of growing to a level of management consistent with economies of scale and scope.

In terms of institutional framework, the law laid down a clear definition of the entities involved in the industry and of their duties. The central Government was charged with the functions of protecting the water resource, preventing pollution, and safeguarding the users' interests, in terms of rational planning of water usage and minimum quality levels of the service that must be guaranteed. Within the Italian Ministry of the Environment, a Supervisory Committee for Water Resources (COVIRI – *Comitato per la vigilanza sull'uso delle risorse idriche*) was established to preside over the tariff method, the monitoring of service quality and user

[1] Directive 91/271/EEC of 21 May 1991 concerning urban waste-water treatment.

protection and, in general, with supervisory duties over the correct implementation of the integrated water system reform.

The Regional authorities were invested with planning and coordination tasks, and were called upon to establish, with their own laws, general principles for organising the industry and managing the service through the delimitation of the geographical boundaries of ATOs, to establish tender methods, and to define tariff criteria. Additionally, the Regional authorities had to devise regulations and measures to promote a reduction in water consumption and the elimination of water wastage.

The Galli Law also established a distinct functional separation between the activities of "policy-making and control" and those of "managing" the service. The former set of activities were devolved to the Authorities superintending optimal-size areas (AATOs – *Autorità d'Ambito territoriale ottimale*), entities that were established as consortiums or by an agreement between local authorities – Municipalities and Provincial authorities – that fell within the same ATO. These entities were entrusted with organising the service in compliance with criteria of efficiency, efficacy and affordability. The latter set of activities were devolved to an entity that was entrusted with managing all segments of the integrated water system for each ATO.

From an operational point of view, the local authorities united in the AATO were tasked with carrying out a reconnaissance of all infrastructure (networks and plants) aimed at gathering data relating to the demographic indicators of the area, checking the state of infrastructure, and the relative efficiency levels. A Regulatory Plan was to be prepared on the basis of said reconnaissance, which would contain plans for the interventions and investment necessary to reach the set service-level targets, a business plan, and an outline of the tariff trend. It was also the AATO's duty to choose the organisational model to be adopted to manage the integrated water system and to maintain the service levels guaranteed to users. Once the Regulatory Plan was drawn up, the AATO would then have to assign the service to an operator via a contract prepared on the basis of a uniform agreement drafted by the Regional authority. For its part, the operator was charged with providing the service in compliance with an agreement, signed with the local authorities, which set out the operator's obligations and rights, and defined the methods for delivering the service, the duration of the assignment, the service quality level, and the relative control and monitoring methods. With regard to the financial aspects, the agreement would also set out criteria for defining the business plan and the application of tariffs. The AATO would then play the role of supervising and controlling the service management after the assignment of the contract.

From a tariff point of view, the Galli Law introduced the European principle of "full cost recovery", meaning the recovery of the entire costs of the service, both operational and investment, via tariff revenues. The goal was to untether, at least partially,[2] the growth possibilities of the water service from the critical situation of the public budget, by allowing the industry to self-finance. In compliance with

[2] There was no restriction with regard to public capital transfers.

Article 13 of the Galli Law, the Decree of the Ministry of Public Works of 1 August 1996 introduced a Standardised Tariff Method (MTN – *Metodo tariffario normalizzato*) as the basis from which to calculate the tariff for integrated water services. This was a tariff mechanism that took into account, on the one hand, a price-cap regulating system, in order to provide businesses with suitable incentives to reduce costs; and on the other hand, a rate-of-return regulating system, in order to prevent any problems of underinvestment in the infrastructure. However, this method, which was to be followed by all AATOs, did not apply to the old Municipal water and sanitation services, for which the tariff that had been defined by the agreement signed at the time still applied, covering only the variable operating costs and leaving the burden of investment costs on taxpayers.

14.2 The Period of Ministerial Regulation and the Inability to Review a Problematic Tariff Method

From 1996 to 2011, the regulation of the service was in the hands of Ministers, via the COVIRI and, afterwards, the National Commission for the Supervision of Water Resources (CONVIRI – *Commissione nazionale per la vigilanza sulle risorse idriche*), which replaced it in 2009, with areas of responsibility over the tariff method, service quality and user protection monitoring and, more generally, with duties of supervision over the correct application of the integrated water supply reform.

Both the COVIRI and the CONVIRI, however, had a negligible role in the evolution of the Italian water and wastewater industry. These bodies were dependent on and subordinate to political power, with poor financial resources, limited personnel, and insufficient powers of inspection and control.

Since the start of the millennium, changes in the operational and financial context in which the management companies found themselves made it apparent that the Standardised Tariff Method needed to be reviewed. Some of the main criticisms levelled towards the method included:

- tariff acknowledgement of investments even when said investments were not made;
- lack of incentives to improve service quality;
- excessive discretionary application of the method, since it allowed for the projection of growing volumes in order to squeeze tariffs, with the consequence that the resulting adjustments would fall onto the management companies, exposing them to financial imbalance and difficulty in accessing credit;
- a return on capital of a 7% fixed rate, not linked to market conditions;
- a regulatory time period of 3 years, which was considered too short;
- an efficiency recovery factor that was not linked to the productivity of the industry or the economy.

However, over the periods of their regulatory work, neither COVIRI nor CONVIRI managed to update the Standardised Method, fuelling a deep dissatisfaction among industry insiders and also the public and users, which in turn laid the ground for the birth of the referendum campaigns demanding the abolition of the "fixed remuneration on water services". As we will see below, a solution to this situation was found only later, with the tariff methods established by the independent regulatory authority set up in 2012.

14.3 The Uncertain, and Not Always Linear, Outcomes of the Law on Tendering the Service

Over the years, the legislature has often intervened in matters of local public services, and in particular of the water supply, with measures that have integrated and partly modified the provisions concerning the institutional and organisational setup. The results of such interventions were not always linear. After the enactment of the Galli Law, numerous regulatory measures followed delaying the reform process, which in fact never reached full implementation.

From the Galli Law (1994) to the advent of the independent regulatory authority (2012), the rules on the procedures to be followed in the event of new tenders changed again and again, and at such speeds that entities could not adapt to the new standards. The initial intent of the legislature, inspired by the principles of market competition, was substantiated by a series of Ministerial decrees and circulars issued since the end of 2001, reiterating that the choice of operator had to be carried out via public open tender, while direct assignment to special undertakings or to companies owned by a public entity was reserved only for cases where the management was in-house, that is, those cases in which the public body or bodies holding the share capital had a control similar to that exercised over their own services, and the third party had carried out the bulk of its activities with the local authority or authorities that controlled it. Subsequently, the Financial Law for 2002[3] revised the regulations on assigning of the Unified Text Governing Local Authorities (TUEL – *Testo unico degli Enti locali*) by requiring that the assignment should be carried out by tender or, alternatively, that it should be assigned directly to capital companies controlled solely by local authorities of the same ATO. This direct assignment process, however, should have taken place by the end of 2003 and with a maximum duration of 5 years, with the subsequent transfer of 40% of the capital to private entities. With Decree-Law no. 269/2003, the legislation was changed once again, setting out three licensing forms: assigning via tender, direct assignment to a joint enterprise with the selection of the private partner carried out via tender, and in-house assignment. In 2008 there was another legislative intervention,

[3] Law no. 448/2001. A Financial Law (*Legge finanziaria*) is a law, enacted on a yearly basis, whereby the Italian Parliament plans the Country's economic policy of the next few years.

culminating in Article 23 *bis*, of Law no. 133/2008, which restored the assignment via open call to tender as the ordinary process to manage public services, leaving direct assignment to in-house companies only for cases in which the "particular financial, social, environmental and geomorphological characteristics of the territorial context do not allow an effective access to the market". This assignment process was also to be subject to the submission of a report containing the outcomes of the aforementioned checking of the condition for direct assignment to the Antitrust Authority and, where established, to the sector's regulatory authorities, for them to express an opinion concerning the aspects within their competence. The combined provisions of Article 15 of Legislative Decree no. 135/2009 and the subsequent Presidential Decree no. 168/2010 reiterated that market competition should be the general approach with which to manage the assignment of local public services, leaving a residual role to in-house assignment, justifiable only in exceptional circumstances. Moreover, assigning the service via a tender procedure was equated with the direct assignment to a public-private joint enterprise, as long as the private shareholder, chosen via an open call to tender, was also awarded the management of the service itself. Article 23 *bis* was repealed by the first question of the 2011 referendum, from which it now derives that the assignment processes continue to be regulated by general European Union principles.[4]

More generally, with regard to legislation on water resources and their institutional framework, Legislative Decree no. 152/2006, the so-called Environmental Code, reiterated the indications already present in the Galli Law, leaving them largely unchanged, and clarified the duties and activities assigned to the various institutional actors involved. Moreover, the Environmental Code deemed it necessary to transform the AATOs from mere contracts between local authorities to actual legal persons. This is one aspect to which the legislature returned with Law no. 42/2010, which provided for the elimination of the AATOs from 31 December of that same year, referring to the Regional authorities the task of redesigning the service governance by 2012 by redefining the ATOs, establishing the optimal-size areas' new governing bodies (EGAs – *Enti di governo d'ambito*), and allocating to them the industry's organisational functions.

14.4 The Implementation of the Reform Fifteen Years After the Galli Law

An uncertain legislative framework, together with the inertia of local authorities, has certainly not helped the implementation of the Galli Law.

In order to complete the reform process, a series of implementation phases were necessary, such as, first of all, Regional laws identifying the ATOs, the

[4] On the principles governing the assignment of a service contract see, in this volume, Chap. 13 by Parisio.

establishment of the AATOs, the infrastructural reconnaissance and the drafting of Regulatory Plans with the relative identification of the necessary investment, and finally, the assignment of the service.

Almost 15 years after the Galli Law was issued, the Bank of Italy carried out a review of the status of its implementation, which highlighted long timescales, critical issues in the documents drafted, and the unfinished state of the reform.

With regard to the definition of area boundaries, an initial review was carried out by all Regions[5] between 1995 and 2002, with 91 ATOs identified[6] across the entire nation. This situation, however, showed a high diversity in terms of size, with the presence of Regional ATOs, Provincial ATOs and ATOs defined by sub-Provincial or inter-Provincial boundaries, and a predilection by the Regions for an administrative logic rather than an orographic one. Five years after the reform's entry into force, the establishment of the AATOs covered less than 50% of the ATOs, with a marked acceleration between 1999 and 2003, reaching completion in over 90% of the ATOs, and achieving around 100% in 2006. In terms of effectiveness, the infrastructure reconnaissance had been completed in 22% of cases in 1999, 77% of cases in 2003, and 85% of cases in 2006. The preparation of Regulatory Plans had been completed in only 3% of cases in 1999, around 60% of cases in 2003, and slightly over 80% of cases in 2006. As of April 2007, only 61 out of 91 ATOs had brought the assignation process to completion.

With regard to the required documentation, COVIRI found various gaps with the absence of Regional agreements and regulation standards, insufficient descriptions of the state of the network, and the consequent unsuitability of the definition of the necessary investments and the tariff measures to cover them. With reference to 58 Regulatory Plans, in 2008 COVIRI calculated an average level of planned investment of 37 Euro per year per resident, and an effective implementation of investment that was less than half of the planned level. Nonetheless, these levels were, at the time, significant for operators, given the difficulty in finding adequate funding in a situation where the revenues from tariffs were insufficient to cover all costs (Benvenuti and Gennari 2008).

CONVIRI's last report shows that, at the end of 2009, almost all AATOs had been established and the Regulatory Plans had been drafted and approved by 82 AATOs out of 91, with delays in the Regions of Aosta Valley, Lombardy, Friuli-Venezia Giulia, and Liguria. For the last implementation phase of the Galli Law, i.e., assigning the service, only 69 AATOs had completed the assignment to one or more operators, with a total of 114 assignee entities. The cases where there was no assignment were mainly concentrated in Aosta Valley, Lombardy, Friuli-Venezia Giulia, Liguria, Lazio, Molise, Campania, Calabria, and Sicily, but they also involved, to a lesser extent, Veneto and Marche (CONVIRI 2010). It was a fragmented situation, with Regions such as Toscana or Emilia-Romagna, where the

[5] Except for Trentino-Alto Adige, extraneous to the regulation due to its special statute under Italian law.

[6] These are characterised by a certain heterogeneity, with the widespread prevalence of administrative criteria rather than orographic ones.

Galli Law was implemented, coexisting side by side with a large majority of the Country, in which the resistance of local authorities to start the sole service management continued to support the management of Municipal water and sanitation services by local authorities.

The long implementation process of the Galli Law, which moved at different speeds in different areas, also produced important consequences in terms of the economic regulation of service charges. Indeed, the Galli Law provided for "transitory" cases, which were excluded from applying the Standardised Method and which included the operators that were already in receipt of a license as of the date of the law's entry into force. In such cases, and in those areas where the Galli Law had not been fulfilled, the tariff adjustments continued to be updated on the basis of a transitory system, governed by the resolutions of the Interministerial Committee for Economic Planning (CIPE – *Comitato interministeriale per la programmazione economica).* For over a decade, therefore, two different forms of economic regulation of the integrated water service and of determining the relative tariff coexisted: the Standardised Method and the so-called CIPE Method. This situation persisted still in 2010 (INDIS-Unioncamere & REF Ricerche 2010; INDIS-Unioncamere & REF Ricerche 2011) and it was resolved only with the entry into force of Decree Law no. 83/2012, the so-called Development Decree, which provided for the termination *ex lege* of the transitory system to determine tariffs, and which saw the subsequent regulation mandate entrusted to an independent national authority.

14.5 The Referendum and the Advent of Independent Regulation

From 2011, the integrated water service governance underwent a profound change. The June 2011 referendum resulted in the abolition of Article 23 *bis* and therefore the abolition of the tender as the priority method for assigning local public services. It follows that in Italy, for local public services, European Union law applies, which provides for the tender procedure only in the case of assignation to private undertakings, allowing the direct assignation to public undertakings as long as the local authorities exert over them the same control they exert over their own services, and as long as said undertakings carry out the bulk of their activities with the parent public entities. The referendum also banned the so-called "adequate return on capital", set at 7% and independent from the conditions of the capital market.

The referendum heralded the beginning of the independent regulation period. In December 2011, with Decree-Law no. 201/2011, converted into Law no. 214/2011, the Government entrusted the task of economic regulation and control over the water service to an independent authority, which had already gained recognition for its great work in the electricity and gas sectors: the Authority for Electricity and Gas, which became the Authority for Electricity, Gas and Water Systems (AEEGSI – *Autorità per l'energia elettrica, il gas e il sistema idrico*), as specified in Decree of the President of the Council of Ministers of 20 July 2012, and currently called the Authority for Energy, Networks and Environment (ARERA – *Autorità di Regolazione Energia Reti Ambiente*), as a result of the more recent attribution of duties for regulating also the waste management sector.[7]

The Authority operates autonomously and independently within the limits of the policy guidelines formulated by the Government, by Parliament and by European Union regulations. The Authority's objectives are:

- ensuring accessibility and uptake of services in a homogeneous way across the country;
- ensuring adequate service quality to end users;
- formulating certain and transparent tariff plans based on predefined criteria;
- protecting the interests of consumers and end users.

The Authority carries out its functions by combining the operating and financial objectives of the undertakings to which the services are assigned with the societal objectives of environment protection and efficient use of resources. Its main responsibilities are:

- preparing and updating the tariff method to set the charges for the integrated water service;
- approving the tariffs proposed by the appointed subjects;
- defining a minimum level of technical quality of service;
- encouraging infrastructure investment;
- increasing protection of and information provided to consumers;
- imposing fines;
- assessing and, if appropriate, accepting the commitments made by fined undertakings aimed at restoring the adversely affected interests (Legislative Decree no. 93/2011);
- monitoring and supervising the work of regulated undertakings in terms of security, access to networks, quality of service offered, tariffs, etc.

Since 2012, ARERA has sought to promote a stable and efficient regulation, aimed at removing the uncertainty of the regulatory framework and designed to adopt a tariff method that could overcome the principal critical issues encountered with the Standardised Method, to promote efficiency in operators, to increase their operational and financial heft, and to attract the financial resources necessary to fulfil the infrastructural requirements of the sector.

[7] Law no. 205/2017 attributed to the Authority the functions of regulating and controlling the waste cycle, including separated, urban and related waste, to be exercised "with the same powers and in the framework of the principles, the purposes and the powers, also including penalties, set by Law no. 481 of 14 November 1995 and already exercised in the sectors of competence".

14.6 The Reorganisation of Governance Between Delays and Shortcomings

After the suppression of the ATOs, responsibilities were reassigned to the Regional authorities, who in turn reallocated them in some cases to Provincial authorities and in other cases to Regional agencies. The Government intervened to clarify things with Decree-Law no. 133/2014, so-called "*Sblocca Italia*, and the subsequent Stability Law for 2015,[8] making a number of changes to the Environmental Code with the goal of streamlining levels of governance and consolidating managerial structures. The *Sblocca Italia* Decree began a reorganisation of water service governance with a redefinition of the roles and prerogatives of the various subjects involved: Regions, EGAs and local authorities. This chain of command had remained disordered for a lengthy period due to inertia in local administrations, in a deadlock that blocked, for a large part of the Country, the development of a water purification and distribution industry (Berardi, Quaglino & Traini 2014; Berardi & Casarico 2016).

The intent of the *Sblocca Italia* Decree was to guarantee certain timescales by identifying precise milestones and schedules:

- by 31 December 2014, Regions were to set up the EGAs;
- by 1 March 2015, the local administrations were to join, compulsorily, the EGAs and deliver the water infrastructures to the assignee operators;
- by 30 September 2015, the EGAs were to draft the Regulatory Plan, choose the management form and arrange assignment to the sole area water operator.

In order to try to overcome the obstacles to the reorganisation of governance, the *Sblocca Italia* Decree also provided for the activation of substitutive powers by the central administrations *vis-à-vis* the Regional and local authorities, in cases of repeated shortcomings.

This governance system forms part of a wider regulatory framework that is a step towards affirming the principle of single management, as opposed to a unitary management system, with the identification of a sole area water operator of the integrated water service that incorporates all existing managing entities in the area, even those with safeguarded assignment licenses. In light of this aspect, the timings to achieve a sole area water operator could be spread out in some cases over a 10-year timespan, in order to wait for the expiration of the safeguarded licenses. Such timings could be reduced in the event of mergers between operators.

Amongst the changes brought by the *Sblocca Italia* Decree, there is also recognition for the role of AEEGSI. The Authority is called upon, on the one hand, to define the standard agreements and the criteria to determine the residual value to be compulsorily paid when management is taken over; and on the other hand, to monitor

[8] Law no. 190/2014. "Stability Law" (*Legge di stabilità*) is another – and, officially, the current – name for the already mentioned Financial Law, that is, a law whereby Italy's economic policy of the next few years is planned by the legislature together with the Government.

compliance with the procedures and timescales set out by the *Sblocca Italia* Decree, reporting any shortcomings.

With a view to promoting corporate operations such as mergers and the disposal, by local authorities, of operators that have ceased *ex lege*, the new Stability Law for 2015 intervened by providing, for companies involved in such operations that are partially or wholly publicly held, the acknowledgement of an extension to the expiration term for existing licenses, the exclusion from the constraints of the Stability Pact for investment expenditure made with proceeds from the disposals (partial or total) of investments in companies that manage public services of economic importance, and the priority assignation of public financing to operators that have approved operations of corporate aggregation.

Over the past 25 years, the desire to substantiate the setup indicated by the Galli Law, and strengthened by the *Sblocca Italia* Decree and the new ARERA regulation, has been constant. However, the road has been long and troubled, because of legislative interventions at Regional level that have proven to be heterogenous in their timing, and also because of resistance by the local authorities (Berardi & Signori 2017b). Thus, the process cannot be considered complete. Based on reconnaissance relating to the reorganisation of the local setups of the integrated water service, carried out on a six-monthly basis by the Regulatory Authority, the number of ATOs has dropped from the initial forecast of 91 to 68 in June 2016, down to 62 in June 2018. This reduction was made possible by the decision of several Regions to enlarge the boundaries of ATOs from a Provincial level to a Regional one, and through the elimination of ATOs smaller than those at a Provincial level. Eighteen months after the start of the governance reorganisation proposed by the *Sblocca Italia* Decree, 20 EGAs were not operational, and in 26 cases, the joining of the EGAs by local authorities had not been fully completed. Moreover, the assignment to a sole water operator had not been carried out in 13 ATOs, in breach of the regulation (ARERA 2016). In the two subsequent years, some progress has been made, despite the fact that, as of June 2018, 10 EGAs are not yet operational and the assignment to a sole operator has not yet been carried out in as many areas (Fig. 14.1). The aspect on which the main difficulties are encountered continues to be the fragmentation of management which, despite having been significantly reduced, continues to be high, with still over a thousand Municipal operators and over 340 operators that have ceased *ex lege*, which are resisting delivering the plants to the 56 sole area operators; there are then 202 safeguarded operators who are entitled to carry out the service until the natural expiration of the management agreement (ARERA 2018) (Fig. 14.2). In the Regions and ATOs in which the reorganisation of governance has been concluded, there has been a significant level of streamlining in the number of operators, but in various parts of the Country, the road to achieve sole area water operation is still long.

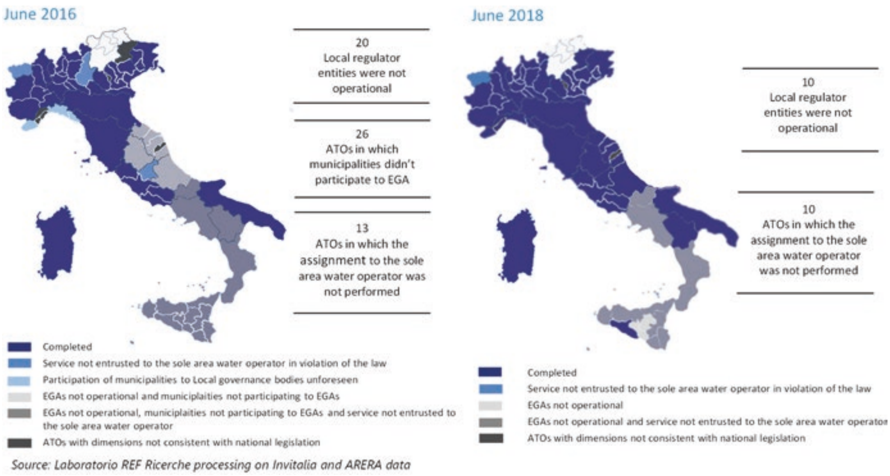

Fig. 14.1 The status of governance implementation in the integrated water service June 2016 – June 2018

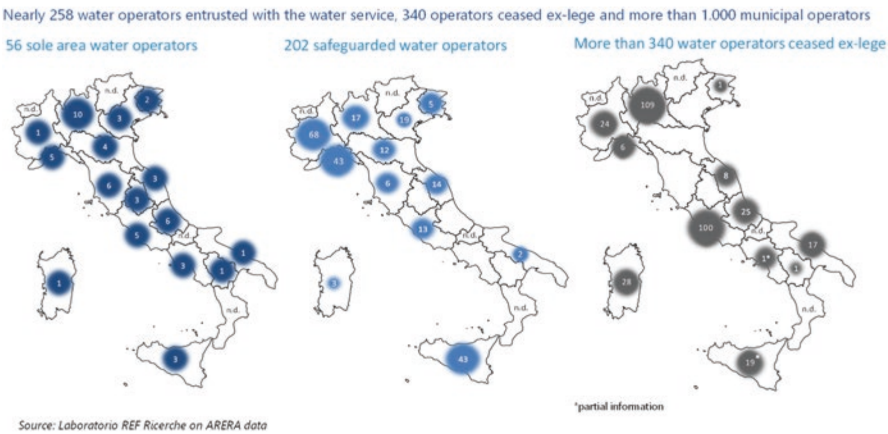

Fig. 14.2 Management fragmentation as of June 2018

14.7 ARERA's Regulatory Work

Compared with the meagre regulatory work carried out under the Ministerial aegis, the work by the independent Authority has provided responses to many needs (Fig. 14.3). ARERA has adopted an asymmetrical and incentivising regulation as a tool to ensure, on the one hand, the sustainability and certainty of investment, and on the other hand, the protection of end users via defined tariffs that are certain and transparent and consistent with costs, suitable incentives for efficiency, and the improved contractual and technical quality of the service.

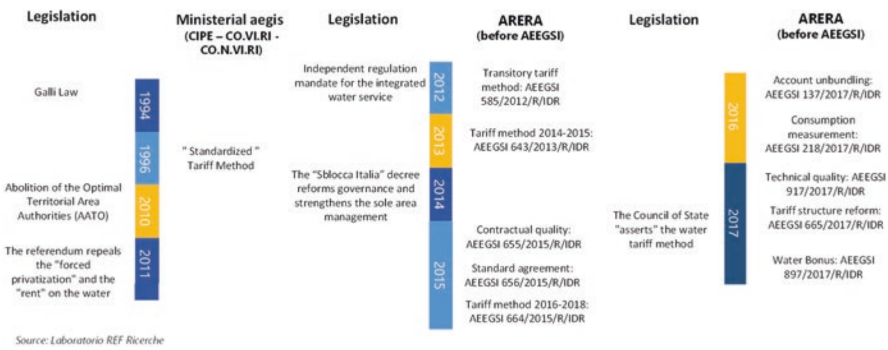

Fig. 14.3 The legislative and regulatory timeline from 1994 to 2017

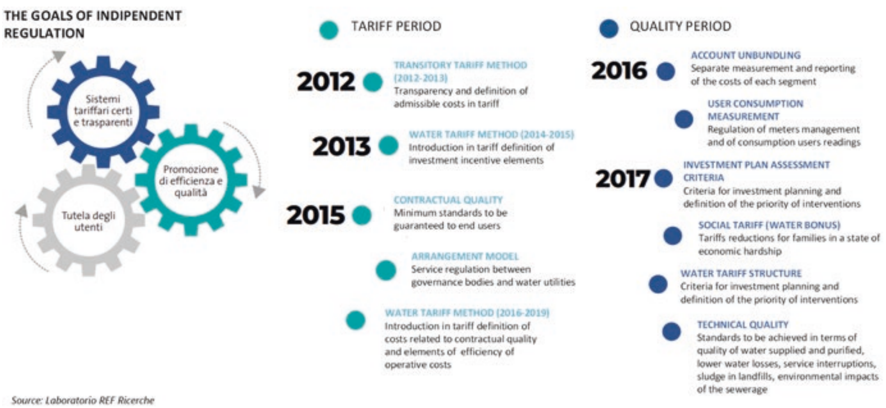

Fig. 14.4 The measures adopted by ARERA in the tariff period and in the quality period

The initial regulatory period can be defined as a "tariff period", in which the main provisions adopted by the Authority concerned the criteria to define tariffs, so as to ensure that eligible operating costs are covered and facilitate the sourcing of resources to support the industry's necessary investment. From 2016 a new period started, the "quality period", in which the focus was on the need to improve both service and infrastructure, as well as on monitoring the effectiveness of investment made in carrying out the planned works, to benefit end users and the environment (Fig. 14.4).

In the following sub-sections, we will go through the main issues dealt with by ARERA and we will indicate, where available, the evidence of the impact of the regulation by the Authority.

14.7.1 Tariff Regulation

With the first approvals in June and December 2013, the Authority started an initial four-year tariff cycle, divided into two stages: an initial two-year period (2012–2013) governed by the Transitory Tariff Method (MTT for assignee operators and MTC – the CIPE Tariff Method – for Municipalities still under the CIPE system), and a second two-year period (2014–2015) governed by the Water Tariff Method (MTI – *Metodo tariffario idrico*).[9] Both methods replaced the ones previously in force. The tariff adjustments were initially intended to cover the gap between revenues for the operator and the actual costs of the service accumulated in the years prior to 2012. The criteria set out by ARERA in this initial phase allowed for a tariff increase differentiated on the basis of the relationship between the requirement for investment and the value of infrastructures, granting more significant increases in areas with more deficit in terms of infrastructures, in order to allow the operator to obtain the funding requirements to finance new works from the tariff revenue. Moreover, an initial efficiency-driven mechanism has been implemented through a system of recognition of costs related to the starting condition – named rolling cap – which allows for the reduction of endogenous costs (i.e., personnel, raw materials, services, etc.). This mechanism will need to be replaced over time by a cost recognition system based on the margin between actual and viable cost (standard costs).[10]

Starting from the first revision of 2012, the changes to the Standardised Tariff Method made by the Authority have highlighted the will to establish a regulatory framework that is as transparent, consistent and homogeneous as possible across the entire Country, by finding the right balance between societal needs and those of the regulated undertakings.

The second revision, with the MTI for the regulatory period of 2016–2019, was consistent with the choices made in the previous regulatory period, with regard both to methodology and tariff determination criteria, and to the logic governing their adjustment. However, this revision contained some significant changes, such as the promotion of merger processes aimed at accelerating the establishment of sole area water operators, the promotion of production efficiency and the strengthening, in compliance with the *Sblocca Italia* Decree, of the responsibilities and competencies of the EGAs, which include management and improvements of quality (Berardi et al. 2015). On the one hand, such increase in the accountability of local operators is risky in those areas of Italy where they are not yet operational or are inactive. On the other hand, such a delegation of powers to local regulators demonstrates the difficulty of the Authority's task of governing a sector that is still characterised by over 2000 operators.

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[9] On the tariff method see also, in this volume, Chap. 17 by Massarutto.

[10] The subsequent provision on account unbundling of 2016 has moved in this direction, as it requests operators to report separately the costs of the various stages of the water supply chain from the activities carried out.

14.7.2 Increase in Investment

The effective application of full cost recovery is the tool to ensure sustainability and certainty of investment and the protection of end users through tariffs that are defined, transparent and consistent with costs, suitable incentives for efficiency, and the improvement of the contractual and technical quality of the service.

For agreements between operators and EGAs, the regulation of service contracts has brought stability and returned trust to investors who were worried, in particular, by the risk of early cessation or termination of the license in the event of unclear takeover procedures. This situation was overcome by the codification of criteria to quantify compensation figures.

One of the factors that stimulated the financial viability of the system was definitely the certainty of the regulatory framework, by virtue in particular of the introduction of strict criteria of arrears recovery and of strong guarantees regarding the determination of the terminal value and its actual collection at the conclusion of the management.

The stability of regulations, both in terms of determining tariffs and assigning the service, has led to a rapid increase in investments over recent years.

In the 2012–2017 period, investments increased to 42 Euro/inhabitant in 2017,[11] with investment programmes for the 2018–2019 period exceeding 55 Euro/inhabitant. It is a remarkable effort, but it must be compared with an average of 90 Euro/inhabitant/year for EU-15 countries. The peaks of the pre-ARERA era had been reached in the 1980s, supported by non-repayable grants and therefore by the taxpayer. The 1980s are also the historical period in which Italy's debt doubled, from 60% to 120% of the GDP, a situation that was no longer acceptable or sustainable. The operators' capacity to carry out investments has also improved, with an increase in the rate of planned investments carried out from 55% to 60% in the 2007–2009 period, where regulation was in the hands of agencies of the Ministry of the Environment, to over 80% in the 2014–2017 period (Fig. 14.5). These percentages are expected to grow, since ARERA has recently issued a consultation paper which refers to starting a special procedure to stimulate the full implementation of the Plan of interventions by operators. For 2018, industrial operators have planned investments of 3.5 billion Euro, an amount that is almost triple what was being spent in the 1990s.

[11] Analysis of the programme of interventions of a sample of 74 water operators serving a population of 34.8 million inhabitants (more than half the Italian population).

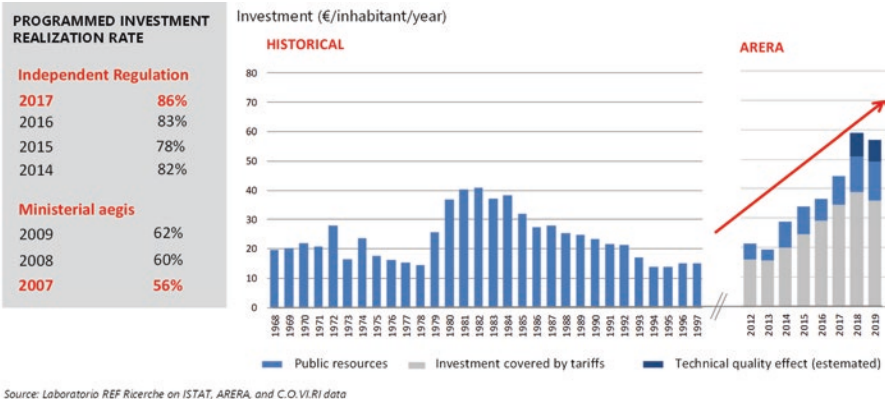


Fig. 14.5 Investment rend from 1968 to today

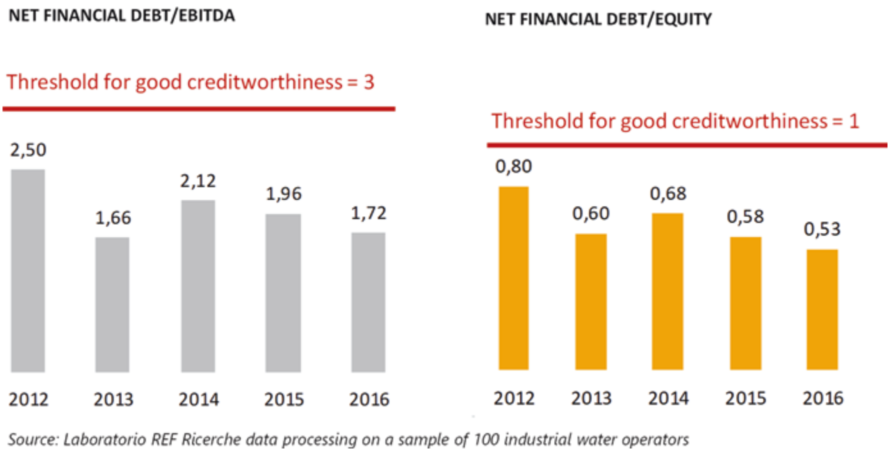


Fig. 14.6 Improvement in the financial, economic and asset robustness indicators of the main Italian water operators in the 2012–2016 period

14.7.3 Improvement of Operators' Financial and Economic Position

An analysis of the financial statements of the first 90 industrial operators in Italy shows a marked improvement in the economic and financial robustness indicators between 2012 and 2016 (Fig. 14.6). This is a consequence of the new tariff method, which allowed for the emergence of the true running and investment costs, the recovery of sunk costs, and the restoration of economic and financial robustness conditions that are consistent with access to credit, which had long been precluded to water operators in the pre-ARERA period. From the latest data available, the Country's main industrial companies have a potential recourse to credit for over five billion Euro, consistent with the investment needs deemed necessary by many, without compromising their financial stability (Berardi et al. 2018).

An implicit attestation of the improved solvency of the water industry is offered by the number of operators that managed to access funding offered by the European Investment Bank (EIB), an operating arm of the European Commission, which, as a credit institution with an infrastructural mandate, makes financing available at preferential interest rates, lower than those of the capital market, for works of public interest. Between 2012 and 2017, the EIB supported investments of Italian water operators with resources from European Union programmes with over two billion Euro. It should be underlined that in recent years, as proof of the improved solvency of the water sector, the EIB commitment, supported by the so-called Juncker Plan, has also supported smaller projects and companies in the *Mezzogiorno*. A noteworthy case is the loan of 20 million Euro granted to AMAP (*Azienda Municipalizzata Acquedotto di Palermo*) to invest in improving the quality and reliability of integrated water services and increase operational efficiency, in particular via a reduction in non-invoiced water.

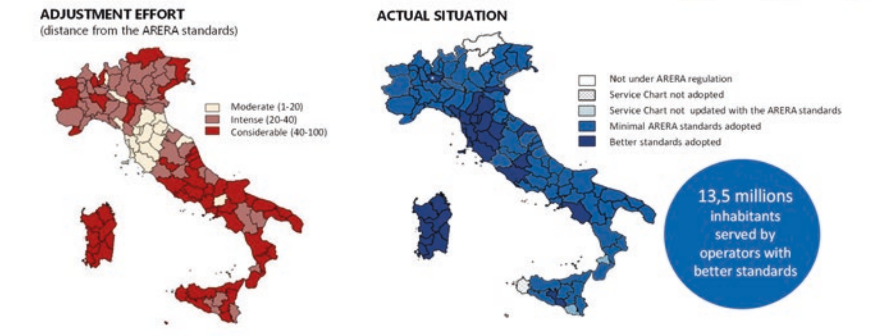
Therefore, industrial operators do not rely today on public finances and are free from all that follows in terms of freedom of action, less interference from politics, effectiveness, and efficiency.

14.7.4 Contractual Quality of the Service

The national regulator has also worked on service quality. Contractual quality regulation, aimed at ensuring quality in contracts between operators and end users, set by the Service Quality Charter (*Carta della qualità dei servizi*), is another example of the benefits offered by independent regulation. By virtue of ARERA's work, standards that had long been provided for by Decree of the President of the Council of Ministers of 29 April 1999, but which had been left largely unimplemented until the Authority's intervention, were finally applied. The Authority's intervention also had the advantages of raising and homogenising contractual quality standards across the nation, which had been highly diversified before, of providing for automatic refunds to users in the event of failure to meet specific standards, and of establishing a reward/penalty system for general standards. ARERA forced operators to report the degree of compliance with commitments made to users, going beyond a mere declaration of intent. The performance levels codified in the Service Charter are today payable commitments (Berardi et al. 2016; Berardi and Signori 2017a) (Fig. 14.7).

CUSTOMER CARE	Presence in CdS	Standard CdS max-min	Standard ARERA
Maximum wait at the front office (minutes)	69/116	15-90	60
Billing adjustments (working days)	98/116	2-180	60
Reply to written questions (working days)	106/116	4-43	30
Reply to complaints (working days)	109/116	5-64	30

START AND CESSATION OF THE SERVICE	Presence in CdS	Standard CdS max-min	Standard ARERA
Water connection (working days)	113/116	2-90	30
Supply activation (working days)	106/116	1-20	5
Supplu cessation (working days)	112/116	1-30	7
Wastewater connection (working days)	88/116	2-90	30



Source: Laboratorio REF Ricerche data processing on Local governance bodies and provincial capital operators data

Fig. 14.7 The scope of the improvements achieved and a measure of the adjustment effort requested of the Regions

14.7.5 Water Bonus: Supporting Users in Economic Hardship

The protection of users is another cornerstone of the regulation mandate awarded to ARERA. The application of the water bonus falls within this area of action by the regulator. On the basis of Law no. 221/2015 (so-called "*Collegato ambientale*") and of the subsequent Decree of the President of the Council of Ministers of 29 August 2016, ARERA introduced a social water bonus to support users in economic hardship. This is an important measure, also in terms of combating the various types of conscious and endemic arrears which affect many areas throughout the Country, as proof of how green civic and environmental conscience still is unripe, supporting operators' economic and financial balance. However, the special national compensation intervention to financially support situations of hardship currently translates to a transfer of around 10 Euro per inhabitant in hardship per year, approximately 10% of the water bill. This is still a weak measure, because it covers only 50 litres/inhabitant/day, when for "normal" consumption without waste at least twice as much is necessary. The bonus also concerns only the variable aqueduct portion of the tariff, as it does not take into consideration the variable portions relative to sewerage and purification, nor the part relative to consumption guaranteed as free by fixed quotas and taxes. In view of this situation, some EGAs have adopted additional measures (Berardi et al. 2019c).[12]

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[12] On the water bonus, and the human right to water more generally, see, in this volume, Chap. 11 by Turrini and Pertile.

14.7.6 Service Technical Quality

Among the most recent work by the Authority, commitments have been requested from industrial operators to ensure greater knowledge with regard to the state of infrastructures, which in many areas is still hardly known. With its regulation of technical quality (RQTI – *Regolazione della Qualità Tecnica*) issued at the end of 2017, ARERA requires operators to measure and report systematically on the state of infrastructures, and to meet annual improvement targets on the basis of indicators relative to network losses, service interruptions, quality of drinking water supplied, adequacy of the sewerage system, and quality of purified water returned to nature. The interventions' plans must be calibrated on the basis of the disparity from the stated goals, in order to reach acceptable quality levels within a specific time period. Thanks to the RQTI, the water industry is taking an important step towards increasing the effectiveness of investments, as the various uses of expenditure will be assessed based on expected improvements and evaluated *ex post* based on whether the stated goals have been met. Regulation of technical quality has brought to light a picture with both positives and negatives with regard to the state of infrastructures, with more critical situations in the Centre and South of the Country (Figs. 14.8 and 14.9).

In the initial application of the RQTI, also due to the short time between its approval (December 2017) and the deadline for updating the tariffs (April 2018), operators carried out a remodulation of capital expenditure in order to take the regulation's hint, rather than carry out a true revision of the intervention programme. The result was a raise of just over 8% of the value of planned interventions for the 2018–2019 period, compared with the previous forecast. It is expected that the full effects of the regulation for technical quality will unfold with the planning of interventions for the new regulatory period of 2020–2023 (Berardi et al. 2019a).

	Water losses	Service interruptions	Drinking water quality	Sewer system adequacy	Landfills sewer sludge disposal	Purified wastewater quality
A	8%	n.d.	8%	11%	54%	14%
B	23%	n.d.	0%	3%	0%	23%
C	25%	n.d.	32%	18%	27%	5%
D	26%	n.d.	18%	4%	19%	58%
E	18%	n.d.	42%	64%	-	-

Source: Laboratorio REF Ricerche data processing on a sample of 97 water operators for a population served of 39 million inhabitants

Fig. 14.8 Distribution of Italian population by class and macro-indicator of technical quality

	North-East		North-West		Center		South and Isles	
M1a Linear water leakages (m^3/km/day)	16,75	C	24,35	C	47,22	D	47,39	D
M1b Water losses (%)	37,4%		29,1%		47,5%		52,1%	
M2 Service interruptions	n.a.		n.a.		n.a.		n.a.	
M3a Incidence of non-potability orders (%)	0,01%	E	0,01%	E	0,21%	E	1,08%	E
M3b Non compliant drinking water sample (%)	4,1%		2,8%		5,8%		4,9%	
M3c Non compliant drinking water parameters (%)	0,3%		0,2%		0,7%		0,2%	
M4a Wastewater floods/spillovers (no/100 km)	7,24	E	5,49	E	22,04	E	41,14	E
M4b Overflow spillway not adequate (%)	38,7%		10,8%		48,6%		25,4%	
M4c Overflow spillway not controlled (%)	36,8%		22,7%		55,9%		25,4%	
M5 Sludge disposal in landfills (%)	14,3%	A	2,1%	A	27,6%	C	84,1%	D
M6 Non compliant purified wastewater sample (%)	9,6%	C	9,3%	C	12,7%	D	9,3%	C

Note: weighted values for the population served by water operators

Source: Laboratorio REF Ricerche data processing on a sample of 97 water operators for a population served of 39 million inhabitants

Fig. 14.9 Average levels of technical quality indicators per geographical macro-area

14.7.7 New Per-Capita Tariff Articulation

In September 2017, ARERA approved the Compendium for Water Service Charges (TICSI – *Testo Integrato Corrispettivi Servizi Idrici*) with the aims of standardising, simplifying and streamlining charges, of eliminating cross-subsidies between households with different family components, and of promoting appropriate behaviour to conserve water and protect the environment, albeit guaranteeing the provision of the minimum subsistence amount of water at a preferential tariff for all. The Inter-Ministerial Prices Committee (CIP – *Comitato Interministeriale Prezzi*) had already tried, without success, to standardise the tariff schemes at the beginning of the 1970s. Adopting the TICSI is the beginning of a systematic reform of water tariffs, long awaited and hoped-for by many, inspired by principles of fairness, able to ensure an end user partnership that is in line with service costs, aimed at removing cross-subsidies between end users, and at the same time offering an adequate price signal to prevent waste.

Once the June 2018 deadline to approve the new tariff schemes passed, an analysis of the implementation of the reform shows that the streamlining goal has been met where there was approval, but 40% of the territory has not yet implemented the reform. Of the 60% of the Country that did carry out the directives to completion, the majority opted for a gradual transition, with the application of a standard per-capita tariff, postponing until 2022 the implementation of the full per-capita tariff. The per-capita tariff is therefore a reality for only one Italian out of four (Berardi et al. 2019b).

14.7.8 Towards the Tariff Method of the Third Regulatory Period

ARERA has started the procedure to define the tariff criteria for the 2020–2023 period, revealing some directions and objectives that will shape the next update to the tariff method. The intention is to confirm the tariff criteria applied up to now, which are deemed effective and credible: this is an important declaration of intent, which suggests that there will be improvement interventions but that they will not revolutionise the guiding principles. More generally, ARERA intends to encourage management efficiency and improvement of technical quality, as well as to grow the effectiveness of expenditure for investments, improving the quality of planning in an output-based perspective. A substantial point deals with the stated goal of encouraging operators to carry out environmental sustainability improvements in the activities they manage, also by promoting the use of innovative technologies that can increase the degree of reliability and safety of water infrastructures, and that are characterised by high efficiency, including energy efficiency, and a lower environmental impact. An analysis of the tariff plans of 79 operators of the integrated water service, serving a population of around 36 million inhabitants, shows that, for many water operators, the 2020–2023 period heralds a reduction in tariffs, in some cases with downward trends in the double digits. With the new regulatory period, part of the system definitely closes down the realigning of tariffs with the service's actual costs (post-2012 arrears), and – it being understood that a tariff reduction is always desirable where a balance has been achieved between infrastructure in a good state and a high quality of service – the ideal conditions occur for a wide-ranging plan of interventions that incorporates fully the needs of the various areas.

Forecasts show that by keeping tariffs sustainable, today it is possible to close the gap in investment that separates us from the best European practices: an increase in tariffs of 3.6% per year could allow an investment of 80 Euro per inhabitant per year that is consistent with maintaining infrastructures in good condition and mitigating environmental impact. For this to happen, it is important that the legislature, the regulating authority and operators each do their part: the legislature via regulations that streamline the tendering procedures and speed up the procedures of permit-granting; the Authority by encouraging efficiency gains and requesting a greater commitment on the realisation of investments; and operators by speeding up the necessary cultural and organisational leap to fully become the implementers of public directives across the Country (Berardi et al. 2019d).

14.8 Conclusions

At the start of the 1990s, the Italian water and wastewater industry was characterised by deep fragmentation and was managed mainly at Municipal level, directly by local authorities. In the vast majority of cases, these water operators were in a deficit situation or bankrupt, with low levels of efficiency and investment, and poor service quality. It is in this period that we can identify the causes of today's infrastructural emergency.

Against this general state of negligence, the advent of the Galli Law began a long process of reform that redefined the organisational and regulatory structure of the water service, with the purpose of gaining efficiency in managing water resources via the introduction of an industrial logic, and setting out a clear definition of the entities involved in water sector governance and service management, and their respective tasks.

Over the following years, the legislature has often intervened on the topic of local public services, and in particular of the water supply, with measures that have integrated and partly modified the provisions concerning the institutional and organisational setup, with results that were not always linear, in particular with respect to the procedures of assigning the service. An uncertain legislative framework, together with a chain of command that remained disordered for a lengthy period due to inertia in local administrations, certainly did not help to implement the reform.

Over the past 25 years, the desire to substantiate the setup indicated by the Galli Law, and strengthened by the *Sblocca Italia* Decree and the new ARERA regulation, has been constant. However, the road has been long and troubled, because of legislative interventions at Regional level that have proven to be heterogenous in their timing and also because of resistance by the local authorities, and so the process cannot be considered completed, despite some important steps forward.

The long implementation process of the Galli Law, which moved at different speeds in different areas, produced and continues to produce important consequences also in terms of regulation, in a deadlock that has blocked, for a large part of the Country, the development of a water purification and distribution industry.

The work of ARERA has generated a provision of public services centred on a guarantee of cost control and service quality for inhabitants, as well as on a system of homogeneous rules, making the EGAs accountable for the choices and the consequences in their areas. By virtue of this regulation, water operators must measure and report the state of their infrastructures (in many areas still hardly known) on the basis of homogeneous indicators and, via a reward/penalty system, they have an incentive to implement interventions aimed at pursuing acceptable quality standards. The EGAs are thus made accountable for the consequences of their decisions in their areas.

The advent of independent regulation has been an important tool to stimulate operators, and in those areas where the qualitative leap has not yet occurred, it was politics that put the brakes on industry.

Against a regulatory framework that has given a boost to the industry and that still needs to be refined, we are still missing all the operators that do not comply with the regulation, the Municipal water and wastewater services managed directly by Municipalities, the operators ceased *ex lege*, the ones resisting the ARERA regulation and the handing-over of infrastructures to the legitimate sole area operators and still continue to operate across Italy. These operators exist mainly in the *Mezzogiorno*, although there are also cases in more economically developed areas of the Country. They operate outside the rules, devoid of any transparency requirements or any responsibility towards users. Moreover, the failure to act by the EGAs or the lack of the necessary competencies to implement the national regulation continue to represent a "burden" for end users, who are unable to benefit from the positive effects of independent regulation.

The water service of the twenty-first century is very different from what we were accustomed to in the last century. The water cycle is now much more than simply what is necessary to ensure a continued provision of drinking water and removal of wastewater from urban centres. The future of the water cycle is at the centre of a redefinition of lifestyles, starting with the protection of the environment and ecosystems, and going all the way to ensuring high-quality drinking water, to managing emerging pollutants, to the circular economy and smart cities, to the consequences of climate change and the growing anthropisation of the planet, to the impact of migratory flows caused by water shortages. The water industry is called upon to take responsibility for epochal challenges, to preserve a resource that is essential for life, and to hand over to future generations a common heritage of infrastructures in good condition.

A size consistent with economies of scale, the know-how necessary to design, carry out and maintain technologically advanced works, the need for managerial and organisational skills that can meet the demands of a complex management: all of these are essential conditions of any look to our future.

Moreover, it is widely believed that current levels of investments are still far from the true requirements, and from what is necessary to pursue the ambitious goals of the regulator to improve the infrastructure. The delays in examining the network fully, and the organisational difficulties of procurement, with companies being called upon to double the volume of purchases, tenders and contracts in a few years, with all the corollary administrative procedures, suggest that the benefits of the more recent regulatory innovations will become visible with the new investment planning cycle for the 2020–2023 period. Therefore, it does not seem far-fetched to state that over the next few years, industrial operators will be able to steadily move from current per-capita investments exceeding 50 Euro per year towards 70 Euro per year; this commitment is consistent with the investment volume already planned by the best practices in the Country. This plan appears to indicate a bridging of the gap that currently separates Italy from the best European practices, where investment is 94 Euro per capita per year.

It is only through expertise and by ensuring that autonomy and responsibility go hand in hand, by strengthening the roles that provide direction and control, within a framework of clear, transparent and enforceable rules, that "industrial" operators, inspired by criteria of efficiency, effectiveness and affordability, can truly become established.

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Part IV
The Implementation of the EU Water Framework Directive and the EU Floods Directive

Chapter 15
Water Governance in Italy: From Fragmentation to Coherence Through Coordination Attempts

Mariachiara Alberton

Abstract This chapter aims at putting the institutional management of water bodies in Italy in perspective. The evolution of the regime governing water bodies is discussed, taking into account the situation prior to as well as after the implementation of the Water Framework Directive. In particular, the current regime, enforced through Legislative Decree no. 152/2006, meant to bring the Italian legal system in line with the abovementioned Directive, is illustrated and commented upon. The long implementation process is described, from Law no. 13/2009 to Legislative Decree no. 49/2010 (which transposed the Floods Directive), Law no. 221/2015 and Ministerial Decree of 25 October 2016, which ultimately brought to completion the reform in water management. Indeed, this dynamic process represents an interesting case that triggers a number of questions about the effectiveness and coherence of the national institutional and legislative framework. The main phases that marked water governance history in Italy are analysed.

Keywords Water management · Multi-level governance · EU water law implementation · Italian water governance · Institutional cooperation and conflicts

15.1 Introduction

The analysis of the Italian water governance offers an interesting way of exploring the complex institutional architectures that have been developed over the years in Italy and have been reshaped in more recent decades by the European Union (EU) environmental policy. Indeed, the Italian multi-level system governing water resources has been strongly influenced by several political, legal and administrative arrangements occurred at different stages and now results in a patchwork of current and pre-existing contexts and dynamics, as it is showed in this chapter.

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The evolution of water governance in Italy is enclosed in a time-lapse of laws and related institutional settings that can be grouped in subsequent distinct phases: the first period coincided with the fragmented pieces of legislation enacted from the beginning of the 1930s until the beginning of the 1970s of the last century; a second period followed a number of pollution scandals; a third period can be traced back to the implementation of the first EU directives and in response to a series of dramatic floods; a fourth period can be identified with the enactment of Law no. 36/1994 and, finally, a fifth period opened with the implementation of the Water Framework Directive (WFD) and the Floods Directive (FD), which tested the existing Italian multi-level water governance architecture and required some additional efforts of coordination among the different levels of government (national, regional and local) and the river basin districts, in addition to some re-arrangements of functions and competences. The main phases that marked water governance history in Italy are analysed in the following sections, by underlining the most problematic aspects and inconsistencies of the institutional settings and arrangements.[1]

15.2 From Fragmentation to Preliminary Harmonising Attempts

The first brief chapter of the Italian water governance history was mainly marked by a technical, engineering-based approach where environmental objectives were almost inexistent and the responsibility of water management was assigned to Municipalities.[2]

A second chapter started after some clamorous cases of pollution occurred and the Italian legislator approved Law no. 319/1976,[3] some recovery plans and a set of measures for sewage disposal. Law no. 319/1976 introduced for the first time in the national framework a list of pollutants and a limit of concentration and discharge for each substance; however, water services continued to be managed locally by Municipalities and water collection by supplier companies was neither regulated nor charged. In addition, the national territory was split into electric power districts and drainage areas and the Italian water governance system remained fragmented with only some planning and control functions assigned to the central Government (Citroni et al. 2008).

[1] For a historical overview of water governance in Italy, albeit from a different perspective, see, in this volume, Chap. 5 by Boscolo.

[2] Among the most relevant laws enacted in the first period are the following ones: Law no. 1775/1933, Royal Decree no. 383/1934 (*Testo unico della legge comunale e provinciale*), Law no. 184/1952 (*Piano orientativo ai fini di una sistematica regolazione delle acque e regolazione delle acque e relazione annuale del Ministero dei Lavori pubblici*), Law no. 129/1963 (*Piano regolatore generale degli acquedotti e delega del Governo ad emanare le relative norme di attuazione*).

[3] The law, also known as *Legge Merli* (Merli Law) after its main proponent, contained rules for the protection of waters against pollution (*Norme per la tutela delle acque dall'inquinamento*).

Moreover, the newly established Regions[4] acquired competences also in the environmental field and started to adopt legislative and administrative acts without any attempts of horizontal coordination. The partial transfer of legislative and administrative responsibilities in the water sector from the centre to the periphery without a parallel coordination mechanism jeopardised from the beginning the creation of a coherent and integrated water governance in Italy and produced a fragmentation of the natural river basins that did not coincide with administrative boundaries.

A third phase started with a series of extreme flood events,[5] alongside with an increased public attention to environmental and water issues and the enactment of some important EU directives in the field of drinking water and waste water treatment.[6] In addition to the adoption of specific measures for water and environmental protection, the Italian legislator approved an original and pioneering law on soil protection (Law no. 183/1989), which divided the territory into hydrographical basins (*bacini idrografici*) at national, regional and interregional levels, each basin being administered by newly created Basin Authorities (*Autorità di bacino*). These new public administrative structures associated with hydrographical basins were introduced as a tool for improving the critical situation of soil and water resources, for water resources planning and investments acquisition in the water sector.

The highest political and administrative body of the Basin Authority, called Institutional Committee (*Comitato istituzionale*), included representatives of the main Ministries concerned – that is, Environment (*Ambiente*), Infrastructure (*Infrastrutture*), Agriculture (*Agricoltura*) and Cultural Goods (*Beni culturali*) – the Department of Civil Protection (*Dipartimento della Protezione civile*),[7] Presidents of Regional Governments and the Secretary General, thus ensuring an internal coordination of different levels of governments and experts. The Institutional Committee was assisted by the Technical Committee (*Comitato tecnico*), formed by public servants nominated by the central Government and members of Regional administrations in charge of the preparation of the main planning document (basin plan), and by the Technical Secretariat (*Segretario generale*) which carried out all the routine day-to-day work.

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[4] The process of establishment of Regions passed through Law no. 281/1970, Decree of the President of the Republic no. 8/1972 and Decree of the President of the Republic no. 616/1977.

[5] After the floods occurred in Florence, in Triveneto and in the Piedmont Region in the 1960s, and in Genoa in 1970, dramatic flood events occurred in Salorno, Parma, Stava and Valtellina in the 1980s.

[6] The Drinking Water Directive (Directive no. 80/778/EEC) and the Urban Waste Water Treatment (Directive no. 91/271/EEC).

[7] A body established in early 1990s and under the supervision of the Office of the President of the Council of Ministers, the Department of Civil Protection is entrusted with the task of predicting, preventing and managing natural and man-made disasters.

The two most innovative novelties of Law no. 183/1989 were the improvement of inter-institutional collaboration of national and Regional representatives and technical experts, on the one hand, and the definition of a strategic framework for a cross-sectoral planning and regulation of water and soil use within the respective geographic area, on the other. However, these initiatives were partially hindered by the fact that water management and protection competences remained blurred, since the Ministry of Public Works (*Ministro dei Lavori pubblici*) continued to act as if the main actor for the regulation of water management, the newly established Ministry of the Environment, were only marginally involved in the water sector, and since the Regions competed with the central Government in the field of environmental and water protection (Citroni and Lippi 2006).

A significant step forward in terms of coherence and coordination of the water sector, at least on paper, was made in 1994, when the Italian legislator enacted Law no. 36/1994[8] with the aim of integrating all phases of water management into a comprehensive scheme based on the territorial integration ensured by a coherent system of water protection and use on the scale of hydrographical basins, and on functional integration of the water cycle, guaranteed through a balanced regime of extraction, supply, purification and disposal.

The law envisaged a comprehensive reform of water management based on optimal-size areas (*Ambiti territoriali ottimali* – ATOs) aggregating Municipalities within river basins. The main objective was the creation of an integrated system of water management for civil use, comprising regulatory (tariffs, technical standards) and institutional (organisation and policy instruments) innovations. To this end, the definition of the ATOs was assigned to the Regions, while the integrated water service within each ATO had to be run jointly by Municipalities and Provinces. At the national level, the reform established the Vigilance Commission for Water Resources (*Comitato per la vigilanza sull'uso delle risorse idriche*), first within the Ministry of Public Works then, after some years, under the control of the Ministry of the Environment.

The Authorities governing such optimal-size areas (*Autorità d'ambito territoriale ottimale* – AATOs) were given the tasks of planning and controlling local water services, identifying appropriate management tools and selecting managing companies for services of aqueduct, drainage and sewage disposal, while the Commission was granted the tasks of monitoring water services across the country, defining a uniform tariff calculation method and collecting and disseminating data on the national water management system.

Despite its high potential in terms of nationwide coordination power, however, the role of the Commission remained weak, as the implementation of the entire reform (Massarutto 2005). These quite modest achievements can be explained with the absence of the necessary conditions enabling an effective implementation scenario: for instance, a rational and clear policy design, a smooth process of institution-building and decentralisation, and the financial autonomy and responsibility of the

[8] Also known as *Legge Galli* (Galli Law), after its main proponent.

actors involved. On the contrary, the reform process appeared to be slow and quite fragmented, the institutions were reluctant to change the status quo at regional and local levels (Carrozza 2008) and only a third of OTUs could elaborate plans and monitor water resources by the end of the 1990s (Massarutto 2003).

This phase of integration and multi-level water governance attempts was formally completed by the enactment of Legislative Decree no. 152/1999,[9] which introduced the Water Protection Plans (*Piani di tutela delle acque*) as part of the basin plans and established actions and measures for qualitative and quantitative protection of water bodies at river basin and regional levels (i.e. the minimum environmental status and the quality status for waters with specific uses), thus aiming at improving the coordination of water protection actions at different government levels.

Once again, the rationale of administrative coordination and integration of existing territorially-based structures with new functional jurisdictions in the water sector prompted by the Italian legislator was mainly disattended in practice. At the same time, the implementation of EU Directives on water polices,[10] in particular those on pollution by nitrates from agricultural sources, urban wastewater treatment, public service contracts and public tenders, proved to be an additional factor of complexity. Therefore, instead of a more coherent water management and water protection governance, the provision of instruments and measures to be elaborated and approved at different institutional levels increased fragmentation within the territory and overlapping of functions.

Although some progress in the creation of the decentralised system of water management and protection was finally achieved at the beginning of the twenty-first century across the national territory, in many areas the reforms were limited to just a formal fulfilment, because of significant resistance of the existing institutions strongly sustained by regional and local political actors. For these reasons, the innovative spirit of these reforms did not find a sound application in the Italian regional context.

[9] This Decree implemented both EU Directive no. 91/271/EEC concerning urban waste-water treatment and EU Directive no. 91/676/EEC concerning the protection of waters against pollution caused by nitrates from agricultural sources.

[10] In particular, Directive no. 91/676/EEC concerning the protection of waters against pollution caused by nitrates from agricultural sources; Directive no. 92/50/EEC relating to the coordination of procedures for the award of public service contracts; and Directive no. 93/38/EEC coordinating the procurement procedures of entities operating in the water, energy, transport and telecommunications sectors. This EU sectoral legislative corpus was not fully and promptly implemented, thus the Commission opened some infringement procedures against Italy: see the letters of formal notice no. 8/11/2000 (SG(2000)D/108243) and no. 26/6/2002 (C(2002) 2329); and the procedures opened before of the EU Court of Justice no. 2000/5152, no. 2002/4801, no. 2004/2034, no. 2006/2163 and no. 2009/2034.

15.3 The WFD and FD Transposition in Italy and the Impact on the Existing Institutional Framework

While from the 1970s until the 1990s EU water law had developed in a piecemeal fashion, focusing on specific types of water use and pollution sources, the WFD combined different instruments and approaches to achieve good ecological and chemical status for all EU waters by 2015. The WFD identified the river basin districts as the natural geographical and hydrological units for water management, instead of adopting administrative or political boundaries. In addition, the WFD identified the River Basin District Authorities as competent authorities for coordinating all programmes of measures for the river basin districts, namely: to implement measures to prevent the deterioration of the status of all bodies of surface water and progressively reduce pollution from priority substances; to protect, enhance and restore all bodies of surface water; and to protect, enhance and restore all bodies of groundwater by implementing necessary measures to reverse any significant pollutants concentration.

The WFD emphasised the need for close cooperation and coherent action at EU, Member State and local levels, thus promoting a multi-level governance of water (Grimaud 2001). For each river basin district, the WFD required the elaboration of a river basin management plan to be updated every six years and including the river basin's characteristics, a review of the impact of human activity on the status of waters in the basin, estimation of the effect of existing legislation and the remaining gap to meeting these objectives, a set of measures to fill the gaps, and an economic analysis of water use.[11] Notably, the river basin management plan was considered the major tool through which the environmental objectives set by the WFD should be achieved in the Member States (Kallis and Butler 2001).

It is also worth noting that the WFD placed a variety of procedural obligations on the shoulders of competent authorities (i.e., the River Basin District Authorities), as mentioned above, and specific public information and consultation duties (Lee 2009; Howarth 2009).[12]

However, almost 20 years since it was adopted, the great expectations that came with the Directive have not been fully realised yet, as the implementation of the WFD highlighted the difficulty of finding appropriate domestic operational tools for implementing the new European strategy for sustainable water management, which prevented the achievement of the established political goals in due time in most Member States (Kessen et al. 2010; Liefferink et al. 2011; European Commission 2015; Jager et al. 2016; Voulvoulis et al. 2017).

In Italy, too, despite the presence of some favourable domestic pre-conditions that could have promoted a straightforward process of adaptation to the EU

[11] On the economic aspects of water management under the WFD see, in this volume, Chap. 17 by Massarutto.

[12] On public participation in the context of the WFD see, in this volume, Chap. 19 by Fasoli, Bastiani and Puma.

obligations and ultimately led to a more coherent system of water governance, the implementation stage has resulted in a cumbersome process of structural reorganisation that has generated numerous inter-institutional conflicts and created uncertainty in terms of competences. For example, the concept of integrated water management in the context of hydrographical districts, which definitely constituted the core of the WFD, was quite close to the logic of hydrographical basins established in Italy by Law no. 183/189. A further rationalisation of the existing framework and the aggregation of national, regional and interregional basins into hydrographical districts on the basis of effective functional criteria, in addition to a real engagement of higher and lower levels of governments and the involvement of all stakeholders, would have been in line with the new EU approach to water governance. Through the enhancement of horizontal and vertical coordinated interactions, the excessive fragmentation of the Italian water management system could have been likely overcome.

Instead, a clash of interests along the centre-periphery line had emerged in the first implementation phase of the WFD, with a strong opposition of regional and local actors to the decisions taken by the national Government (Alberton 2010). This clash was mainly rooted in the almost concurrent revision of Title V of the Constitution on the allocation of competences between State and Regions. Indeed, after the profound reform of 2001, the Constitution came to reserve the "protection of the environment, the ecosystem and cultural heritage", including water protection, to the exclusive legislative competence of the State. The Regions, conversely, would have enjoyed concurrent legislative and regulatory powers in a number of areas related to the environment and water resources.[13]

The centralistic approach fostered, in the field of water policy, by the constitutional reform of 2001 did not entail any concrete mechanisms for coordination and cooperation between central and Regional levels (vertical integration) and caused the immediate critical reaction of Regional and Autonomous Provinces authorities. Against this background, constitutional adjudication has been decisive (Maddalena 2010). However, in contrast with an initial interpretation of the normative power of the Regions with regard to environment-related interests – including water – as concurrent, more recent case law has recentralised environmental competences also through the erosion of Regional cross-cutting competences.

Notably, the conflicts among the State and the Regions/Autonomous Provinces increased with the approval of Legislative Decree no. 152/2006, transposing the WFD into domestic legislation.[14] Such decree detailed the new constitutional division of competences concerning the environment by transferring regulative power from local to central bodies and centralising many of the administrative competences previously shared with the Regions and Provinces. In addition, it abrogated

[13] Art. 117, Para. 2, of the Constitution. Under Art. 117, Para. 3, Regions are also given a general (residual) competence in sectors whose disciplines may have environmental implications. In addition, Art. 116 includes environmental protection among the areas in which Regions may request and obtain further forms and conditions of autonomy.

[14] Also known as the "Environmental Code" (*Codice dell'ambiente*).

almost all previous Italian laws in the field of water management and protection, including Law no. 183/1989, Law no. 36/1994 and Legislative Decree no. 152/1999.

With specific reference to river basin districts, Legislative Decree no. 152/2006 provided for the division of the whole national territory into eight hydrographical districts – reduced to seven after the enactment of Law no. 221/2015, on which see *infra* – thus replacing existing national, Regional and inter-Regional river basins.[15] The existing Basin Authorities were destined to be suppressed, while new Basin District Authorities (*Autorità di bacino distrettuale*) (hereinafter, only "District Authorities") with planning and programming functions had to be established by Ministerial Decree, with a view to bringing Italy in compliance with the organisational structure set out by the WFD.[16]

The Regions did not accept a limited legislative, regulatory and administrative role and tried to challenge many of the provisions of the new decree.[17] Besides, they even enacted Regional laws on water protection and management recalling their concurrent competence in sectors cross-cutting environmental issues, which required the intervention of the Constitutional Court, that eventually ruled in favour of the State by abrogating those Regional provisions on water protection.

Institutional struggle, however, has been almost pervasive. The identification of the District Authorities, in charge of the preparation and implementation of river basin management plans and programmes of measures, and, in particular, the composition and functions of the main decision-making body of the Authorities, i.e., the so-called Permanent Institutional Conference (*Conferenza istituzionale permanente*), have been at the core of institutional conflicts between State and Regions, thus hindering the whole transposition of WFD provisions. Indeed, according to Legislative Decree no. 152/2006, the Institutional Conference should have included six representatives of sectoral Ministries,[18] a representative of the Department of Civil Protection, and the Presidents of the Regional Governments involved. The reason for Regional resistance is evident, as, compared with the structure of former Basin Authorities, Ministerial representation has become dominant in all new hydrographical districts, even in cases where Regional presence was larger.[19]

[15] The districts thus established are the following: Eastern Alps (*Alpi orientali*), Po (*Padano*), Northern Apennines (*Appennino settentrionale*), Serchio River (*Fiume Serchio*), Central Apennines (*Appennino centrale*), Southern Apennines (*Appennino meridionale*), Sardinia (*Sardegna*) and Sicily (*Sicilia*).

[16] As their name makes clear, District Authorities are the River Basin District Authorities the WFD requires to establish (see *supra*).

[17] *See*, among others, Constitutional Court, judgments nos. 232 and 233 of 15 July 2009, 246 of 16 July 2009, 254 of 23 July 2009, 1 of 11 January 2010, 29 of 27 January 2010, 142 of 14 April 2010, 325 of 3 November 2010.

[18] These are: Ministry of the Environment (*Ambiente*), Ministry of Transports and Infrastructure (*Trasporti e Infrastutture*), Ministry of Industrial Activities (*Attività produttive*), Ministry of Agriculture and Forests (*Agricoltura e Foreste*), Ministry of Public Administration (*Funzione pubblica*), Ministry of Cultural Goods and Activities (*Beni e Attività culturali*).

[19] This applies to the following three districts: the Po district (covering the territory of Valle d'Aosta, Piedmont, Lombardy, Veneto, Liguria, Emilia Romagna and Tuscany), the Central

The centralisation trend pursued by the 2001 constitutional reform and, with a specific focus on environmental policy, by Legislative Decree no. 152/2006, shifted the main coordinating roles as well as legislative and administrative powers from the Regions to the State, thus provoking the former's strong reaction. In particular, the Regions tried to reaffirm their former prominent role within the river basin district bodies – without succeeding.[20]

Against this conflicting scenario, the new District Authorities were not established within the prescribed deadline, so that the abolishment of the existing Basin Authorities was postponed by Decree-Law no. 208/2008. These latter authorities were granted by Law no. 13/2009 the responsibility for the preparation of river basin management plans, in collaboration with the Regions concerned, with the specific purpose of meeting the deadline of 22 December 2009, set by the WFD for the submission of these documents to the EU Commission. Thus, the contents of the river basin management plans had to be collected in a few months and, as a consequence, most water planning and protection measures were directly transplanted from the existing Regional plans to the new plans.

Such delays in the implementation of institutional and procedural requirements of the WFD have inevitably undermined the achievement of its substantive objectives,[21] for instance, a stable and coordinated system of water management and protection measures on the scale of river basin districts, capable of overcoming the pre-existing fragmentation of competencies and functions in water planning, management and protection between different territorial bodies and functional agencies.

In addition, the final rush in the attempt at meeting the WFD targets shed some light on the significant differences in approach and timing of actions across the Regions, including those belonging to the same river basin districts. Indeed, the elaboration of river basin management plans and programmes of measures proved to be more rapid and effective in those districts where Basin Authorities had been promoting practices of cooperative and inclusive decision-making for years, while in general the organisation of the public consultation procedure required by the WFD was reduced in terms of both duration and scope, turning, in most cases, into a mere procedural exercise (Alberton and Domorenok 2011).

While the Regions continued to elaborate their water protection plans and to organise the collection and dissemination of information on the status of waters,[22] monitoring remained under the responsibility of local consortia operating within the

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Apennines district (comprised of Emilia Romagna, Marche, Abruzzo, Toscana, Lazio, Molise and Umbria), and the Southern Apennines district (extending over Campania, Lazio, Abruzzi, Molise, Puglia, Basilicata and Calabria).

[20] In a document dated 18 April 2007 and sent to the Minister of the Environment, Regional Governments clearly expressed their dissatisfaction with the design of both the new districts and the related Authorities. The Regions asked for an open institutional consultation on these issues insofar as the territorial and functional basis of the new system could be more efficiently defined.

[21] For a full list of implementation failures, see European Commission (2009).

[22] These data had then to be collected at national level and further submitted to the European Commission.

ATOs, which also had the task of guaranteeing water treatment, under the supervision of the Regions. AATOs continued to adopt their own system of tariff calculation under no common frame of reference at national or sub-national levels, in contrast with the instructions of the WFD on the cost recovery principle.

This situation further deteriorated as a consequence of Law no. 166/2009, which introduced a partial privatisation of water management. The most controversial provisions were abolished by a referendum in 2011 (Alberton 2011), but the overall scenario remained more uncertain than ever for both the water service companies and the sub-national authorities concerned. AATOs were eventually suppressed by Law no. 42/2010 and the Regions were required to identify new bodies in charge of water services management, planning and control at local level,[23] while Law no. 214/2011 assigned the competences in matters of regulation in the water sector to the National Authority for Energy and Gas (now also covering waste and known as ARERA). However, it is only with Laws nos. 164/2014[24] and 190/2014[25] that the Italian legislator has undertaken a strong action of rationalisation in the field of water services (Aru 2019). Finally, another important and WFD-connected implementation process to be mentioned – one that involved an extensive institutional rethinking – was introduced by the Floods Directive (FD).[26]

The FD built on the identification of river basin districts under the WFD[27] and provided for a series of additional institutional and coordination obligations. In addition, the FD called for the establishment of management units[28] and the selection of competent national authorities with the mandate to carry out a preliminary flood risk assessment with a view to identifying areas in which potential significant flood risks exist or may be considered likely to occur, as well as to preparing flood hazard maps and flood risk maps and developing flood risk management plans.[29]

Some administrative efficiency could be achieved by synergising the implementation of the WFD and FD, as explicitly indicated by the latter: EU Member States were indeed required to coordinate the application of the two instruments "focusing on opportunities for improving efficiency, information exchange and for achieving common synergies and benefits".[30] More precisely, Member States had to ensure consistency of information in the respective planning processes, coordinate these processes with a view to possibly integrating the first flood risk management plans and their reviews into the reviews of the river basin management plans, as well as

[23] It must be noted that the substitution of AATOs with the new *Enti di governo d'ambito* (EGAs) has been taking much longer than prescribed. A decade after the enactment of Law no. no. 42/2010, not every EGA was operative yet.

[24] See Art. 7.

[25] See Art. 1, Para. 609.

[26] Directive no. 2007/60/EC of the European Parliament and of the Council of 23 October 2007 on the assessment and management of flood risks.

[27] *Ibid.*, Art. 2.

[28] *Ibid.*, Art. 3, Para. 2.

[29] *Ibid.,* Arts. 4–7.

[30] *Ibid.*, Art. 9.

coordinate public involvement under the two directives (Alberton and Palermo 2012).[31]

Legislative Decree no. 49/2010, implementing the FD in the Italian system, required the Basin Authorities to undertake a preliminary assessment by 2011 to identify the river basins and the associated coastal areas at risk of flooding. For such zones, the Authorities should have elaborated flood risk maps by 2013 and established flood risk management plans with a focus on prevention, protection and preparedness by 2015. Such flood risk management plans should have been coordinated with river basin management plans and included public participation procedures in their preparation. Interestingly, the suppressed (by Legislative Decree no. 152/2006 and Decree-Law no. 208/2008) and soon thereafter resurged (through Law no. 13/2009) Basin Authorities had once again to undertake the activities related to the implementation of the EU directives, thus increasing their water planning and management role in the vacuum left by the ongoing partial institutional reform. As already occurred for the implementation of the WFD, the responsibility for the preliminary flood risk assessment, as well as for the elaboration of the flood hazard map, the flood risk maps and the flood risk management plans were eventually borne by the existing Basin Authorities, in cooperation with the Regions. These latter were also in charge of the establishment of an early warning system for the Civil Protection.[32]

It should be noted that the FD[33] required EU Member States to appoint competent authorities different from those identified pursuant to the WFD, therefore the Italian legislator should have identified specific entities different from the Basin Authorities as those competent for developing the necessary documents and plans. However, in this regard, the Italian legislator did not opt for some institutional novelties, preferring administrative convenience and existing institutional settings (Muratori 2010). Therefore, the former Basin Authorities had to carry out all the activities and obligations listed by the two directives before the new District Authorities could turn into a full-fledged mechanism.

15.4 Conclusions: Present and Future Challenges

After several years of provisional institutional settings, Law no. 221/2015 has finally established the Basin District Authorities (*Autorità di bacino distrettuale*) by replacing previous articles of Legislative Decree no. 152/2006[34] with new provisions: the Ministry of the Environment is responsible for the general coordination, political direction and supervision of the Authorities, thus preserving a central role.

[31] *Ibid.*, Art. 9, Paras. 1–3.

[32] Legislative Decree no. 49/2010, Art. 3, Para. 2.

[33] Directive no. 2007/60/EC, Art. 3, Para. 2, letter (a).

[34] Legislative Decree no. 152/2006, Arts. 63–64.

According to the most recent norms, the new main organs are: the Permanent Institutional Conference (*Conferenza istituzionale permanente*) and the Secretary-General (*Segretario generale*), with the assistance of the Operational Conference (*Conferenza operativa*) and Financial Auditors (*Collegio dei revisori dei conti*). The Permanent Institutional Conference includes the Minister of the Environment, the Minister of Transports and Infrastructure, and in some cases – where their competences are needed – the Minister of Agriculture and Forests and the Minister of Cultural Activities and Tourism (the respective Secretaries-General can take the place of these Ministers if delegated), the Head of the Civil Protection Department, in addition to the Presidents of the interested Regions and Autonomous Provinces or their delegates.[35] Notably, this composition reaffirms the centralistic approach dominating after the enactment of Legislative Decree no. 152/2006 and is further strengthened by the selection procedure of the Secretary General. He/she is officially nominated by the President of the Council of Ministries among the names proposed by the Ministry of the Environment.

The seven District Authorities[36] are now fully operational following the approval of the Decree of the Ministry of the Environment of 25 October 2016. Personnel, financial resources and headquarters have been transferred from former Basin Authorities to the new District Authorities. After 10 years from the approval of Legislative Decree no. 152/2006 and the abrogation of the former Basin Authorities, the institutional reform concerning water management and protection has been completed.

As demonstrated above, over the years the Italian system has revealed its flaws, that is, a patchwork of discontinuous principles, institutions and measures that have increased fragmentation and inter-institutional conflicts rather than attain stronger coordination and consistency of water policies and governance across different jurisdictions. Even if the implementation of the WFD and the FD could have played a greater role in delivering a more coherent and sustainable water management system, the process has proven to be another missed opportunity.

The policy, institutional and administrative challenges are likely the main reason behind many of the gaps and delays in the implementation efforts. An effective decentralisation and the simultaneous involvement of different levels of government and stakeholders are the next challenges for the Italian water governance.

[35] Cf. the previous composition of the Institutional Conference, *supra* Sect. 3. Some differences can be spotted, most notably a decrease in Ministerial representation, as two Ministers (of Public Administration and of Industrial Activities) are no longer present, whereas other two Ministers are invited only if issues within their competences are discussed.

[36] The District Authorities are the following: Eastern Alps, Po, Northern Apennines, Central Apennines, Southern Apennines, Sardinia and Sicily. As it can be seen, the Serchio River District was abolished: the relative area was merged into the Northern Apennines District.

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Chapter 16
A Practitioners' View on the Application of the Water Framework Directive and the Floods Directive in Italy

Marta Martinengo, Antonio Ziantoni, Fabio Lazzeri, Giorgio Rosatti, and Riccardo Rigon

Abstract The European Union directives commonly known as Water Framework Directive and Flood Directive represent turning points for European water policies. In this chapter, we briefly describe how they affect people working in the fields of water resources management, exploitation and protection of and from water bodies in Italy. We illustrate the work needed to comply with the obligations of the directives generally, who did the work and with what responsibilities in past implementation cycles, and what was actually done for both directives up to 2016. The result is a picture of the Italian water management system: one that is defined not only by laws, but also by habits and the way institutions have developed during recent history through their interplay with growing technical knowledge, the implementation of policies, and the evolution of the Italian society. The chapter is divided as follows: Sect. 16.1 reports what has to be done to accomplish the goals of the directives generally; Sect. 16.2 explains who performed the actions required by the directives in past implementation cycles; Sects. 16.3 and 16.4 describe and discuss the state of Italy's application of the directives; Sect. 16.5 covers the role of science in the implementation of the directives; and, finally, Sect. 16.6 contains some considerations on the main critical aspects of the whole process and on the challenges the future application of the directives (in the period 2021–2027) is going to face.

Keywords Water governance · Water management plan · Flood control · Water status · Science-based governance

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16.1 Introduction (What Has to Be Done)

Compliance with the Water Framework Directive (WFD)[1] and Floods Directive (FD)[2] of the European Union (EU) is a huge task that affects a considerable portion of the economy and is subject to the evolving understanding of water-related processes by earth sciences and engineering. As such, it requires integrated, interdisciplinary, and holistic approaches (Voulvoulis et al. 2017) as well as reasoned debate between many social actors. Implementing these two directives affects everyone who works in the water management sector, from practitioners to government officials, and their comprehensive objectives cannot be accomplished once and for all: an iterative process is required, one based on the definition of practical measures and control of the results (Sabel and Zeitlin 2012). For this reason, both directives are based on a six-year cycle of planning approach. The first management cycle of the WFD ran from 2009 to 2015 and the second from 2015 to 2021. In harmony with the WFD, the FD first management cycle ran from 2015 to 2021. The timetable of the main implementation stages of the WFD and FD, as reported by the European Commission (2014) and described below, is shown in Fig. 16.1 and the related layers and deliverables are presented in Fig. 16.2.

According to Article 1 of the WFD, the purpose of the directive is the protection of all waters, by preventing further deterioration and enhancing the waters status, promoting the sustainable use of water, reducing discharges, emissions, priority substance losses and pollution and mitigating the floods and droughts effects. Overall, the key objective of the WFD is to maintain or achieve good water status for all water bodies (European Commission 2003a).

To achieve this objective, the key actions to be taken are: (i) to characterise the river basins, by identifying pressures and impacts of human activity on water body status and performing an economic analysis of water use; (ii) to develop monitoring programmes; and (iii) to establish River Basin Management Plans (RBMPs) and Programmes of Measures (PoMs) defining the environmental objectives with a view to managing pressures and impacts and achieving a good status of water (European Commission 2014) (Fig. 16.1).

The characterisation of the river basins requires many types of data and inventories that allow to describe the drainage basin, the pressures and the impacts and to perform an economic analysis. The collection of data and inventories is the first step necessary to implement the WFD and, for this reason, is shown as a "basic layer" element (red rectangle) in Fig. 16.2. Measuring the state of a water system is very complicated. It usually requires identifying quality elements and, for each element, a quantitative *indicator of quality,* whose value can be used as a measure of performances (Voulvoulis et al. 2017). A classification must be established and has to be

[1] Directive no. 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy.

[2] Directive no. 2007/60/EC of the European Parliament and of the Council of 23 October 2007 on the assessment and management of flood risks.

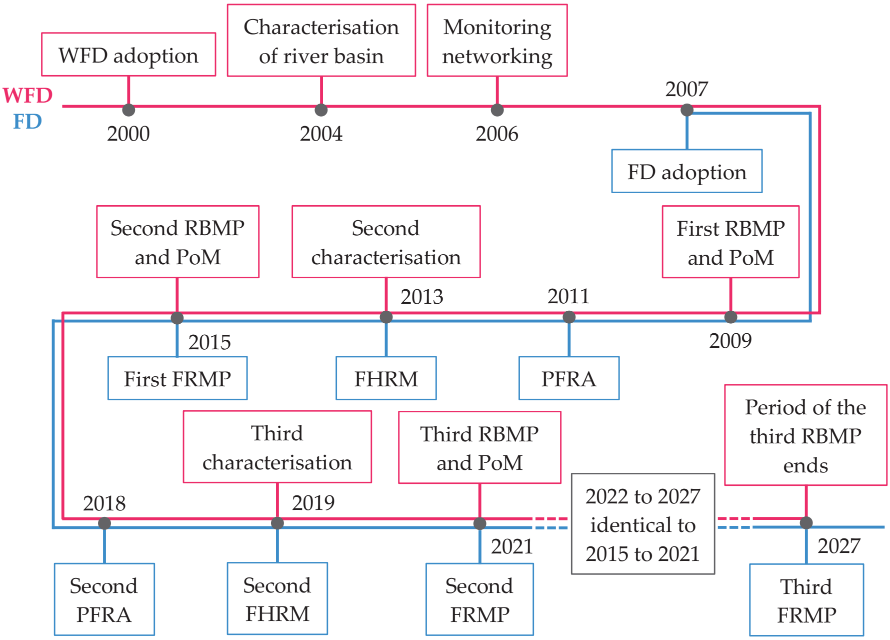

Fig. 16.1 The timetable of the main key stages of the WFD and FD implementation. The meaning of acronyms can be found in the following paragraphs

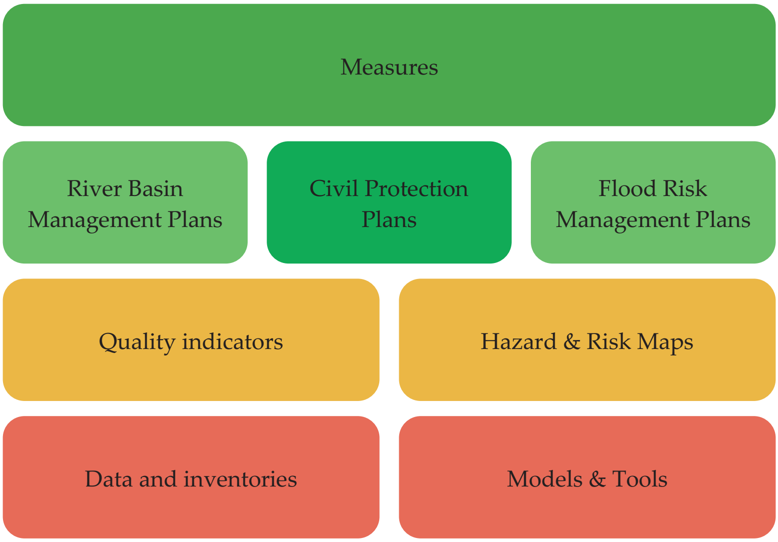

Fig. 16.2 Layers and deliverables related to the accomplishment of the WFD and FD. The red rectangles contain the element that constitutes the "basic layer" for the directives' implementation. The intermediate and final deliverables of the directives are respectively reported in the yellow and green rectangles

composed of either five classes (for surface waters) or two classes (for groundwaters) (European Commission 2003b). The quality elements cover a wide range of areas and can be classified as biological, hydromorphological and physicochemical (European Commission 2003a). Examples of these categories are the permitted concentration of a certain substance in drinking water, the abundance of certain biota in a lake, the amount of pesticide in groundwater, and the geomorphology of a stream. The quality indicators are intermediate tools in the accomplishment of the directive's goals and are shown in Fig. 16.2 as intermediate deliverables (yellow rectangle).

According to Article 8 of the WFD, the quality elements, once set, must be monitored "to establish a coherent and comprehensive overview of water status within each River Basin District" (European Commission 2003b) and, for this reason, a monitoring programme is required. Moreover, to achieve the environmental objectives (Article 4 of the WFD), a PoM based on the characterisation of the river basin and the results of the monitoring programme must be established and implemented. Measures are shown in Fig. 16.2 as one of the final deliverables (green rectangle) of the directive. All the previously described information (i.e., characterisation, monitoring, objectives and measures to maintain or improve water status) should be included in the RBMP that must be produced for each river basin district (European Commission 2003c). In Fig. 16.2, RBMPs as well are shown in green since they represent a final deliverable of the directive.

The core goal of the FD differs from that of the WFD since it relates to the reduction and management of flood risk to human health, cultural heritage, the environment and economic activities. Complying with the FD comprises three steps (Tsakiris et al. 2009): (i) to carry out a preliminary flood risk assessment (PFRA); (ii) to prepare flood hazard and risk maps (FHRM); and (iii) to write down a flood risk management plan (FRMP) (Fig. 16.1).

Once the areas with potential significant flood risk are identified, the flood hazard and risk maps should be developed for these areas. This means choosing a sequence of available models and tools to estimate the flood hazard and risk. In Fig. 16.2, the red "Models and Tools" box is to indicate how they constitute an internal layer of deliverables in fulfilling the directive, almost as basic as data. For what concerns the development of the maps, the FD is prescriptive in terms of flood return periods for the hazard map (Article 6, Paragraph 3) and of vulnerable and exposed elements for the risk map (Article 6, Paragraph 5). The maps themselves are an intermediate deliverable of the process, represented in yellow in Fig. 16.2. Finally, the FRMP, shown in green in Fig. 16.2, is drafted on the basis of the flood hazard and risk maps. It should establish the flood risk management objectives and related measures, and all aspects of flood risk management should be addressed, focusing on (i) prevention; (ii) protection; and (iii) preparedness (Article 7, Paragraph 3).

One of the main topics, common to both the WFD and the FD, is information dissemination and public consultation.[3] Indeed, according to Article 14 of the WFD

[3] For further information on public participation in the implementation of the directives in Italy, see, in this volume, Chap. 19 by Fasoli, Bastiani and Puma.

and to Articles 9 and 10 of the FD, EU Member States should encourage the "active involvement of interested parties in the production, review and updating" of the plans. Institutions need to interact with communities in order to understand their needs and get feedback and suggestions related to the ongoing process. Deploying shared procedures, which grow into accepted solutions during the process, is by default the best case of all and this becomes possible by making intermediate material and data available to the public.

To sum up, the directives require three types of deliverable. Data, inventories and models constitute the first level, quite hidden to the general public, but available to technicians (the red boxes in Fig. 16.2). Based on these, indicators and maps of hazards and risks are produced as a second level (yellow boxes in Fig. 16.2). RBMPs and FRMPs are the third level (the green boxes in Fig. 16.2). To these deliverables, we also added Measures in Fig. 16.2. These are contained in the management plans, but they are shown separately here because they involve activities by other actors, as clarified below. For the sake of completeness, in Fig. 16.2 Civil Protection Plans have also been added; they are related to preparedness even if they are not the same type of product required by the FD.

16.2 Who (Is Who in Italy's Water Resources Governance)

In Sect. 16.1, we briefly presented the technical processes behind the application of the WFD and FD. Here we summarise the issue of who manages such processes in Italy. In addition to the layers and deliverables already presented in Fig. 16.2, the key actors and stakeholders involved in the implementation of the directives and their interactions, described below, are shown in Fig. 16.3.

In order to apply the WFD, Legislative Decree no. 152/2006 (also known as the "Code on the Environment" – *Codice dell'ambiente*)[4] subdivided the country into eight River Basin Districts (RBDs): Eastern Alps, Po, Northern Apennines, Serchio, Central Apennines, Southern Apennines, Sardinia and Sicily (Fig. 16.4). Since the establishment of the Districts, there has been some reform to improve the system. With Law no. 221/2015,[5] in particular, the territorial subdivision was modified, incorporating the Serchio RBD into the Northern Apennines RBD, while with Ministerial Decree no. 294/2016,[6] the Italian Government identified several competent authorities to implement the WFD at national, river catchment and regional levels (European Commission 2019b). Specifically, the Ministry of the Environment and of the Protection of the Territory and the Sea (*Ministero*

[4] Decreto legislativo n. 152/2006 ("*Norme in materia ambientale*").

[5] Legge n. 221/2015 ("*Disposizioni in materia ambientale per promuovere misure di green economy e per il contenimento dell'uso eccessivo di risorse naturali*").

[6] Decreto ministeriale n. 294/2016 ("*Disciplina dell'attribuzione e del trasferimento alle Autorità di bacino distrettuali del personale e delle risorse strumentali, ivi comprese le sedi, e finanziarie delle Autorità di bacino, di cui alla legge 18 maggio 1989, n. 183*").

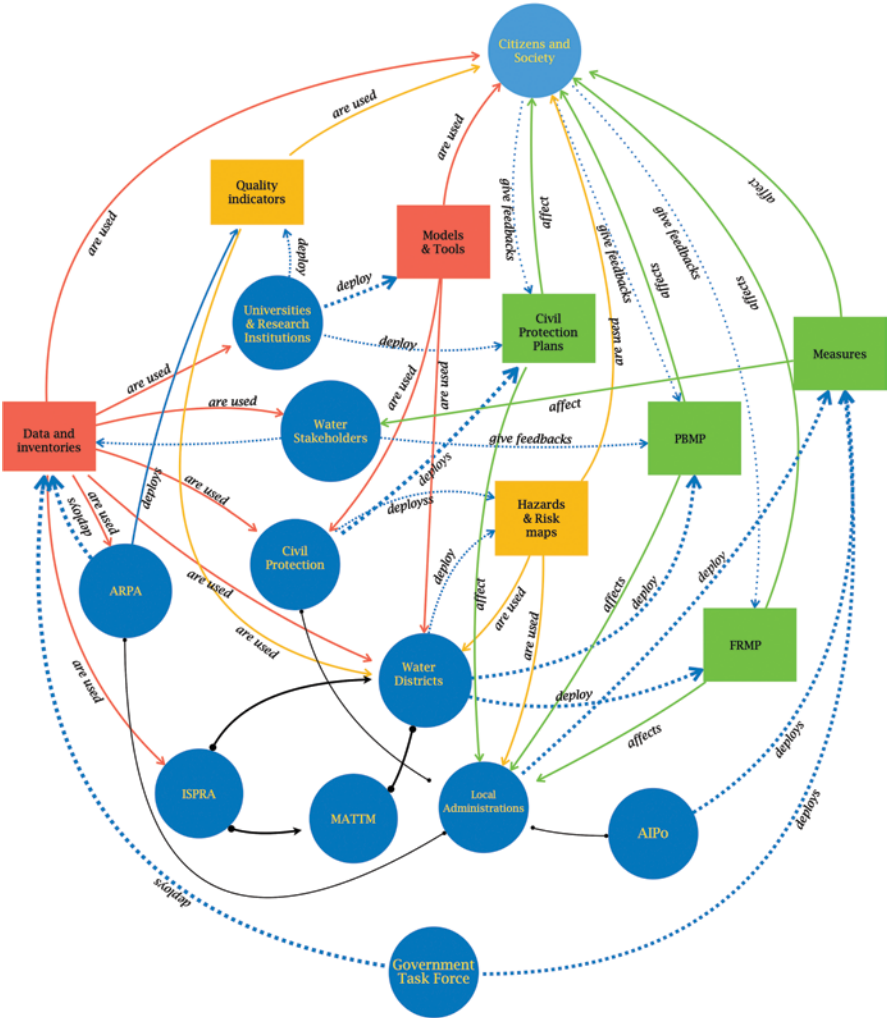

Fig. 16.3 WFD and FD in Italy: base level (red rectangles), intermediate (yellow rectangles) and final (green rectangles) deliverables, actors (blue circles), stakeholders (light blue circles) and their interactions. The meaning of acronyms can be found in the previous and following paragraphs

dell'Ambiente e della Tutela del Territorio e del Mare – MATTM) and the National Institute for Environmental Protection and Research (*Istituto Superiore per la Protezione e la Ricerca Ambientale* – ISPRA) are designated at the national level, the RDBs at the river basin level, and the Regions and Autonomous Provinces at the regional level. However, according to Legislative Decree no. 219/2010,[7] the RBD

[7] Decreto legislativo n. 219/2010 ("*Attuazione della direttiva 2008/105/CE relativa a standard di qualità ambientale nel settore della politica delle acque, recante modifica e successiva abrogazi-*

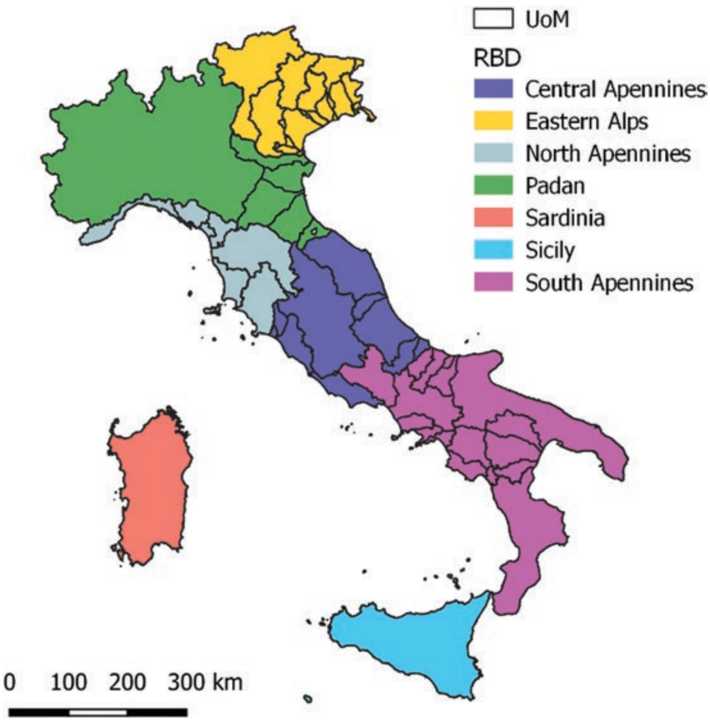

Fig. 16.4 Italy's River Basin Districts (RBDs – post Law no. 221/2015) and Units of Management (UoMs)

Authorities (*Autorità di bacino distrettuale*) have a coordinating role for the implementation of the WFD within their districts. These institutions are shown as actors (blue circles) in Fig. 16.3.

Furthermore, in accordance with Article 3 of the FD, Italy has designed 47 Units of Management (UoMs) to accomplish the goals of the directive (Fig. 16.4). As described by the European Commission (2019c), "the FRMPs are coordinated and prepared at RBD level and detailed at UoM scale by the Prime Competent Authorities (River Basin Authorities and Regional Authorities)".

According to Legislative Decrees nos. 152/2006 and 49/2010,[8] the MATTM is in charge of the eight Italian RBDs, playing the role of director and harmonizer, while ISPRA supports the MATTM with guidance on how the management plans should be written and deployed. In Fig. 16.3, these institutions are connected with a black

one delle direttive 82/176/CEE, 83/513/CEE, 84/156/CEE, 84/491/CEE, 86/280/CEE, nonché modifica della direttiva 2000/60/CE e recepimento della direttiva 2009/90/CE che stabilisce, conformemente alla direttiva 2000/60/CE, specifiche tecniche per l'analisi chimica e il monitoraggio dello stato delle acque").

[8] Decreto legiuslativo n. 49/2010 ("*Attuazione della direttiva 2007/60/CE relativa alla valutazione e alla gestione dei rischi di alluvioni*").

line to indicate that they represent the State. Local administrations are shown separately because they have a different role in the process.

Regional governments possess the capital to operate (provided by the State through various forms of financial support) and have the duty to plan regional and local development (both urban and non-urban). Exceptions in the governance chain here shown are the Autonomous Regions and Provinces, which have some specific prerogatives and, therefore, bypass part of the process, having all the competences themselves (Coen 2006). For instance, the Adige river basin falls in part within the provinces of Trento and Bolzano; these Autonomous Provinces exert their constitutional rights and produce indicators and hazard and risk maps for their territories on their own. Another exception in governance with respect to the rest of the country is the Po RBD. The Padan one is the largest river basin and extends across North-Western and North-Central Italy (Fig. 16.3). In 2003, in order to harmonise the policies of the various Regions that fall within the district (mainly Piedmont, Lombardy, Emilia-Romagna and Veneto), the Italian legislature instituted the Interregional Agency for the Po River (*Agenzia Interregionale per il fiume Po* – AIPo), a public body that provides engineering and environmental services related to flood risk mitigation. In Fig. 16.3, AIPo is shown connected with the local authorities that it represents.

There are at least two other actors in the process, which have not been mentioned yet, though they are shown in Fig. 16.3: the Civil Protection Department (*Dipartimento della Protezione Civile* – DPC) and the Regional/Provincial Environmental Protection Agency (*Agenzia Regionale/Provinciale per la Protezione dell'Ambiente* – ARPA/APPA). In Italy, hazards management intersects not only the competence of RBDs and Regions but also that of the DPC. Indeed, according to Article 7 of Legislative Decree no. 49/2010, the preparation and implementation of the national and sub-national warning systems for hydraulic risk for civil protection purposes must be carried out by the Regions in coordination with the DPC. This highlights the dichotomy between the planning bodies (the RBDs) and the executing bodies (Regions, Autonomous Provinces and the DPC) in flood risk management, a dichotomy that becomes evident in the civil protection plans. To support the DPC, the Decree of the President of the Council of Ministers of 14 September 2012[9] designated a group of institutions, among which university departments and research centres, as Centres of Competence (*centri di competenza* – CC), with the initial goal of supporting with scientific expertise the DPC in carrying out its duties. In practice, most of these Centres were never financed or utilised. In Fig. 16.3, they mostly fall into the "Universities and Research Institutions" group, except AIPo, which is shown separately, even though it is formally declared a CC.

The current situation is even more interwoven than it appears to be. As previously mentioned, producing a map requires some type of modelling and usually many data. No practitioner can estimate floods without a considerable amount of

[9] Decreto del Presidente del Consiglio dei Ministri del 14 settembre 2012 ("*Definizione dei principi per l'individuazione ed il funzionamento dei Centri di Competenza*").

meteorological, hydrological and geological information. Any WFD indicator is the synthesis (a model) of many other data. Each model requires datasets for validation and verification. Data measurement, collection, storage and supply are key functions of the governance chain. Decision making can be centralised or regionalised, but data need to be collected locally. During the last decades, Italy has undergone a transition from national services providing data, as was the case of the *Istituto Idrografico e Mareografico*, to regionalised data providers, specifically ARPAs (or equivalent services for the Autonomous Regions and Provinces).[10] With Decree-Law no. 132/2016,[11] ARPAs together with ISPRA now constitute the National System for Environmental Protection (*Sistema Nazionale per la Protezione dell'Ambiente* – SNPA). ARPAs, therefore, represent another actor in Fig. 16.3 and are connected by a black line to the local administration of which they are part. From a practical point of view, by means of ARPAs, the Regions give the "raw material" with which any analysis is produced. ARPAs manage networks of hydro-meteorological stations and the routine water quality measurements and other environmental campaigns.

As is the case elsewhere, in Italy models are usually produced by universities and research institutions, as shown in Fig. 16.3. We will talk about this in detail in the next Section; now, we have to make an annotation about the so-called Institutional Task Forces (*Strutture di Missione*). Under previous Italian Governments, these were instituted by the Prime Minister, to whom they were accountable, to accomplish specific environmental tasks. An interesting case is that of *Italia Sicura* (Safe Italy).[12] It was established in 2014 as a task force to mitigate hydrogeological risk. It also created a series of databases containing environmental data and released the data as open source. It is evident that the Italian Government realised that the entire water management sector needed a boost, but it provided a further infrastructure in an already complicated institutional set-up. The subsequent Government closed *Italia Sicura* but, at the same time, with the Decree of the President of the Council of Ministers of 20 February 2019[13] it approved *ProteggItalia* (ProtectItaly) on the same lines as *Italia Sicura*, adding two interesting keywords, "Simplification" and "Governance and Organisation", about which we shall return in the discussion Section.

It should be clear at this point that the already complex system represented in Fig. 16.3 is even more articulated. Many of the circles are in fact containers of

[10] ISPRA, *Inquadramento storico del monitoraggio idro-meteografico e delle relative competenze*, www.isprambiente.gov.it/it/progetti/cartella-progetti-in-corso/acque-interne-e-marino-costiere-1/progetto-annali/inquadramento-storico-del-monitoraggio-idro-meteografico-e-delle-relative-competenze

[11] Decreto-legge n. 132/2016 ("*Istituzione del Sistema nazionale a rete per la protezione dell'ambiente e disciplina dell'Istituto superiore per la protezione e la ricerca ambientale*").

[12] On *Italia Sicura*, see also, in this volume, Chap. 2 by Rosso.

[13] Decreto del Presidente del Consiglio dei Ministri del 20 febbraio 2019 ("*Approvazione del Piano nazionale per la mitigazione del rischio idrogeologico, il ripristino e la tutela della risorsa ambientale*").

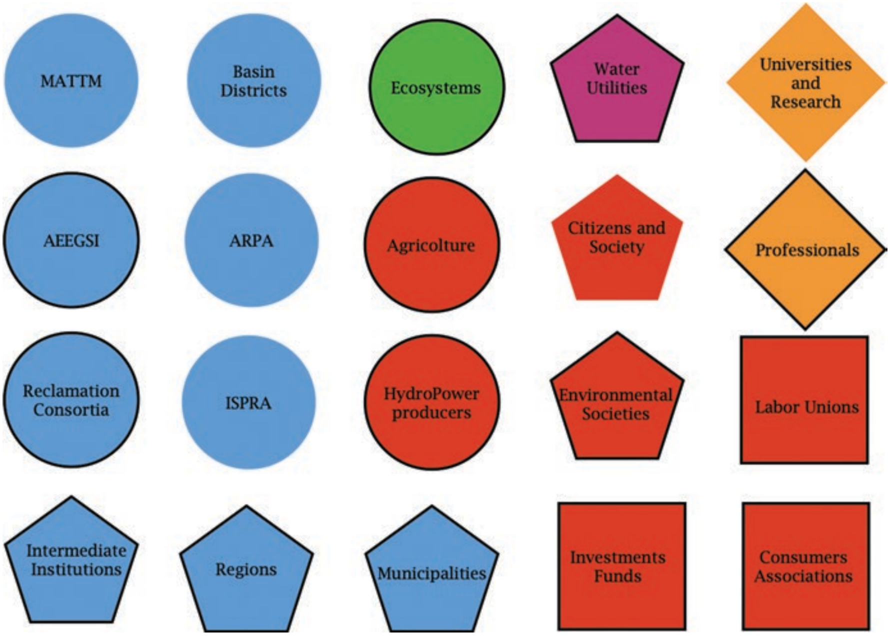

Fig. 16.5 Stakeholders of the WFD and FD: managers of the resource (in circles), managers of water services (in squares), managers of both (in pentagons) and providers of technical advice (in diamonds). Colours are blue for public institutions, red for interest groups or lobbies and bordered icons are those not included explicitly in Fig. 16.3. The meaning of acronyms can be found in the previous and following paragraphs, except for AEEGSI, which is the Electricity, Gas and Water System Authority (Autorità per l'Energia Elettrica, il Gas e il Sistema Idrico)

various actors. For example, the main water stakeholders are listed in Fig. 16.5, in which they have been subdivided into managers of the resource (in circles), managers of water services (in squares), managers of both (in pentagons), and providers of technical advice (in diamonds). Colours are blue for public institutions, red for interest groups or lobbies. The actors represented with bordered icons are those not included explicitly in Fig. 16.3: they fall mainly into the "Local Institutions" and "Water Stakeholders" collective containers. Only for technical advisors (orange) and water utilities (violet) colours coincide with the responsibility. A special mention must be made of professionals. They are hydrologist, geologists, engineers, agronomists and others who, as consultants, carry out part of the preparatory work for the plans, according to the rules adopted by each Region and the decisions taken by the RBDs. Their role and the quality of their work are fundamental for the quality of the result, but often they are not even considered in any overview of the directives' implementation process. They are often involved again as consultants in the carrying out of measures. As technique-informed citizens, they participate in discussion forums and roundtables created through the implementation of the directives. For all these reasons, they cannot be forgotten.

Finally, in Fig. 16.5, we have dared to show the public interest embodied by ecosystems (green circle). They are, in principle, one of the main subjects of the WFD, though they are not thought of as stakeholders, and their interests must be defended as if they were a group of individuals. Actually, doing so would provide better placement of the ecosystem services they provide.

16.3 An Overview of What Has Been Done (How)

The above-described organisation provided for the 2016 elaboration of the second RBMPs and the first FRMPs. As mentioned, the governance framework was only completed in 2015 with Law no. 221/2015. Therefore, the application of the directives up to 2016 was, in most cases, a collection of what was ready before, with no clear coordination. The actual paper products of those implementation efforts are indexed at the MATTM site.[14] The available links lead to thousands of pages written from different perspectives and without a standard layout. In accordance with Article 18 of the WFD and Article 16 of the FD, the European Commission has drafted a report (European Commission 2019a) about the implementation of these directives that provides an assessment of the related plans (the second RBMPs and the first FRMPs) of all EU Member States. As an annex to the report, the Commission has provided a country-specific assessment of each plan (for Italy the relevant documents are European Commission (2019b) and European Commission (2019c), which provide a synthesis of the implementation of the directives in the country).

16.3.1 The Implementation of the WFD in Italy: The Second RBMPs

For the second cycle of the WFD, the (then) eight RBDs published their RBMPs between 17 December 2015 and 29 June 2016. According to the European Commission (2019b), the first notable aspect of the WFD implementation in Italy is that between the first and the second implementation cycles there was an increase in the number of water bodies. The factors that led to this change vary within each RBD, since the analyses were carried out at the regional level (e.g., monitoring, division or unification of water bodies, more hydrogeological knowledge, etc.). The definition of significant pressures was also characterised by different approaches, with the tools used to assess point- and diffuse-source pressures varying between RBDs. In general, Italy's RBMPs identified organic, chemical and nutrient pollution as having the most significant impacts on surface water bodies and groundwater.

[14] RBMPs are available at www.minambiente.it/direttive/aggiornamento-dei-piani-di-gestione-dei-bacini-idrografici; FRMPs are available at www.pcn.minambiente.it/mattm/pgra/

The ecological status of surface water bodies was classified for most of them. Also, methods to quantify the biological quality, based on the definition of the reference conditions and class boundaries, were defined and intercalibrated for all relevant biological quality elements, as specified in point 1.1 of Annex V of the WFD. At the same time, monitoring of ecological status improved with respect to the first cycle, thanks to Ministerial Decrees nos. 56/2009[15] and 260/2010,[16] which imposed monitoring methods compliant with WFD requirements. This also increased confidence in the ecological status (or ecological potential) classifications that were found. This notwithstanding, some gaps remain, mainly in hydromorphological and biological quality elements (for lakes, transitional waters such as estuaries and lagoons, and coastal waters) and in hydrological regime monitoring. For instance, the morphological conditions of coastal waters are monitored only in the Eastern Alps and Po RBDs.

With regard to the chemical status of surface water bodies, there were improvements in all of Italy's RBMPs with respect to the first cycle. Indeed, the number of surface bodies with unknown status decreased and the good chemical status was attributed to a larger proportion of water bodies. In addition, the number of monitoring sites increased, as well as the number of surface bodies monitored. However, also as regards the chemical status, some gaps in monitoring remain. For example, long-term-trend assessment arrangements are only in place in four RBDs (Eastern Alps, Northern Apennines, Po and Serchio), and the monitoring of most priority substances discharged, as defined in Directive no. 2008/105/EC,[17] is explicitly conducted in only five RBMPs.

Regarding groundwater, in the second cycle, the good quantitative and chemical status was attributed to a larger number of groundwater bodies but the number of bodies with unknown quantitative status increased slightly overall (i.e., it decreased in the Eastern Alps, Po and Sardinia RBDs, but increased in the Northern Apennines, Central Apennines and Southern Apennines RBDs). In all of Italy's RBMPs, the quantitative status was assessed with "a water balance method" but this was applied differently in the various RBDs. On a positive note, to achieve national coordination in line with the European Commission's recommendations, in 2017 ISPRA published a national set of guidelines (SNPA 2017). As for the chemical status of groundwater, not all substances causing risk have a threshold in all RBDs and both

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[15] Decreto ministeriale n. 56/2009 ("*Regolamento recante «Criteri tecnici per il monitoraggio dei corpi idrici e l'identificazione delle condizioni di riferimento per la modifica delle norme tecniche del decreto legislativo 3 aprile 2006, n. 152, recante Norme in materia ambientale, predisposto ai sensi dell'articolo 75, comma 3, del decreto legislativo medesimo»*").

[16] Decreto ministeriale n. 260/2010 ("*Regolamento recante i criteri tecnici per la classificazione dello stato dei corpi idrici superficiali, per la modifica delle norme tecniche del decreto legislativo 3 aprile 2006, n. 152, recante norme in materia ambientale, predisposto ai sensi dell'articolo 75, comma 3, del medesimo decreto legislativo*").

[17] Directive no. 2008/105/EC of the European Parliament and of the Council of 16 December 2008 on environmental quality standards in the field of water policy, amending and subsequently repealing Council Directives 82/176/EEC, 83/513/EEC, 84/156/EEC, 84/491/EEC, 86/280/EEC and amending Directive 2000/60/EC of the European Parliament and of the Council.

the threshold and the extent of exceedance of a groundwater quality standard are computed using different methods in different RDBs (Sicily's RBMP reported no method at all). In terms of monitoring, half of all groundwater bodies are not monitored for quantitative status and only have surveillance monitoring for chemical status.

As to the designation of "heavily modified and artificial water bodies", there was progress with respect to the first cycle, thanks to the introduction of a common national methodology by means of Ministerial Decree no. 156/2013.[18] However, in some RBMPs the designation is still in its preliminary phase or ongoing. In addition, since the national methodology for the definition of "good ecological potential" was introduced later with Directorial Decree no. 341/STA[19] of 2016, no RBMPs have reported this information.

In accordance with Article 4 of the WFD, all of Italy's RBMPs reported the environmental objectives for surface water bodies, in terms of ecological and chemical status, and for groundwater, in terms of chemical and quantitative status; they also reported the exemptions to the achievement of the objectives. The number of exemptions, as defined under Article 4, Paragraphs 4 and 5, increased with respect to the first cycle and the justifications provided changed for the different RBDs. For example, technical feasibility (all RBDs), natural conditions (Eastern Alps, Po, Central Apennines and Sardinia RBDs) and disproportionate costs (Po, Northern Apennines, Serchio and Central Apennines RBDs) were the reasons given for exemptions under Article 4, Paragraph 4.

To achieve the environmental objectives, all the RBMPs considered Key Types of Measures (KTMs) for all significant pressure category, for both surface water and groundwater. To 21 pre-defined KTMs (out of the 25 KTMs recommended in the WFD Reporting Guidance 2016[20]) Italy added another 16 nationally-derived KTMs, for an overall mapping of 2351 national basic measures. In addition, 824 national supplementary measures, related to 23 pre-defined KTMs and 10 nationally-derived KTMs, were also mapped. These measures covered all the types of measures required by Article 11, Paragraph 3, and are listed in European Commission (2019b).

The programme of measures for all RBDs includes those measures required to accomplish both WFD and FD objectives. For instance, the Eastern Alps RBD applied the "Natural water retention measures" KTM to flood protection, and the Po RBD considered the interaction between green infrastructure and the FD. In addition, all the RBMPs except for the one of Sicily reported that structural measures (e.g., flood defences) were designed or adapted to be consistent with WFD objectives.

[18] Decreto ministeriale n. 156/2013 ("*Regolamento recante i criteri tecnici per l'identificazione dei corpi idrici artificiali e fortemente modificati per le acque fluviali e lacustri, per la modifica delle norme tecniche del decreto legislativo 3 aprile 2006, n. 152, recante Norme in materia ambientale, predisposto ai sensi dell'articolo 75, comma 3, del medesimo decreto legislativo*").

[19] Decreto direttoriale n. 341/STA of 30 May 2016 ("*Classificazione del potenziale ecologico per i corpi idricifortemente modificati e artificiali fluviali e lacustri*").

[20] The Reporting Guidance is available at http://cdr.eionet.europa.eu/help/WFD/WFD_521_2016/Guidance/WFD_ReportingGuidance.pdf

In the second cycle, six RBDs (all but Southern Apennines and Sicily) carried out cost-effectiveness analyses and most of these identified funding to guarantee coverage for the second programmes of measures implementation. This approach resulted in the identification of differences in water services[21] among RBDs: for example, the Serchio RBD reported three water services, while the Eastern Alps and the Northern Apennines reported five. Among other things, Ministerial Decree no. 39/2015[22] introduced a methodology for the estimation of environmental and resource costs, defined “as the costs of measures required to fill the gaps to achieving the good water status objective”. However, in the majority of RBMPs, this methodology was mentioned but not applied.

Finally, all the RBDs considered climate change, in some cases with specific sub-plans. The Po, Northern Apennines, Sardinia and Sicily RBDs used the Common Implementation Strategy Guidance Document No. 24 (European Commission 2009) as guidance on climate change adaptation. In addition, drought management plans were reported by all RBDs, except for the Sicily and Southern Apennines RBDs.

16.3.2 The Implementation of the FD in Italy: The First FRMPs[23]

As mentioned above, according to the European Commission (2019c), 47 Units of Management (UoMs) were appointed as part of the implementation of the FD in Italy. The FRMPs were prepared at different levels: some at UoM level, some at sub-UoM level, some at RBD level (which contains multiple UoMs), and in some RBDs there are FRMPs at both RBD and lower levels. In particular:

- the Eastern Alps FRMP was drafted at RBD level;
- the Central Apennines FRMP covered the whole RBD with multiple UoMs, each of which had its own FRMP;
- the FRMPs of the Northern Apennines RBD were drafted at UoM level;
- the Southern Apennines RBD prepared an overall FRMP at RBD level and Regional level plans;
- where the UoM corresponds to the entire RBD (i.e., Sicily, Sardinia, Po and Serchio), only one FRMP was drafted.

[21] As described by Art. 2, Para. 38, of the WFD, “Water services means all services which provide, for households, public institutions or any economic activity: (i) abstraction, impoundment, storage, treatment and distribution of surface water or groundwater, (ii) waste-water collection and treatment facilities which subsequently discharge into surface water”.

[22] Decreto ministeriale n. 39/2015 (“*Regolamento recante i criteri per la definizione dei costi ambientali e della risorsa per i vari settori d’impiego dell’acqua*”).

[23] For the Italian approach to flood control, see also, in this volume, Chap. 2 by Rosso.

All of Italy's FRMPs, except for Sicily's, were adopted in December 2015 and approved by RBD Authorities in March 2016 and by the National Council of Ministers in February 2017. Sicily's FRMP was characterised by delayed administrative steps and overrunning of the deadline for its arrangement. The plan was adopted by the RBD Committee in February 2016, approved with Decision of the Regional Parliament no. 274/2018 in July 2018,[24] and then also by the National Council of Ministers in September 2019.

As permitted by Article 13 of the Flood Directive, none of the UoMs undertook a preliminary flood risk assessment (PFRA) or identified areas of potential significant flood risk (APSFRs). Indeed, pursuant to Article 67 of Legislative Decree no. 152/2006, the Basin Authorities had prepared a hydrogeological status plan (*Piano per l'assetto idrogeologico* – PAI), which contains the flood hazard and risk maps and the implementation rules to safeguard the territory from hydrogeological risk, on the same terms as the FD. All the FRMPs used PAIs as a starting point for the flood hazard and risk maps (FHRMs), which were updated with further data and studies. There are some differences in the drafting of FHRMs among different UoMs. In terms of hazard, the main differences concerned:

- the methodologies used to map flood hazards (e.g., some FHRMs were computed by hydraulic simulations, while others are based on historical data);
- the hazard elements shown on the maps (e.g., some FHRMs did not report the flow depth and the flow velocity);
- the flood sources considered. Primarily, the FRMPs considered river flooding. Some UoMs also considered pluvial flooding (e.g., Sardinia) and/or the coastal flooding (e.g., Tuscany). Other flooding sources, such as groundwater, artificial water-bearing infrastructure, and sewerage systems, were generally not considered. An exception is the FRMP of the interregional Tronto basin, where dam breach of Lake Campotosto was considered as a potential hazard.

Almost all the UoMs divided the floor risk management objectives into four risk categories: reduction of risk (or of adverse consequences) to human health, cultural heritage, environment and economic activities. To achieve such risk management objectives, the measures were divided into four types: prevention, protection, preparedness, and recovery and review. As part of the implementation, the UoMs proposed a total of 10,067 aggregated measures but, since some measures were assigned to more than one measure type, the total number of individual measures was 8348. The degree of detail with which the measures were described varied greatly between FRMPs. The cost of the measures (non-mandatory information) was reported by some UoMs (e.g., the Apulia Region and the interregional Ofanto basin, the Sicily Region, and the Serchio basin) and the related funding was reported as deriving mainly from the use of public budget at national, Regional and local level. The

[24] Deliberazione della Giunta regionale siciliana n. 274/2018 ("*Piano di gestione del rischio di alluvioni – Attuazione della Direttiva 2007/60/CE relativa alla valutazione e alla gestione dei rischi di alluvioni – Aggiornamento*").

RBD/UoM, sub-basin or APSFR are the principal level locations[25] where the measures are to be reached. However, some FRMPSs (e.g., the Apulia Region and the interregional Ofanto basin) grouped the measures in terms of sub-basin without explicitly identifying their specific location. In addition, 10 UoMs belonging to the Eastern Alps district provided a schedule of measures, while 37 UoMs did not report any information on this aspect.

The prioritisation of measures was also done with different approaches by different RBDs. For example, the Central Apennines RBD followed the multicriteria approach proposed by ISPRA (ISPRA 2015). According to this approach, measures are divided into four categories of objectives (reduction of risk to human health, cultural heritage, environment, and economic activities) and then into another twelve specific sub-objectives. Other RBDs chose different classes for categorisation purposes.

In terms of consistency and coordination between the WFD and the FD, the FRMPs differ on the level of information provided and not all of them make express reference to the objectives reported in Article 4 of the WFD. In general, the coordination between the two directives relates to the shared data (e.g., hydrographic network) and some FRMPs provided measures aimed at achieving objectives for both the FRMP and the RBMP. For example, the FRMP of the Po RBD established 159 so-called win-win measures that contributed to compliance with both the WFD and the FD. On the other hand, no explicit mention of the WFD objectives was made in the FRMP for the Sangro interregional basin and the Abruzzo Region.

To account for Italy's Climate Change Adaptation Strategy (*Strategia nazionale di adattamento ai cambiamenti climatici* – SNAC) (MATTM 2015), which was approved in June 2015 by means of Directorial Decree no. 86/2015[26] (the related climate change adaptation plan has not yet been approved), all UoMs stated that climate change impact will be analysed during the second implementation cycle of the FD. However, some phenomena that are probably closely related to climate change were already considered in some FRMPs. For example, some UoMs of the Northern Apennines RBD developed a method to analyse, map and prevent flash floods. In addition, Sardinia's FRMP included an assessment of the SNAC in order to evaluate the consistency of the objectives.

16.4 Critical Analysis and Discussion

Since the publication of the management plans for the implementation of the directives, various comments and suggestions have been made but they have not found a systematic collector. However, as mentioned earlier, in February 2019 the

[25] Other possible levels are: international, national, water body, municipal or local.

[26] Decreto direttoriale n. 86/2015 ("*Approvazione del documento 'Strategia Nazionale di Adattamento ai Cambiamenti Climatici'*").

European Commission issued a report about the directives that included an assessment of the related implementation plans of all EU Member States (European Commission 2019a).

In Italy, what finally made the governance chain described above functional was Law no. 221/2015. Even though RBDs were formally instituted by Legislative Decree no. 152/2006, the absence of a piece of legislation such as Law no. 221/2015 probably lies at the basis of the most evident weaknesses of the Italian application of the directives, that is to say, the lack of harmonisation between regional approaches and the lack of definition of relevant pressures in the RBMPs (European Commission 2019a).

The second implementation cycle of the WFD and the first cycle of the FD fell to RBDs without clear and well-defined responsibilities. Therefore, part of the work was performed according to the older Italian water governance, which contemplated a larger number of districts with the respective governing bodies, called Basin Authorities (*Autorità di bacino*).[27] This approach especially affected the implementation of the FD, which was divided among the UoMs mentioned in Sects. 16.2 and 16.3. For the RBMPs, a very different line of governance was evident, with the Regions having a great influence on the determination and acquisition of quality indicators.

The starting point for the FRMPs were the maps prepared for the PAI, which were planned around the UoM and accomplished by using mostly historical data and obsolete methods. The process of merging the old with the new had no clear direction and, more importantly, it could not rely on a clear allocation of funds for the work to be done. This was caused, in part, by the RBDs not having financial autonomy, as they originally depended on the MATTM.[28] More detailed information on funding sources for measures will need to be provided for in advance in the second and third implementation cycles of the FD and WFD respectively, as required by the European Commission (2019a).

Under these conditions of uncertainty, all subjects involved were pressed to rush to a conclusion without the necessary overall coordination. On the side of harmonisation, it is easy to see that management plans, though built on essentially the same scientific premises and often with similar tools, can differ widely. For instance, regarding water services and uses, although defined by Ministerial Decree no.

[27] On the history of Basin Authorities (*Autorità di bacino*) and Basin District Authorities (*Autorità di bacino distrettuale*) see, in this volume, Chap. 15 by Alberton.

[28] Indeed, till the enactment of Ministerial Decree no. 294/2016, the RBDs have practically been subsidiary bodies of the MATTM or bodies with mixed State-Regions participation, under a special accounting regime. Thanks to the decree, the RBDs have now the nature of non-economic public bodies with legal personality under public law, and they enjoy autonomy in technical-scientific, organisational, asset-management and accounting matters. Pursuant to Articles 5 and 6 of the decree, the MATTM has taken on a role of direction and coordination (*ex ante*) and control and supervision (*ex post*). The attribution of legal personality to the RBDs should primarily entail organisational autonomy, also in relation to spending their budget, which is financed via the transfer of funds by the MATTM. Currently, the RBDs are transitioning from the old legal framework to the new one, which is still in its implementation stage.

39/2015 on a national level, each RBMP identified the relevant ones based on pressures and impact assessments. RBMPs and FRMPs also differed in their organisation of subjects, methods and contents. Even within the same district, when larger than one UoM, one can recognise different imprints and this is due to the trivial fact that the final drafts followed a different template, with different chapters and different sections.

Currently, there is no Italian website that brings all the contributions of the districts together in a reasoned manner. There is one site managed by the MATTM[13] but, so far, it is just a collector of web links. In order to address the criticisms about harmonisation, in the next cycle of implementation, the coordination of work should be based on a common protocol that starts with data collection, storage and availability, continues with tools and models used, and concludes with indications for report dissemination.

However, some criticisms can be levelled directly at the EU. Not much thought was given in advance to streamlining some of the thousands of requirements included in the directives, and the geographic scales of the application were left too generic. Member States had to find their own way and objectives, seldom in coordination with anybody.

One of the weaknesses of the Italian system is that sometimes indicators are produced in chains of decisions that are not sufficiently clear, where technicians underestimate the conflicts they can cause among stakeholders and, not being responsible for the costs they can generate for society, in practice they are asked to take political choices with far-reaching implications which are, in some cases, not made explicit enough to the communities involved. This is a shortcoming of the overall architecture of the governance system which, if not resolved, will cause the planned measures to fail or be opposed during or even after their deployment. In recent years, this problem has become a growing topic of interest in the scientific community and may be common to other States too. Subjects like socio-hydrology and socio-hydraulics found a new impulse to promote ways to eliminate these problems of governance. Among the experiences, the European project LIFE FRANCA (Flood Risk ANticipation and Communication in the Alps)[29] identified some interesting new ways to share information, and many other projects are ongoing, such as, for example, the European Research Council project HydroSocialExtremes.[30]

In its reports and assessments (European Commission 2019a, b, c), the Commission seems to be focused on costs in a strictly budgetary sense (e.g., in European Commission (2019a), “assure the correct application of Article 9 of the directive on costs recovery, including environmental and resources costs”),[31] but the costs can be interpreted as social and economic in a broader sense. Because the choice of quality indicators and their values can be discriminating among uses of

[29] For further information, see the website of the project: www.lifefranca.eu

[30] For further information, see the website of the project: www.hydrosocialextremes.org

[31] On the issue of the full recovery of all costs see, in this volume, Chap. 17 by Massarutto.

the resource, a proper discussion among technicians, population and stakeholders, should be part of the agenda for the implementation of the directives.

The other big issue is data quality and availability. Data are provided by ARPAs and APPAs by means of monitoring networks that are sometimes well-equipped but, more frequently, lack resources for carrying out their tasks, especially regarding the quality of waters and discharges of streams. For hydrometeorological stations, quality seems assured but other data are retrieved in a variety of situations that make them of uncertain reliability. While the meteorological stations network is decent, if not optimal, the gauging stations are still scarce. Rating curves to estimate discharges from stage measurements at a specific gauging station are often obsolete and not released to users, while no reliable results can be obtained without them.

The European Commission (2019a) addressed to Italy at least two main suggestions:

- to provide the relevant information about discharges and measurements and, more specifically, clarify how the monitoring objectives can be achieved (i.e., in the management plans, the priority given to measurements must be systematically indicated);
- to tackle the urban wastewater issues and implement enough measures to achieve what the WFD asks (as well as the Urban Waste Water Directive[32]) in all basins.

There is no doubt that these observations must be answered in 2021. Many ARPAs release data according to an open source protocol, but others do not disclose them at all, despite a recent and clear law about open data (Legislative Decree no. 102/2015),[33] which seems to be mostly ignored or passively resisted. Lack of data slows any process down from the very beginning and makes the results required by the directives unreliable. Also, that is an obstacle to the growth of those businesses that base their activities on the use of environmental data and hinders fair competition among enterprises. Obviously, the topic of data availability is particularly important when dealing with water use and the business of water utilities.

There are also other technical deficiencies, such as the ones concerning the INSPIRE protocols, introduced with Directive no. 2007/2/EC[34] and related to metadata, interoperability of spatial data sets and services, network services and data sharing. They are rarely adopted and data deployment remains fragmented into as many directions as there are data providers.

In its short life, *Italia Sicura* tried to overcome these limitations and offer some nation-wide data. The effort was welcome, but it was not the coordination action required, which should have involved the MATTM, ISPRA and ARPAs together to generate unique protocols and delivery options. A typical example is the intake of water for hydropower plants (but it could just as likely be for agriculture or other

[32] Council Directive no. 91/271/EEC of 21 May 1991 concerning urban waste-water treatment.

[33] Decreto legislativo n. 102/2015 ("*Attuazione della direttiva 2013/37/UE che modifica la direttiva 2003/98/CE, relativa al riutilizzo dell'informazione del settore pubblico*").

[34] Directive no. 2007/2/EC of the European Parliament and of the Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE).

uses). Companies consider these data "sensitive information", whose ownership provides an advantage to business activities, and they think such data should not be shared with anyone. The limits of this argument become evident when we consider that waters are public and, therefore, any limitation to the public access to their status is justifiable only if a collective advantage can be achieved.[35] The European Commission (2019a) wrote that it is necessary to measure all water intakes because this is the condition necessary to take decisions in critical situations like draughts and others. There cannot be a full application of the directives if there is no appropriate policy making the necessary data open and easily accessible, taking for granted that they are of good quality, of course.

Finally, the European Commission (2019a) recalled a few actions to be taken with respect to future FRMPs, which we synthesise here without further comment:

- develop a clear connection between objectives and measures;
- provide a better explanation of how monitoring has to be done (or has been done);
- extend cost-benefit analyses to the selection and classification of action priorities whenever possible;
- coordinate the FD actions with the National Climate Change Adaptation Strategy.

A discussion on the methods used to assess the state of the water environment cannot be hosted in an analysis of the application of the directives such as this one – it would grow too technical, long and ineffective – but at some point, it will be important to discuss the issue. At this level, it is probably more important to dissect at least a little the process that brings to the use of science in the directives.

16.5 The Science Behind the Scenes

In the WFD and FD, knowledge of how water moves in the environment, interacting with sediments and the landscape, is the basis of any action and farsighted policy and, therefore, any planning. In stating this, we do not want to affirm the primacy of science over politics, but certainly we state that science, for its systematic nature and reproducibility, can help politics much more than by providing occasional observations or opinions. Indeed, if the final practical outcomes of a practitioner's work are indicators or maps of indicators, which in turn affect measures impacting the life and well-being of people and society, then there is the necessity of a solid foundation: a science that has to be developed and maintained.

Sciences like hydrology, hydraulics, geology and ecology do not contribute to water governance merely by providing tools for a purpose. They first of all provide the context of the discussions and build the proper perception, the consciousness, of the role played by nature in creating our well-being, now and in the long term. In the

[35] On the public nature of Italy's water resources, and the collective interests deriving therefrom, see, in this volume, Chap. 5 by Boscolo.

second place, they provide the elaboration of the idea itself of nature, which actually promoted the directives being discussed here.

There are aspects of the general discussion that regard the dichotomy between nature and safety. The WFD, once stripped down to norms and maps, proposes a vision of nature that is implicitly assumed as good. The FD, on the other hand, privileges safety, which is also good but often to the detriment of nature. Historically, the two cultures of nature and safety tended to clash (as nature can be unsafe). For the future, we need a new synthesis, which reclaims a deeper interplay between science, society and politics, because the seemingly academic discussion has, in fact, several implications on decision making. It is also apparent that if citizens are not able to grasp this level of discussion, they miss some key elements of knowledge in their own lives.

Obviously, there is also the practical layer, on which we focus our attention more often, that comprises the tools required for the implementation of the directives. This was the rationale behind the Decree of the President of the Council of Ministers of 14 September 2012, which established an organised channel for the interaction of administrative bodies with the research producing the tools. The flow of information from research and practitioners continues but, unfortunately, it is largely disorganised and underfinanced. So far, it has worked thanks to personal or territorial relationships, with all of the fragmentation that this implies. The academia actually felt that this approach was limitative and, as a consequence, various initiatives for discussion and coordination started, such as, for instance, the GRAL (*GRuppo ALluvioni* – Flood Group)[36] or the group of universities now gathering around the AIPo to fill the existing gaps in knowledge transmission.

If the lessons learned with the implementation cycles of the directives are not used to rethink the tools and the science behind them, it will be a missed opportunity that will not be recovered by other efforts, since scientific projects financed by the EU have mostly other objectives. And there are many aspects to rethink, such as, functionally, the environment that we address locally and globally, i.e., at multiple scales. For the most part, indicators were designed for large-scale problems (such as coasts or large river conservation and flooding). They are not necessarily indicative of the quality of small or mountain catchments as they are focused on water and not on the accompanying sediment, for example, and therefore are inadequate for their purpose of showing the truth about the water status.

To be even more specific, the hydraulic and hydrological tools used to produce management plans are at best ten years behind the current state of the art. We do not have space here for a detailed review of the tools currently used by institutions, but they have some common characteristics. Hydraulic analysis is mostly done with a few commercial tools developed by Dutch or UK companies based on twenty-five years old science. They do not deal properly with sediments and with the interaction between groundwater and surface water. Hydrology tools are, on average, more

[36] The GRAL is a group of experts in flood risk management that promotes projects related to the hydraulic protection of the territory in Italy. For further information, see the website of the group: www.gruppoalluvioni.it

recent but mostly oriented to flood forecasting. Those intended to support water management are poorer, with attention to snow production and its effects being highly parameterised (meaning simplified), evapotranspiration poorly represented, information from remote-sensing resources seldom included, and soil moisture simply neglected.

This is a worldwide situation, but it is easy to see that much can be done to improve it. Regional institutions put great effort into building closed systems that are mostly incompatible and cannot be compared easily in their performances, limiting the ability to learn from each other. The same situation presents itself when we look at expert private professionals who are often those who deploy the preliminary work for the management or hazard plans. They use mostly incompatible tools and concepts, which makes it difficult to know if they did it right. Because the chain of tools used is not replicable by third parties, if a judgement is needed, it can be made only on the overall process and the declared features. Obviously, this is not satisfactory. With both open-source and commercial software, simulation replicability and third-party reviews should be made mandatory in future protocols. Basic platforms, models containers, and WebGIS presentations of the results should present open specifications to allow interoperability between different solutions.

16.6 Conclusions and Hopes

In light of the above analysis and discussion, it should be evident that efforts in implementing the directives were huge but certainly in need of a “refactoring”. This should concern coordination between territorial institutions to provide common indicators, common procedures, and common guidelines for the drafting of documents with the same layout and format.

Coordination should start with common protocols for data provision according to open-access schemes. The MATTM and ISPRA, in line with their mission, should take the lead in recognising discrepancies between plans and persuading the RBDs to effect homogeneous analyses. Furthermore, as has been previously said, the problem of data, despite being in the background, is of fundamental importance for science as well.

Importantly, RBMPs should consider droughts more explicitly as, under the pressure of climate change, they will become the most relevant issue in many parts of Italy, especially in the South where drier climate is already hitting.

From a technical standpoint, a set of problems requiring debate regards the adequate choice of quality indicators and sound methods for mapping hazards and pressures. Once agreed, these should be adopted as a basis for all Regions and RBDs. However, to obtain this, someone has to start the cumbersome but necessary comparative analysis of what was done in past implementation cycles, delving into the macro-weaknesses we are only highlighting here, and going into the details of the process – after all, the rationale of the outcomes depends on them.

There is already a continuous transfer of expertise and knowledge from where science is produced to where it is used, due to the turnover of officials and new positions in public institutions. However, a systematic coordination of knowledge transfer would produce far better results than the good will of individuals. This coordination does not need to be headed by researchers. Indeed, it could prove more effective if it came through a direct action of the MATTM and ISPRA towards the research community, as represented by its many groups of interest and disciplinary associations. Obviously, such a coordination effort would require its own funding and organisation.

Organs like the Alpine Convention[37] – an international treaty that aims to protect and develop in a sustainable way the Alps, considered in their geographical entirety – had pioneering importance in offering a place for comparison of approaches to the WFD and the FD in the context of the Alpine regions. A wider context of comparison could be offered at the level of the entire EU, maybe within societies like the European Geoscience Union (EGU),[38] which is certainly interested in the process and gathers thousands of researchers. It is of paramount importance that good practices in the realisation of the directives at the European level be brought to the attention of everyone before the new implementation cycle begins.

After five years since the start of the current cycles in 2015, some statistics should be available to check the state of implementation of the planned measures: how they were funded in the end and if they were effective after all. It would also be the right time to collect bottom-up experiences to improve the implementation process of the directives and make them even more useful to the communities.

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[37] For further information, see the website of the Convention: www.alpconv.org

[38] For more information, see the website of the association: www.egu.eu

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Chapter 17
Economic Regulation, Water Pricing, and Environmental and Resource Costs: The Difficult Marriage Between Financial Sustainability, Investment Requirements and Economic Efficiency

Antonio Massarutto

Abstract This chapter provides an overview of the financing patterns of the Italian water sector, which is segmented and characterised by a wide plurality of management systems and operators. In the last 25 years, Italy has introduced far-reaching reforms, which concerned in particular urban water supply and sanitation. The most important goal was to create the basis for an autonomous and self-sufficient water industry, driving the sector out of the public budget. Financial equilibrium of water undertakings and access to market-based finance have thence dominated over other possible aims of water pricing. Other sectors, and notably irrigation, continue to follow more traditional schemes. The chapter also discusses further reform opportunities with a view to turning water prices into economic incentives for a more sustainable use of water resources.

Keywords Water pricing · Economic regulation · Finance of water investments · Affordability · Economic instruments of water policy

17.1 Introduction

Italy has undergone a vast programme of reform and modernisation of its water management system in the last 25 years, which has especially affected public water supply and sanitation (PWS), often referred to as "integrated water service". The core of this reform concerned the design to establish a financially self-sufficient water industry, previously funded for the most part by the public budget. Consequently, patterns of water pricing system have been dramatically affected.

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This reform was a part of a vaster programme of fiscal consolidation. Its main driver was the need to alleviate the burden on the public budget, in a phase of dynamic expansion of investment needs, driven by the need to refurbish ageing infrastructure and comply with environmental policy; but also the obligation arising from the European Union (EU) Water Framework Directive (WFD) to achieve full recovery of financial and environmental costs, eradicate environmentally-unfriendly subsidies and design economic incentives to achieve sustainable water use and conservation of ecosystems.

An immediate and straightforward consequence of such a "perfect storm" is that water prices had to increase significantly – this actually happened, notwithstanding the fact that still now Italian water prices remain among the lowest in the developed world, and the average expenditure for water is still below affordability thresholds. The sudden and dramatic increase has raised political concern – culminated in the 2011 referendum – and made manifest the need to introduce further issues in the policy agenda: efficiency of water management, equity (interpersonal, intersectoral, interterritorial), as well as environmental and social sustainability.

Thence tariff design, price regulation and financial structure of the industry also needed a fundamental reform. This need remained for a long time latent, until 2011, when regulatory competences have been attributed to an independent regulator, ARERA.

In turn, other sectors of water management – notably irrigation, industry, and hydropower – have substantially maintained their features over time, even though the logic of cost recovery, financial equilibrium and removal of environmentally-harmful subsidies has penetrated in depth.

It can be said that the target of full recovery of financial costs has been achieved for most water services, and notably for PWS. Other sectors of water management, such as flood protection, rainwater and river restoration are still relying almost entirely on the public budget. In turn, the first steps towards the full implementation of the WFD principles have generated conceptual work and guidelines, but still very little practical consequences in terms of water tariff design and use of economic instruments.

In a previous work, I have discussed the historical evolution of the water pricing system and the establishment of the new regulatory paradigm (Massarutto 2018). In this paper we focus on the most recent developments and achievements and discuss the most likely directions of change. Section 17.2 will provide a background of the organisation and regulation of the Italian water management system, to enlighten the structure of financial flows that characterise it. Section 17.3 is dedicated to economic instruments of water management – a still neglected solution in Italy. Since the most notable changes have affected PWS, we shall concentrate on this sector, to which Sect. 17.4 is devoted. In Sect. 17.5 we shall complete the picture with some background information on the remaining sectors.

17.2 The Italian Water Management System and Its Financial Structure

17.2.1 Water Resource Ownership and Allocation

The structure of the Italian water management system is rather complex, as other chapters in this volume have enlightened. Many uses approach directly the natural resource through own abstractions and self-operation of wastewater and drainage. Others, in turn, use a collective service, under separate arrangements and with dedicated institutions for each sector. In this second group we can recognise genuine "public services" – services of general economic interest, in the European jargon – as well as private or communal ones; a distinctive feature that Italy shares with other EU countries, for example, Germany and the Netherlands, concerns private bodies that enjoy public status, such as landowners' associations or industrial syndicates. For this reason, they may be entitled to receive public funds, operate under state supervision, are subject to price regulation, must follow public procurement rules etc.

A typical feature of Italian water management system concerns sectoral fragmentation. Each sector relies historically on independent premises, is administered and regulated by specific institutions and is operated by independent operators. Although it is difficult to generalise, the following points summarise the main distinctive features in the Italian water sector:

Water resources, either surface or groundwater, are owned by the state as a public domain. Every use of water needs prior authorisation and is regulated through the institute of "concessions". Under a concession, users obtain the right to abstract water, use it and give it back to the environment, following the obligations foreseen in the concession document; licenses imply the payment of a fee ("*canone demaniale*").

Until 1994, this regime characterised surface waters only, while groundwater use was free and unregulated. Law no. 36/1994 extended the public domain to groundwater also. Therefore, at least nominally, groundwater abstractions have to follow the same licensing regime; however, the great number of individual abstractions – in the reach of tenths of thousands – makes the enforcement of this principle very difficult. Historically established uses have been often transposed into the concession regime, leaving patterns of water use mostly unchanged, especially in the case of agriculture.

Most water use systems access the water resource directly, i.e. ask for a use license and manage water through own premises. This approach is normally facilitated by the widespread availability of easily accessible natural resources. In some cases, however, water resources management implies the existence of artificial systems (reservoirs, large water transfers); we shall refer to these as "multipurpose bulk water supply systems", emphasising the fact that they typically supply bulk water to many retail distribution operators, either for irrigation or for industry and PWS. Again, we can identify different typologies.

In some cases, these are truly independent establishments. Ownership may be public: this is the case of Romagna Acque, serving the coastal provinces of Emilia-Romagna, and ENAS, managing reservoirs and bulk water transfers in Sardinia. Others are private concessionaires or public-private partnerships, particularly in the South (e.g., Sicilia Acque, SoriCal and Acquedotto Campano Occidentale).

A second category of bulk-suppliers concerns entities created for the sake of administering upstream regulation and storage works and allocating available flows to entitled subjects. For example, all the big subalpine lakes are artificially regulated at their mouth, and consortia of entitled users manage the gauging works.

Finally, a few bulk water schemes operate in the agricultural sector and provide water to irrigation systems. Occasionally they may also provide services to other water users, as in the case of CER (Canale Emiliano-Romagnolo), which provides complementary supplies to urban and touristic dwellings along the Adriatic coast of Emilia-Romagna, or EIPLI and Molise Acque, managing reservoirs and transfer schemes in South-Eastern Italy.

17.2.2 Sectoral Uses of Water and Their Management Systems

On the water demand side, we find either collective entities that provide water services to their associates, or independent individual systems. Table 17.1 illustrate an attempt to break down the relative shares.

Hydropower users generally belong to the latter category, especially when large facilities with upstream storage and flow regulation are present. Power producers usually operate the whole hydropower production and delivery system, including dams, reservoirs, bypass channels and all the concerned infrastructure works. Run-of-the-river plants are also usually independent. Sometimes, however, hydropower facilities are located along man-made artificial watercourses managed by third parties. This is for example the case of canals operated by Reclamation Boards (see below). Similarly, hydropower facilities may benefit from upstream water regulation (e.g. dams operated by third parties).

Public water supply and sanitation (PWS) concerns domestic users (representing 80–85% of the total), commercial and industrial premises, public administration. Coverage reach nearly 100% of residential population, the exceptions being

Table 17.1 Sectoral water management systems in Italy (breakdown by volume)

	Collective services	Self-supply
PWS	99%	1%
Agriculture	80%	20%
Industry	10–15%	80–85%
Industrial sewerage	70–80%	20–30%
Hydropower		100%

Source: Author's estimate

small isolated rural premises and dwellings that traditionally rely on local individual or community systems. Sewage collection is converging towards the standards set by the EU Urban Wastewater Directive, with still some failure especially concerning connections in rural areas and sewage treatment installations. After the reform initiated by Law no. 36/1994, PWS "integrates" water supply, sewage collection and sewage treatment under the joint responsibility of local authorities to be organised by inter-Municipal entities, named ATOs (which stands for "optimal-size areas"). Governance rules vary among Regions. Originally, there were 91 ATOs, later reduced to 72, covering completely the national territory,[1] although some of them still exist only on paper, and not all of them have completed all steps.

Each EGA (*Ente di governo d'ambito*, the authority responsible for each ATO) delegates operation of water services to professional companies, whose ownership can be either public or private. The law prescribes a single undertaking serving each ATO; however, it also allowed the possibility of having more than one operator if this does not imply prejudice of efficiency and effectiveness. The exact number of operators is unknown, since many still operate on a provisional entrustment. In 2018–2019, ARERA counted 131 operators serving 48 million inhabitants (85% of population), while in the remaining part of the Country the service is still run directly by Municipalities. Although slowly, however, the process of concentration goes on, either through the progressive consolidation of management units or inter-company agreements.

The largest share of *irrigation supply* derives from collective institutions (Reclamation Boards). Their creation dates back to the nineteenth century or earlier. These are private associations of landowners having a public status. Participation is mandatory for all landowners that fall within the designated area. Although regulated by the law (now devoted to Regions), Reclamation Boards enjoy a substantial autonomy and operate on a basis of cost recovery, even though they are entitled to receive grants and subsidies in many different forms, especially for capital expenditure.

Individual direct abstractions at the farm level increasingly integrate and often entirely replace collective irrigation, due to a more flexible, reliable, and timely water supply. Although estimates are rather imprecise, this form concerns 10–20% of irrigation water, but a far higher share in water-stressed districts, such as coastal areas or the southern part of the Po river basin (Zucaro 2011). More in particular, direct abstractions from groundwater concern high value-added cultures, and therefore water demand is much more inelastic (Massarutto 2003).

As for Reclamation Boards, Zucaro (2011) estimates a figure around 600 entities; most of them are very small and operate in mountain areas. Overall, they serve an irrigated surface of around 2.2 M ha (they were 2.7 by the year 2000, according to Leone 2005). The largest ones are associated to the National Reclamation and Irrigation Association (ANBI), which counts 132 consortia and 9 "second level"

[1] The Autonomous Provinces of Trento and Bolzano, due to their special autonomy, have a different and specific organisation.

consortia, which provide bulk services to other consortia. ANBI members cover a surface of 15 M ha; they cover 96% of total irrigable land and 91% of total irrigated land. More than 75% if total irrigated land is located in the North of the Country.

Reclamation Boards also perform important tasks in the field of *land drainage* in rural areas and management of small watercourses. *Flood protection* and riverbed maintenance in all other cases is a direct task of Regions, which sometimes have created dedicated institutions such as the AIPO (Interregional Agency for the River Po) in the Po river basin. An innovative trend about Reclamation Boards concerns the attribution of competences in the field of water resources management, environmental protection, and rainwater management, which provides the scope for public financial contributions. For example, Tuscany has designated the 100% of the Regional territory as a "reclamation area": this means that all landowners, including urban ones, are obliged to participate to the consortium and pay the related fee; Reclamation Boards perform a number of functions ranging from rainwater management, drainage, land reclamation, river ecosystem and landscape conservation etc.

Rainwater management is officially a task of Municipalities. Since 2/3 of sewage collection networks are mixed (rainwater plus wastewater), operation is very often delegated to PWS operators; in some Regions, these are also allowed to recover the cost directly through the PWS bill. On top of this, Reclamation Boards may provide "bulk drainage" services, since their networks may receive the outflow of urban rainwater systems and/or of sewage treatment plants; PWS are usually required to pay a contribution which ends in the water tariff.

Finally, for *industrial uses* self-supply is the general rule, especially when water is an important input in the production process (e.g., pulp, food, or textile industry). In some cases, special-purpose industrial aqueducts are in place. These may have installed innovative solutions tailored for specific industrial processes, including wastewater recycling. Typically, they are strategically located in areas that are designated for industrial settlements and are owned and operated by syndicates participated by client firms and a mix of local bodies (local authorities, chambers of commerce, special-purpose financial institutions). Other industries generally rely on the main public water supply system. Approximately 15% of water supplied by public aqueducts is destined to non-household uses.

Industrial sewerage is sometimes operated directly by individual companies, especially for large premises, but more often it is managed by dedicated collective establishments, particularly when industrial discharges require specific ad-hoc treatment. These systems can later discharge into public sanitation systems or directly into watercourses, depending on local situation and convenience. Facilities created to serve industrial premises, nonetheless, can share their treatment capacity with PWS, especially when these facilities are oversized and/or local industrial development has not managed to keep the path foreseen; often the management of these facilities has merged the PWS, in order to improve their financial viability, but the opposite may also happen, that is, industrial syndicates providing a "bulk supply service" to PWS operators.

In the lack of a systematic survey at the national level, it is not possible to provide reliable figures about the number and the economic dimension of the sector.

17.2.3 Regulatory Functions

The regulatory framework involves many government layers, whose interplay often lacks a precise allocation of tasks, thence causing overlap of competences and lack of jurisdiction (OECD 2013). Water resource regulation is framed by the EU and national legislation and implemented at the basin level through the "river district plan", elaborated by river district authorities (RDA). These are inter-governmental bodies whose ruling boards are expressed jointly by the central Government and concerned Regions.

The district plan identifies the actions needed to guarantee the desired ecological quality targets. Following the plan, Regions provide administrative tasks, such as water use licensing and pollution control.

Economic regulation of water services depends on the concerned sector. As for all public services ("services of general economic interest" in the EU jargon), their organisation should follow general framework rules. National legislation has tried to introduce market-based orientation for PWS (such as compulsory competitive tendering), but this approach was finally rejected by a popular referendum in 2011. At present, competent authorities (in the field of water these are normally local authorities) can choose among a range of solution that include own enterprises ("in-house" delegation) and many types of public-private partnership, including full delegation.

Figure 17.1 illustrates the governance scheme that concerns PWS. Services are delegated to professional companies – either public, private, or mixed – based on a contract, which usually entails a concession scheme (i.e., operators are responsible for investments at own risk). However, contracts are not sovereign for any detail. Price regulation and other aspects (such as definition of minimum standards) are ultimately the responsibility of an independent national authority (ARERA), which is also responsible for electricity, gas and solid waste.

For other segments of water use, the State is only responsible for frame legislation and provision of additional funds. All regulatory responsibilities are devoted to Regions and coordinated through River District Authorities. This applies for example to irrigation and drainage, since the framework governance of Reclamation Boards lies under Regional jurisdiction.

The complex structure of the water management system outlined above reflects an analogously complex structure of financial flows. Figure 17.2 provides a simplified diagram of financial transactions between different levels.

Each final user sustains a cost, which includes tariffs and charges paid to access water services and the costs sustained directly (e.g., for groundwater pumping). The positive difference between these costs and the value extracted from water (e.g., electricity or agricultural products sold to the market; direct utility obtained from

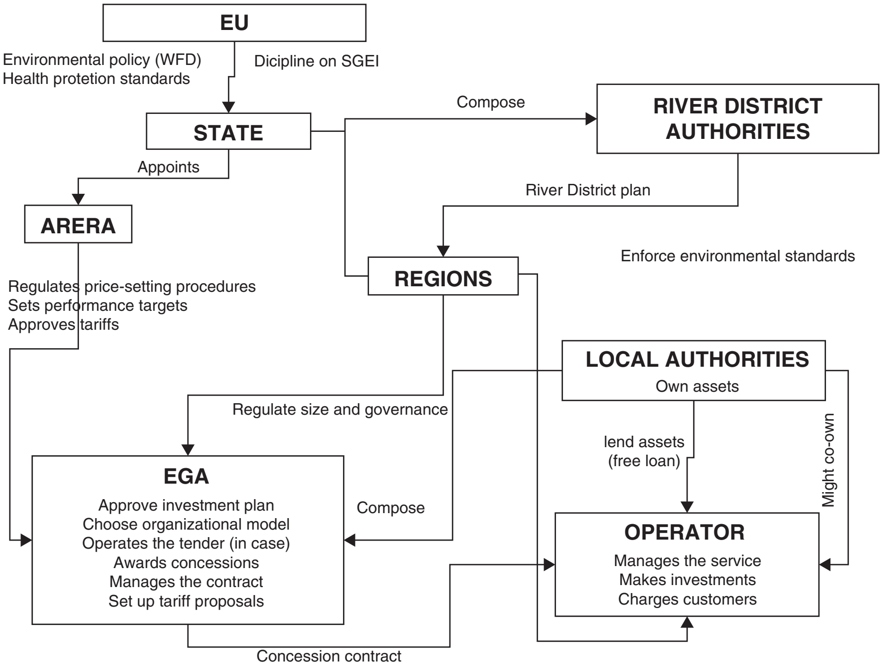

Fig. 17.1 Structure of the governance and regulatory system of PWS
Source: Author's elaboration

final consumption) represents in economic terms a rent, namely the additional price users would be willing to pay to continue using water.

Similarly, retail operators sustain some costs directly (labour, capital, goods and services acquired on the market) and pay for water services they receive from bulk suppliers or other retail operators. The same happens to bulk operators. Both retail and bulk operators must recover their costs out of the revenues received from their clients, eventually complemented by state transfers.

The subject that extracts water from the natural environment (either the bulk supplier, the retailer or the final user directly) is required to pay a charge to the resource owner (the State).

Finally, the State receives financial flows from taxation, but also finances the water sector through direct and indirect subsidies.

It is difficult thence to trace a proper and comprehensive balance of financial flows that intervene in such a complex system. Resources from the public budget originate mostly from Regions, but there are still important funding programs that are released by the State. For example, the extraordinary plan released 2019 has allocated 80 M€ to projects identified as "national priorities" by ARERA.

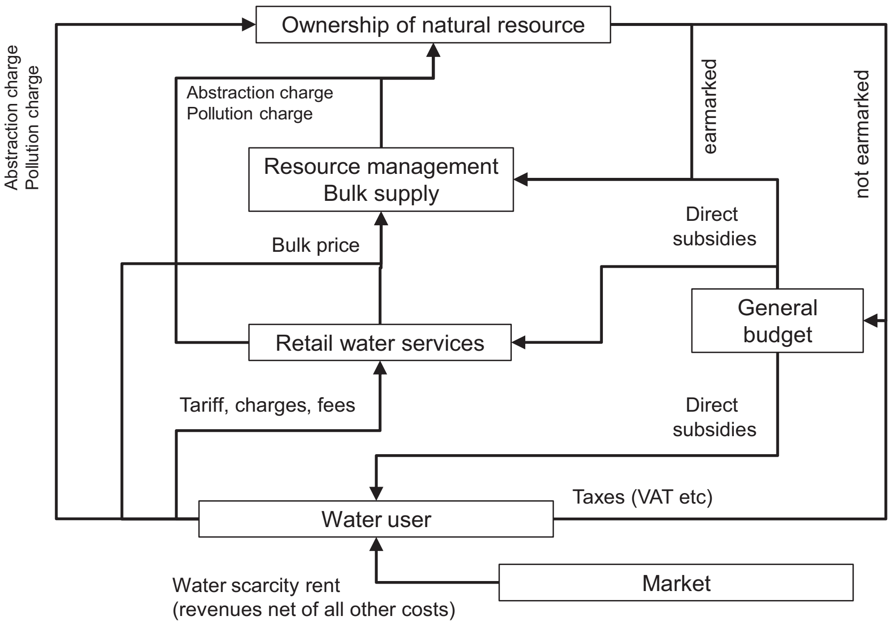

Fig. 17.2 The structure of financial flows characterising the Italian water management system
Source: Author's elaboration

Public funds still dominate the field of flood protection and riverbed maintenance. As said above, these functions are often performed by entities that are responsible for sectoral water uses – e.g., Reclamation Boards, which are thence entitled to receiving financial contributions. In principle, they operate on a cost-recovery level for the services they supply to associates, but this principle is fully applied for operational expenses only (Table 17.2).

17.3 Economic Instruments and Water Resources Management

As said in the previous section, abstraction licenses imply the payment of an abstraction charge. Rates are differentiated by sector. Other charges having similar nature indirectly affect the water domain, such as those regarding the extraction of inert materials from riverbeds, land development in river domains, chemicals used in agriculture (Zatti 2017).

In the case of hydropower, charging principles reveal the clear intention of capturing at least a part of the economic rent. Rates are a function of nominal electricity generation capacity (a standard measure of the potential production), regardless of

Table 17.2 Water management undertakings, financial structure and patterns of price regulation

	Cost-recovery	Pricing instrument	Role of public finance	Regulation	Pricing philosophy
Resource management	No	Abstraction charge	Total	Political decision	Administrative cost recovery Rent sharing (hydropower)
Bulk supply	Legally binding Public contributions admitted	Tariff	Residual (investments only)	Independent authority	
PWS	Legally binding	Tariff	Residual (investments only)	Independent authority	Recovery of efficient cost
Urban rainwater	Not binding	Tariff/local public finance	Total (PWS tariffs admitted)	Public accounting rules Independent authority (if included in PWS	Officially funded by public budget; recovery from PWS bills admitted
Reclamation boards (irrigation)	Legally binding for opex	Membership fee Communal charges	Residual (opex) Substantial (investments)	Public accounting rules Supervised by regions	Cash balance Benefit-based
Reclamation boards (land drainage)	Legally binding for opex	Membership fee Communal charges	Residual (opex) Substantial (investment)	Public accounting rules Supervised by regions	Benefit

Source: Author's elaboration

other characteristics of the site (quantity of water used, height of the dam, environmental impact, etc.). Hydropower producers have also to pay further fees to compensate local communities, which again depend on nominal capacity. These fees are set by a national law and have reached altogether around 30–40 €/kW, depending on facilities' size.

For all other uses, the reference unit of abstraction charges is the "module", corresponding in general to a volume of 100 l/s. For irrigation, the charge is reduced when flows in excess are returned.

Table 17.3 summarises abstraction charges applied throughout the Country – keeping in mind that each Region can now set charge levels and application rules.

Many Regions have recently changed charging rules and rates or have announced the intention of doing so. This is particularly the case of the hydropower sector, taking advantage of the fact that many concessions awarded in the first half of the twentieth century have recently expired. Decree-Law no. 135/2018 assigns to

Table 17.3 Abstraction charges in Italy (mod = 100 l/s)

	Hydropower						Irrigation		
	Resource ownership	Compensation fees to LA	PWS	Hygienic	Fish farming	Industrial	No restitution	With restitution	Unmetered
	€/kW		€/mod	€/mod	€/mod	€/mod	€/mod	€/mod	€/ha
Average	13.4	30–40	1664	2824	264.2	9646	35	8	0.33
Median	14.5	30–40	2110	603		13,474	46	–	0.40
Max	35.1	30–40	4008	98,816		41,361	190	50	2.64

Source: Author's elaboration on a direct inquiry

Regions the full ownership of hydropower facilities after concessions expire; Regions will later release new concessions via tendering process or to own companies.

Translated in the correspondent amount per cubic meter, figures in Table 17.3 mean that the abstraction charge amounts to an overall negligible value, a fraction of a €c/m^3. On a national basis, our estimate of annual revenues provides a meaningful figure only for hydropower (in the range of 200–300 M€/year, which also includes local community compensations). Massarutto and Pontoni (2015) estimate that the share of the hydropower rent accruing to Regions and local communities lies in the range of 13–21%.

Industrial charges generate another 40–50 M€. Revenues from other uses are negligible: both irrigation and public water supply generate less than 1 M€, still lower figures arise from other sectors of water use.

Abstraction of mineral water for bottling and thermal establishments are widespread diffused, given the abundance of natural sources. Abstraction charges in this case follow a binomial structure (partly depending on catchment surface and partly on volumes abstracted). The average charge is around 2 €/m^3, for an overall revenue estimated in around 18 M€, which corresponds to 13% if the industry net profit (Massarutto 2018).

Overall, abstraction charges do not represent at present neither a meaningful revenue source nor a serious incentive to water conservation. They are calculated as a fee aimed for recovering administrative costs for issuing licenses or – notably in the case of hydropower – to share the scarcity rent generated by the resource. No charge at all is levied for discharges into watercourses.

Italy has never adopted a coherent set of environmental economic instruments in the water sector, neither in the form of taxes nor of other market-based instruments such as tradeable water rights. Proposals towards a comprehensive reform have arisen in many occasions, including recent reports of the OECD (2013) and the EEA (Andersen et al. 2011). The consideration of environmental and resource costs of water use, which is foreseen by Article 9 of the EU Water Framework Directive but has never been implemented until now, offers a unique opportunity in this direction.

The Ministry of the Environment has issued in 2015 a guidelines document, that provides a definition of environment and resource costs (ERC), and methods to calculate it. This document aims at providing river district Authorities a common framework for drawing up the "river basin management plan", according to the WFD.

The river basin plan also identifies actions adopted by users to reduce environmental impact and pressures on the resource. For example, in the case of PWS, costs related to potabilisation of water and protection of water catchment are accounted as resource costs, while sewage treatment costs are an example of environmental costs. These costs are accounted separately and provide evidence of the degree of internalisation of ERC. In 2019, 6% of total PWS costs were reported as ERC. The tariff method for the third regulatory period (2020–2023) has included capital costs in the ERC, whereas previously only operational costs were considered.

However, the definition of ERC has not yet been translated into a coherent proposal of environmental taxation. River basin management plans account for all water uses, calculate ERC associated to each use and possibly use this information with the aim of drawing up policies aimed at reducing them, for instance by eliminating environmentally harmful subsidies, promoting water conservation and so on. Surprisingly, the debate around this issue has been very weak, and mostly confined in the academy.

In the case of PWS, for example, Massarutto (2012) calculates that a tax in the order of 0.10 €/m^3 could generate an annual cash flow of 600 M€, corresponding approximately to ¼ of the annual investments planned at present. This tax could apply to abstractions from the natural resource and be passed-through only up to a standard level of allowed leakage, to provide an incentive to PWS operators. Moreover, its rate structure could consider effluent quality and environmental costs of discharge, in order to penalise those with the lowest pollution abatement records.

In a recent contingent valuation study REF Ricerche (2020) survey the WTP of interviewees for "reducing negative externalities arising from their own water use", which is estimated in a mean 44 €/year per inhabitant. Building on this empirical result, they estimate the potential of internalisation of ERC in the water bill to an equivalent 2.2 B€/year.

One major obstacle concerns the identification of the government layer that should benefit from such a tax. Following the international experience, a potential candidate could be the River basin authority, possibly with a mandate of spending the money collected again in the water sector to alleviate financial needs of water operators. A promising option could be the adoption of a scheme that is similar to the French *Agences de l'Eau*, that is, concerning a system of water taxes aimed at fuelling the various public spending programs that concern water, e.g. in order to co-finance investments and avoid the need to rely entirely on market-based repayable finance.

Another option is to collect the ERC directly in the water bill and destine it to interventions in the same territory – as with the "FoNI" component we shall talk about later. This would reduce the redistributive potential and the possibility of adopting a "carrot-and-stick" approach rewarding "virtuous" operators and penalising those who perform worse.

17.4 The Evolution of PWS Price Regulation: Recent Developments

17.4.1 From the MTN to the MTI

Initiated in 1994 by Law no. 36/1994, the process of driving Italian water prices to full-cost reflectivity has finally nearly reached its target. Water bills not only allow the recovery of operational costs, but also seem to provide adequate resources to finance investment plans guaranteeing long-run financial equilibrium of water companies. This does not mean that the cost is 100% recovered in the water bill, since public finance in different forms still contributes 20% of total investment costs.

A significant acceleration has come from the attribution of regulatory competences to an independent authority (ARERA), occurred in 2011. Massarutto and Ermano (2013) have discussed the critical issues that characterised price regulation in the previous period and contributed to slowing the implementation of the 1994 reform.

Since its start, the new regulation has completed two quadrennial regulatory periods, and is in the process of starting the third one. Each regulatory period has an important intermediary phase, where significant changes have been introduced.

The regulatory model has been initiated in the transitional phase (2012–2013) and gradually implemented in the following periods. It is designed as a "building block" scheme; each tariff component follows specific rules. Table 17.4 summarises the most important innovations introduced in each step.

In the first 2 years (MTT), the main target was to set up the baseline and prepare a smooth transition to the new system. For this reason, the regulator identified a large number (21) of regulatory schemes, where each operator was positioned according to a combination of indicators signalling the differences between new and old regulation.

The allowed total revenue consists of operational costs (opex), capital cost (capex) and a non-revenue component aimed at anticipating financial resources for investments, in case available free cash flows are too meagre (this is typically the case of in-house public enterprises, whose own capital is very tiny).

Opex consists of two blocks: "endogenous" (OPEXend) and "refundable" (OPEXal). The latter consist of the cost components that are assumed to be outside the control of the operator, depending on exogenous factors: electricity, bulk supply, concession fees, local taxes, and charges. This cost component is fully reimbursed, with a mechanism that acknowledge in any year a provisional allowance based on the balance value of the year (a–2); eventual gaps will be compensated in year (a + 2).

All other operational costs are included in OPEXend. MTT defines the starting level of this component as a weighted average of the effective balance sheet of the reference year, 2011 (COeff), and the amount that was recognised in the former regulation (OP). The target is a landing point equal to the lower of both, to be reached in 4 years.

The approach to capital cost regulation marks a substantial innovation with respect to the past. The RAB is now based on *existing physical assets* calculated on an *ex-post* basis, whatever their ownership and whatever the source of funding. For this purpose, existing assets are stratified according to the year of realisation and values are systematically updated with inflation so as to correspond to their net reconstruction value; on the other hand, depreciation schedules are now calculated on the basis of true expected economic life. New investments enter the RAB with a two-years' time lag (i.e., an investment realised in year t will be considered in the regulatory cost starting from year t + 2).

Table 17.4 The evolution of rules for identifying cost components from 2012 to 2023

		Meaning	MTT (2012–2013)	MTI-1 (2014–2015)	MTI-2 (2016–2017)	MTI-2 (2018–2019)	MTI-3 (2020–2023)
Regulatory schemes	n.	Number of regulatory schemes	21	4	6	6	6
	Criteria		Actual costs vs costs allowed by previous regulation Time elapsed since the last previous tariff update Investment requirements	Changed service perimeter Investment requirements	Position vs. benchmark Investment requirements Changed service perimeter	Position vs. benchmark Investment requirements Changed service perimeter	Position vs. benchmark Investment requirements Changed service perimeter
	ΔMax	Max annual increase		6.50–9% dep. on scheme	4–9% dep. on scheme	4–9% dep. on scheme	3.7–8.45% dep. on scheme
OPEXend		Endogenous costs (to which a revenue-cap model is applied)	Definition of COeff based on allowed costs in reference year 2011 OPEXend = f (COeff; OP)	OPEXend (a) = OPEXend (a–1) * (1 + RPI-X) X = 0	OPEXend (a) = OPEXend (a–1) * (1 + RPI-X) X = 0	OPEXend (a) = OPEXend (a–1) * (1 + RPI-X) X = 0	OPEXend (a) = OPEXend (a–1) * (1 + RPI-X) X calculated as a function of Δ from standard cost function

(continued)

Table 17.4 (continued)

		Meaning	MTT (2012–2013)	MTI-1 (2014–2015)	MTI-2 (2016–2017)	MTI-2 (2018–2019)	MTI-3 (2020–2023)
OPEXal	COee	Electricity cost	Actual cost	Actual kWh consumed * standard price of electricity	Actual kWh consumed * standard price of electricity	Actual kWh consumed * standard price of electricity	Actual kWh consumed * standard price of electricity + reward for kWh saving
	Cows	Bulk water service cost	Actual cost	Actual cost	Bulk water: cost (a–2) Other: actual cost	Actual cost	Actual cost
	COfanghi	Cost of sewage sludge disposal	Included in OPEXend	Included in OPEXend	Included in OPEXend	Included in OPEXend	Actual cost if actual cost 2017 > 2% higher than allowed cost
	MT-AC	Lease fees paid to municipalities and other asset owners	Actual cost	Actual cost	Actual cost	Actual cost	Actual cost
	COres	Local taxes and charges Other unavoidable costs Provisions for delinquent payment	Actual cost Provision for delinquent payment not admitted	Actual cost Standardised provision for delinquent payment	Actual cost Standardised provision for delinquent payment	Actual cost Standardised provision for delinquent payment	Actual cost Standardised provision for delinquent payment

OPEXtel	OPnew	Cost-passthrough elements Cost for new services not offered in 2011: territorial enlargement, new services, quality improvements	Not foreseen	Allowed following an inquiry	Allowed following an inquiry	Allowed following an inquiry	Allowed following an inquiry
	OPqc	Cost-passthrough elements Cost for reaching minimum quality standard (commercial quality)	Not foreseen	Not foreseen	Allowed following an inquiry	Allowed following an inquiry	Min (ex-post actual cost; previous estimate)
	OPqt	Cost-passthrough elements Cost for reaching minimum quality standard (technical quality)	Not foreseen	Not foreseen	Not foreseen	Allowed following an inquiry	Min (ex-post actual cost; previous estimate)
	OPmis	Cost-passthrough elements Cost for reaching minimum quality standard (metering)	Not foreseen	Not foreseen	Not foreseen	Not foreseen	Allowed following an inquiry
	OPsocial	Cost-passthrough elements Targeted tariff rebates for low-income	Not foreseen	Not foreseen	Input by EGA	Input by EGA	Input by EGA

(continued)

Table 17.4 (continued)

		Meaning	MTT (2012–2013)	MTI-1 (2014–2015)	MTI-2 (2016–2017)	MTI-2 (2018–2019)	MTI-3 (2020–2023)
ERC	ERCend	Environmental and resource costs (same perimeter as OPEXend)	Not foreseen	Not foreseen	Deducted from OPEXend based on actual costs in year (a–2)	Deducted from OPEXend based on actual costs in year (a–2)	Deducted from OPEXend based on actual costs in year (a–2)
	ERCal	Environmental and resource costs (same perimeter as OPEXal)	Not foreseen	Not foreseen	Deducted from OPEXend based on actual costs in year (a–2)	Deducted from OPEXend based on actual costs in year (a–2)	Deducted from OPEXend based on actual costs in year (a–2)
	ERCcapex	Environmental and resource costs (capital cost)	Not foreseen	Not foreseen	Not foreseen	Not foreseen	Investments belonging to ERC categories separately listes
CAPEX	RAB	Regulatory asset base	Based on all investments made still in depreciation Reconstruction value = historical cost * inflation	Same	Same	Same	Same
	CIN	Net invested capital	Includes net RAB + standard operating capital – provisions made	Same	Same	Same	Same
	AMM	Depreciation of operator's assets	Regulatory economic life	Regulatory economic life Financial depreciation allowed in scheme III–IV	Regulatory economic life Financial depreciation allowed in scheme IV–V–VI	Regulatory economic life Financial depreciation allowed in scheme IV–V–VI	Regulatory economic life More detailed list of assets Financial depreciation allowed in scheme IV–V–VI

	OF	Standard cost of capital	Based on market values	Based on market values	Based on market values	Based on market values	Based on market values
	Ofisc	Standard provision for taxes	Based on tax legislation	Based on tax legislation	Based on tax legislation	Based on tax legislation	Based on tax legislation
	ΔCUITcapex	Compensation for capitalised concession	Limited to the capital cost of municipal assets	Limited to the capital cost of municipal assets	Limited to the capital cost of municipal assets	Limited to the capital cost of municipal assets	Limited to the capital cost of municipal assets
FoNI	ΔCUITfoni	Capital cost of assets owned by municipalities	AMM + OF+OFisc – (MT + AC) - ΔCUITcapex	AMM + OF+OFisc – (MT + AC) – ΔCUITcapex	AMM + OF+OFisc – (MT + AC) – ΔCUITcapex	AMM + OF+OFisc – (MT + AC) - ΔCUITcapex	AMM + OF+OFisc – (MT + AC) - ΔCUITcapex
	AMMfoni	Depreciation of assets funded with public grants and non-repayable contributions	Same as for CIN	Same as for CIN	Same as for CIN	Same as for CIN	Same as for CIN
	FNIfoni	Advance for new investment	Allowed in some schemes = ψ*(planned investment – capex) with $0.4 < \psi < 0.8$	Allowed in scheme III–IV = ψ*(planned investment – capex) with $0.4 < \psi < 0.8$	Allowed in scheme IV–V–VI = ψ*(planned investment – capex) with $0.4 < \psi < 0.8$	Allowed in scheme IV–V–VI = ψ*(planned investment – capex) with $0.4 < \psi < 0.8$	Allowed in scheme IV–V–VI = ψ*(planned investment – capex) with $0.4 < \psi < 0.8$
	Allowed destination		New investments Targeted tariff rebates	New investments Targeted tariff rebates	New investments	New investments	New investments
RC		Adjustments (allowed revenues/ costs – actual revenues/costs)	Total revenue, OPEXal Unforeseen extraordinary expenses	Total revenue, OPEXal Unforeseen extraordinary expenses	Total revenue, OPEXal Unforeseen extraordinary expenses	Total revenue, OPEXal Unforeseen extraordinary expenses	Total revenue, OPEXal, OPqc, OPqt
INCENTIVE	Awards	Not foreseen	Not foreseen	Not foreseen	Not foreseen	Not foreseen	Foreseen
	Penalties	Not foreseen	Not foreseen	Not foreseen	Not foreseen	Not foreseen	Foreseen

Source: Author's elaboration on ARERA deliberations nos. 285/2012; 643/2013; 664/2015; 580/2019

Therefore, depreciation costs are considered for all assets, including those that have not been financed by the operator; however, cash flows arising from public funds or from assets owned by Municipalities will be set aside in a fund that can be used for new investments or social purposes (the so-called "fund for new investments", FoNI – see below). Investments to be remunerated include working capital, calculated as a standardised function of revenues and operational costs, net of provisions set aside in previous years and any kind of non-repayable grants.

The regulatory rate of return is based on a calculation following the capital asset pricing model (CAPM), namely considering the risk-free rate plus a risk premium which is calculated from market data. An extra bonus of 1% is added, as a lump-sum compensation for the time lag of 2 years. A standard fiscal component is also added.

Finally, FoNI – perhaps the most innovative component – is intended as a particular kind of non-repayable contribution, and consists of an anticipation for new investments that final customers pay, conceptually similar to the connection fees that are paid as an installation cost when the contract is started. FoNI arises from three possible sources: depreciation of assets paid by public contribution (as we have just seen), capital costs (depreciation plus capital remuneration) of assets under Municipal ownership and a third component which depends on the relative size of expected investments and available free cash-flows.

The total cost calculated in this way represents a guaranteed total revenue for the operator. For this purpose, assuming constant volume of service, the rate structure of the previous year is multiplied per an updating factor, ϑ, corresponding the ratio between the total allowed cost for the new year and tariff revenues from previous year. Eventual gaps between total allowed revenues and actual revenues will be recovered in year (a + 2).

While the transitory scheme entered in operation, ARERA started collecting systematically unbundled accounting data and introduced more detailed monitoring of quality standards, to be used in the next steps. After 2 years, the "definitive" method was approved. This introduced a few marginal innovations with respect to MTT.

Regulatory schemes were reduced to four, depending on (i) the positioning of actual costs with respect to the average national cost and (ii) the size of investment needs relative to available free cash-flows. Positioning in the grid of regulatory schemes implies a different maximum tariff increase. The definitive baseline for OPEXend was finally set at the intermediate point between OP and COeff, abandoning the original design of piloting it towards the lower of both. Regulatory schemes were reduced. Regionally standardised provisions for delinquent payment were admitted as exogenous costs.

With MTI-2, further innovations were introduced. In the first place, ARERA set the minimum quality standards, separately for commercial and technical quality. Two specific cost components were introduced to pass-through these expected costs; later, this forecast should be verified, and allowed cost will be reduced to the minimum between ex-ante estimate and actual costs. Each operator had to forecast the additional cost needed to meet the standard; investment plans needed to be targeted to quality indicators and specifically referring to the specific critical issues – prior to 2018 investment plans used to be simple lists of programmed works, with no reference to targets. This fundamental innovation marks a decisive step towards a performance-oriented tariff system.

This new philosophy starts being implemented with MTI-3 (2020–2023). Its main novelties are the introduction of a system of awards and penalties related to the achievement of quality improvement targets. Moreover, for the first time ARERA introduces a standard cost function for benchmarking. The formula, which results from an econometric study, is the following:

$$\begin{aligned}\ln\left(CO_{TOT}^{S}\right) = {} & 3.2766 + 1.0315 * \ln\left(1 + PE\right) + 0.2817 * \ln\left(1 + PL\right) \\ & + 0.7841 * \ln\left(1 + WS\right) + 0.2263 * \ln\left(V\right) + 0.1455 * \ln\left(L\right) \\ & + 0.4685 * \ln\left(Pa\right) + 0.1418 * \ln\left(AE\right) - 0.0753 * PREQ1_4 \\ & - 0.0611 * PREQ3 + 0.0281 * \ln\left(M1a\right)\end{aligned}$$

where PE = cost of electricity; PL = ratio of personnel cost to resident population; WS = bulk supply costs; V = volume of water supplied; L = total length of water mains; Pa = resident population + 0.25 of commuting population; AE = equivalent inhabitants served by sewage treatment; PREQ1, PREQ3 and M1a are indicators of technical quality.

Depending on the distance of actual 2016 costs to the formula and to the sign and the size of the gap between actual costs and allowed OPEXend, the operator will be assigned an efficiency improvement target ranging from 0 to 50% of the difference between actual costs and allowed costs. In practice, if the operator has been more efficient than OPEXend, a max 50% of this efficiency improvement will be shared with customers; if actual costs are higher, OPEXend will be maintained.

17.4.2 Tariff Structure

In 2018, ARERA introduced a widespread reform, with the aim of reducing the range of variability, introducing some rationalisation criteria and ultimately for equity reasons (TICSI). While the structure is still based on an increasing-block tariff (IBT), ARERA set more uniform rules for determining the width of blocks and to calculate rates for each block.

The tariff structure for PWS remained substantially the same since it was first regulated in 1974. The water supply charge includes a fixed charge a subsidised block (for residential clients only), an average block ("*tariffa base*") and up to three upper blocks with an increasing unit charge. Dimension of blocks can vary, while different schedules apply to different use categories (e.g., domestic, second houses, commercial, industry, etc.). Essential water endowments and poor households are entitled to rebates and special subsidised charges. Public uses (e.g., fire protection, hospitals, street cleaning, public buildings) have dedicated (and subsidised) charges.

Although metering is the general norm, there are still cases of (individual and collective) unmetered customers, whose tariffs are calculated on a flat basis, possibly considering some indicator of water quantity, such as the diameter of the pipe.

It is difficult to provide a picture that summarises the situation in the whole Country prior to the 2018 reform, since these general rules apply in very different ways across Italy. The number of different tariff schemes can be very large (up to 10–20 different types, according to the category of use). The size of blocks also varies significantly. However, charges for sewage collection and treatment follow a much simpler schedule since they apply a uniform volumetric charge to all uses.

The 2018 reform introduces some important novelties, with the aim of reducing the degree of variability and, at the same time, adopting a structure that is more coherently oriented at social and environmental sustainability, as well as cost responsiveness.

For residential uses, an important innovation consists in the consideration of the number of family components either for determining the fixed charge or the size of blocks. The subsidised block must correspond to an equivalent of at least 50 l/day per person. In this block, the rate must be in the range of 20–50% of the base rate. Operators are free to decide upon the other blocks.

Furthermore, the TICSI provides for domestic users below the poverty threshold a "water bonus" corresponding to a free provision of the subsidised block. This rebate is paid for by a dedicated national fund to which all water undertakings must contribute. Local regulators can dispose further targeted rebates, which will be financed by a dedicated component of the tariff paid by its customers (OPsocial).

Another important innovation introduced by TICSI concerns the discipline of actions to combat delinquent payment – a social plague, especially in the South where unpaid ratios reach an average 13.5% and peaks of 25–30% in some areas. Disconnections of residential uses are forbidden only in case the customer can demonstrate a financially distressed situation, and in this case supply restrictions are applied (reduced pressure). Increased frequency of billing for large consumers and the possibility of instalment plans, together with rebates and redesign of schedules, are aimed at further combating and possibly eradicating "water poverty". The number of families that encountered troubles in paying utility bills reaches 4% of the total, aligned with Western European standards; however, once more the national average is misleading, being generated by a pretty low value in the North (2.2%) and a high value in the South and the Islands (7–7.5%); This aggregate indicator, however, considers altogether all basic utilities. On average, Italian families spend 252 €/month on essentials, and only 5.8% of this on water (Fig. 17.3).

Utilitatis (2020) shows how the average unit cost has varied among families according to the number of components (Fig. 17.4). TICSI has seemingly advantaged large families and penalised singles, even though the degree of redistribution does not seem dramatic until now. A standard family composed of three members and consuming 150 m^3 saves annually 2 € on average, with an average expenditure of 322 €. However, the adoption of TICSI is still lagging behind, since many operators have encountered implementation difficulties.

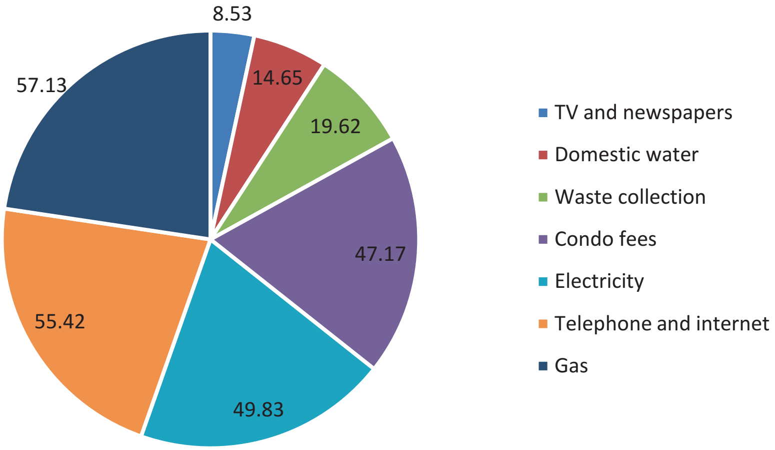

Fig. 17.3 Average monthly expenditure for living essentials (€/household)
Source: Author's elaboration on ISTAT

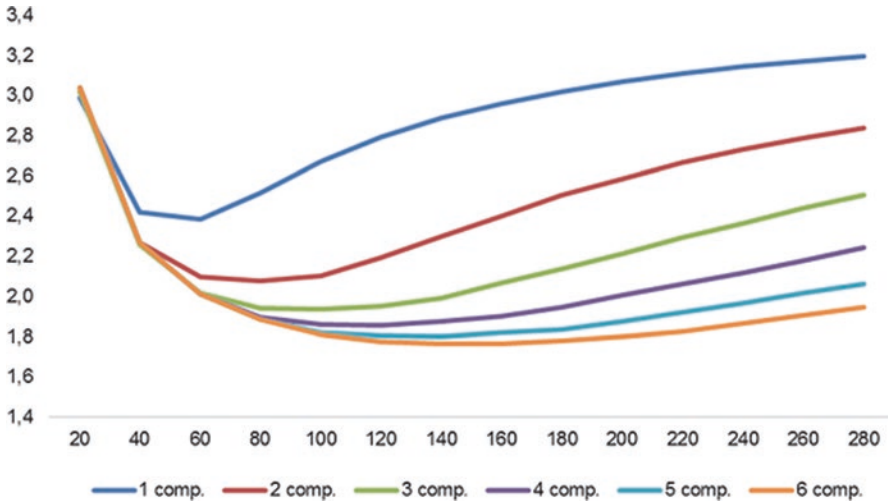

Fig. 17.4 Average unit cost of water according to consumption and number of family members
Source: Utilitatis (2020)

TICSI finally defines the maximum number of fees for non-domestic uses (industrial, agricultural, commercial, public, other) and specifies a number of "merit uses" that cannot be disconnected (e.g., hospitals, schools, prisons). All uses different from the domestic one can adopt proportional rates instead of IBT. In parallel, ARERA has also reformed the rate structure for industrial sewerage. The adopted scheme is based on a formula that includes a fixed charge (TF), a capacity payment component (TC) and a variable component (TV) depending on quantity and quality of effluents.

It is also remarkable to notice that the expenditure for bottled water is almost as big as that for PWS (12 €/month) (Massarutto 2018).

17.4.3 Tariff Dynamics and Affordability

Since the approval of the 1994 reform, tariff dynamics has been rather impressive, moving from 0.97 (the average tariff in year zero) to 1.37 €/m^3 in 2010 for water supply and sanitation (ANEA-Utilitatis 2011). The growth of expenditure is much larger, since 0.97 €/m^3 already includes some of the increases introduced by interim tariff regulations during the transition phase. Actualised estimates of the aggregate industry annual revenues in the pre-reform era were 3.37 billion € (Malaman and Cima 1999); the same aggregate in 2010 came to 7.61 billion € (ANEA-Utilitatis 2011). Hence, a first apparent outcome of the reform is that tariff revenues more than doubled, with a net increase of 4.14 billion €/year.

Since 2011, the price increase trend has continued. Since ARERA has not completed the procedure of approval of all tariff proposals submitted by AATOs, only partial results are available. Setting 2011 tariffs as the starting level ($t_{2011} = 1$), the average index grew to 1.024 in 2012 and 1.058 in 2013. Utilitatis (2020) estimates a further 15% increase between 2015 and 2019. Future dynamics is expected to be rather impressive as well. ATO plans foresaw an overall average tariff of 1.46 in equilibrium (after the full deployment of investment plans). Yet these were only the initial forecasts: after the first interim reviews, planned tariffs were revised and further increased to finance investments and guarantee balance-sheet equilibrium.

Average data, however, mask a very uneven situation. ARERA (2020) shows that for 17% of population (mostly located in the North-East) tariffs have decreased in 2018–2019, while a 42% of population show an increase. Although, again, no systematic data are available on a national basis, evidence from selected case studies shows that the MTI implies a much higher price increase – for the same planned investment – than the MTN, especially where the previous regulation had not opted for financial amortisation (Massarutto 2012) (Fig. 17.5).

Table 17.5 illustrates the structure of the typical schedule for a water bill. Despite the harmonisation efforts, variability ranges seem to be still quite large.

Figure 17.5 illustrates the annual expenditure of a typical representative family, also providing a range of minimum and maximum values. The national average is 99 € and 242 € respectively, with a minimum in the North-West and a maximum in the Centre. The variability is arguably influenced by technical features, such as the lower energy requirements in the North thanks to gravity pumping, and the higher/lower density of customers along the network.

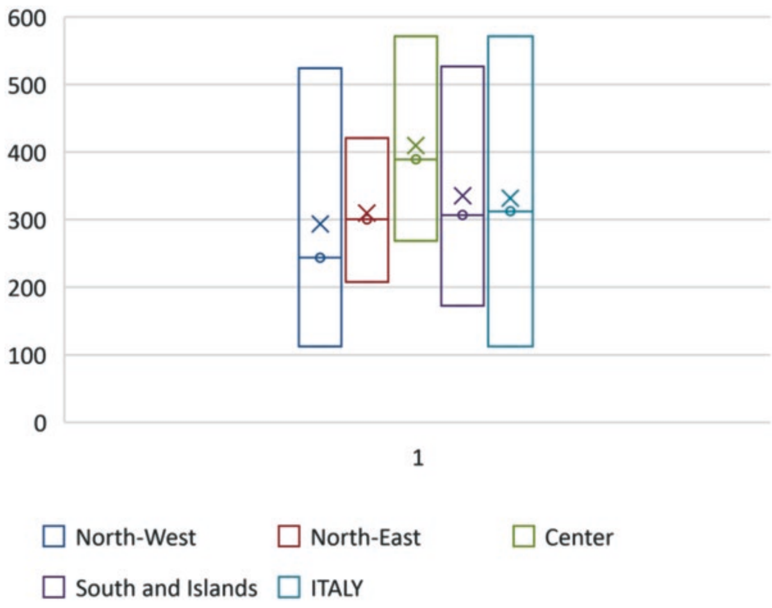

Fig. 17.5 Mean annual expenditure for a standard household of three components, consuming 150 m³/year in 2019
Source: Author's elaboration on ARERA (2020)

Table 17.5 Range of unit charge for a sample of water operators

			Min	Max	Weighted Average
			€/person³	€/person	€/person
Fixed charge					
Water supply			1.9	64.7	18.9
Sewage collection				17.1	4.5
Sewage treatment				25.5	8.6
Variable charge	m^3/person	m^3/person	€/m^3	€/m^3	€/m^3
Water supply					
Subsidised	0–111	79	0.113	1.324	0.545
Base	31–228	74.3	0.141	1.891	0.945
I block	81–486	84.3	0.29	4.67	1.639
II block	106–792	113.5	0.491	5.649	2.194
III block	131–		0.54	6.314	3.189
Sewage collection			0.094	0.859	0.253
Sewage treatment			0.29	1.077	0.602

Source: Author's elaboration on Utilitatis (2020)

Table 17.6 Indicators of affordability of water and sanitation services (IWS)

	% of IWS on average annual expenditure on total consumption	Incidence of IWS expenditure on the average income poverty line (%)
60 m^3	0.47	1.39
150 m^3	0.72	1.53

Source: Author's elaboration on Utilitatis (2014)

The 4.6% of population (1 ATO) spends in the range between 0 and 150 €/year. The most numerous classes lie in the median range, with nearly 30% of the population (12 ATOs) spending an average of 200–250 €/year. Further 22% of Italians (15 ATOs) spend no less than 300 €/year.

Finally, Table 17.6 illustrates the impact of water tariffs on families in terms of affordability. The first indicator (share of PWS expenditure on total family consumption) shows that IWS expenditure is still quite modest and far below the affordability thresholds that are commonly proposed in the international literature (3% on average). In turn, the second indicator shows some more worrying information concerning the impact on the poor. Families whose income is equal to the poverty line spend on average 1.39–1.53% of their income on IWS. This suggests probably the need to consider specific subsidies to poor families, which by no means should afford IWS alone, since the impact of price increases in other utilities (electricity, gas, transport) is even more relevant (Miniaci et al. 2008).

Despite tariff increases that took place in the last years, measures aimed at contrasting water poverty seem to have been effective.

17.4.4 Tariffs, Investments and Financial Sustainability

Water management is a capital-intensive industry, where the economic life of infrastructure and therefore the length of investment cycles is very long. Immobilisation of capital can last for 40–50 years or more. Therefore, financial sustainability of water companies is not simply a matter of "cost recovery", intended as a short-term equilibrium between revenues and financial costs; it rests instead on the existence of adequate and reliable free cash flows, depending very much on the financing model adopted.

Clearly, if finance comes from the public sector, financial equilibrium of water companies is easy to solve, since it will only concern day-by-day operation. In turn, it will condition the availability of resources for investments since they will depend on the overall macroeconomic stability. This is precisely the trap into which Italian water industry precipitated in the 1990s, where the distress of public finance made it simply unthinkable to obtain further resources from public debt, while investment requirements were compelling, either for refurbishing ageing networks or for expanding and modernising the system according to the requirements of EU environmental policies.

In many countries, water industry finance is mobilised by special-purpose financial intermediaries – the "*Waterschapbank*" in the Netherlands, the "State revolving funds" in the United States – or banks that are not sector-specific, but are specialised in lending to the public sector. This allows the water sector to benefit from soft loans and long repayment schedules; but again, must rely on credible commitments that the debt will be punctually repaid, with the explicit or implicit guarantee of the State. Absent the conditions that make similar financial institutions feasible, water operators must rely on financial markets, and thence must exhibit reliable and stable financial ratios to demonstrate creditworthiness.

Free cash flows are typically generated by depreciation, and thence the way capital assets are accounted for and depreciation calculated is fundamental. The Italian regulatory model has three interesting features with this regard. In the first place, depreciation and capital remuneration are based on reconstruction cost – historical values are systematically updated with inflation. This scheme is also adopted in other countries, for instance in Germany, and allows a dramatic improvement of cash flows, relative to traditional historical cost accounting. However, its benefits arise particularly when companies own historical assets created in the past with their own resources. This is typically not the case in Italy, where many water companies have been created from scratch, with very little initial capital, and most assets have been realised in the past using public funds that never entered in the water tariff.

A second important feature of the Italian model is the possibility of using financial amortisation – that is, adopt a depreciation schedule coherent with the duration of concessions and the time span of loans. Clearly, this implies that water prices must accelerate significantly, and remain high until the end of the concession.

The introduction of the "new investment fund" represents the third innovation, and possibly the most original one. As explained in Sect. 17.4.1, this is an additional cash flow, that is collected with the water bill but has a different nature; it can be assimilated to a special purpose tax that is tied to the same water management system. FoNI originates from the depreciation of past non-repayable grants and publicly owned assets, plus an additional anticipation that is proportional to the gap between normal free cash flows (depreciation of own assets of the water company) and forecasted investment need. FoNI must be spent within 2 years, otherwise the company will not be entitled to charging further of it; its revenues must be set aside as a capital reserve, cannot be distributed to shareholders and do not contribute to the value of assets that the company will receive after the concession expires from the new concessionaire.

Having access to the FoNI, water companies can finance new investments without recurring to debt. In turn, since FoNI flows are assimilated to non-repayable grants, the depreciation of investments acquired with this money will forever remain tied to investments, and no capital remuneration will be allowed on it. In other words, FoNI implies a trade-off between profitability and financial equilibrium: a company using FoNI instead of own resources will be less profitable and will have a lower net value of assets at the end of the concession; in turn, it will enjoy more stable balance between own resources and loans, and therefore sounder financial stability ratios. Even if tariffs must necessarily increase in the short-term, this effect is soon balanced by the fact that in the next years there is lower capital remuneration to account for, pushing prices to the opposite direction.

On a sample of firms, we have conducted an original study aimed at appreciating the effect of FoNI on financial equilibrium, debt levels and tariff dynamics. Everything else remaining equal, we have simulated to finance the investment plans with recourse to "normal" capital markets – bank loans lasting 30 years at an interest rate equal to the standard remuneration of capital applied by ARERA.

We have examined seven water companies of different size and operating in different conditions. In all cases, we have elaborated two scenarios, one in which FoNi has been applied at the ratio that was effectively chosen, and another one in which we assumed no FoNI was applied. Until now, our analysis has been constrained to the period from 2016 onwards, since the database lacks observations from the first 4 years, where FoNI has been extensively used. An extension of the study to overcome this gap is underway.

Despite this limitation, results are quite striking (Table 17.7). In the "no FoNI" scenario, financial indicators worsen dramatically, reaching and often trespassing the range of acceptable values – which means that such companies would probably not be able to obtain credit. Financial needs become significant – while FoNI allows some of them to have even a positive total cash flow.

Table 17.7 The effects of FoNI on financial sustainability of water companies in Italy

		ADSCR	DSCR MIN	Σ Financial need (M€)	Residual debt	Residual debt/terminal value	NFP/ NA	NFP/ EBITDA
	Reference value	> 1.2– 1.3	> 1			< 0.5–0.8	< 4	< 2
1	FoNI	4.48	1.93	−818	−83	−0.16	−0.56	−1.46
	No FoNI	1.74	0.39	579	574	1.1	−0.51	−13.36
2	FoNI	1.71	1.46	−243.19	53.92	0.24	0.86	2.79
	No FoNI	1.53	1.02	629.96	332.79	0.64	2.56	4.88
3	FoNI	6.09	4.18	−2.43	71.03	0.18	0.14	1.34
	No FoNI	2.87	2.3	59.77	138	0.31	0.25	3.29
4	FoNI	5.44	3.44	−25.33	12.48	0.18	−0.12	1.53
	No FoNI	2.63	1.49	45.46	46.57	0.58	0.21	4.76
5	FoNI	3.06	2.04	15.58	143.97	0.3	0.05	0.08
	No FoNI	2.43	1.68	16.6	194.6	0.4	0.25	0.68
6	FoNI	3.25	1.75	−71.23	12.17	0.54	1.35	1.01
	No FoNI	1.05	0.86	341.32	142.22	1.35	5.25	3.24
7	FoNI	6.76	0.67	−799.47	121.16	0.81	0.25	1.61
	No FoNI	3.07	0.34	210.62	564.09	1.01	1.05	2.09

Source: own elaboration on own database

17.5 Experiences with Other Sectors

17.5.1 Experiences with Irrigation Pricing

Reclamation Boards, which supply collective irrigation water, are not precisely equal to “service providers”. They are in fact private associations, ruled by boards that represent landowners. Charges paid by associations resemble more “condo fees” than tariffs. On top of these, Reclamation Boards may obtain further revenues from the market (for instance, from the sale of electricity produced by hydropower plants located along the distribution network).

Accounting rules generally follow cash flows instead than accrual criteria. Legislation obliges consortia to reach annually a balance between revenues and expenses; although, public institutions may contribute grants and subsidies, which are registered in the accounts. In the past, this allowed many Reclamation Boards to elude cost recovery provisions, since public contributions constituted in practice systematic annual bailouts. Nowadays, budget equilibrium enforcement is stricter, especially for operational costs.

Figure 17.6 illustrates a breakdown of financing sources of Reclamation Boards in different river basin districts.

In Northern Italy, charges paid by associates cover the largest part of revenues, while an important source is also represented by revenues from market activities, such as hydropower production and services provided to other subjects (including PWS operators). Regional and State contributions, in turn, represent a figure around 10% maximum. In turn in central Italy and especially in the South and in the Islands the situation is reversed, with a share of public contributions around 50–80%.

As said above, public contributions in principle could compensate ecosystem services such as riverbed maintenance and flood protection. When paid as grants-in-aid for irrigation networks, the legal requirement is that investments contribute to

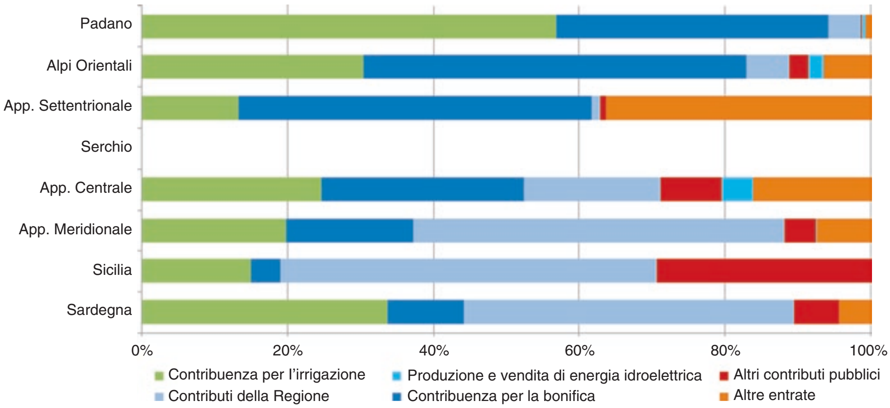

Fig. 17.6 Breakdown of financing sources of Reclamation Boards
Source: own elaboration on Zucaro (2011)

Table 17.8 Average normalised profit and loss accounts (operational cost = 100) for a sample of Reclamation Boards

	NW	NE	C	S + I	Italy
Fees paid by associates	91	93	101	56	87
Other revenues	19	13	10	13	13
Operational cost	100	100	100	100	100
EBITDA	9	6	11	−31	−0
Use of set-aside provisions	7	23	–	2	11
Depreciation and provisions	2	24	–	2	11
Net capital costs	1	0	0	3	1
EBIT	14	5	11	−34	−1

Source: Author elaboration on direct inquiry (*NW* North-West, *NE* North-East, *C* Centre, *S* South, *I* Islands)

water conservation and sustainable water use, although the criteria for assessing whether the criterion is fulfilled are rather fuzzy and discretional.

Table 17.8 illustrates the result of an original study we have conducted on a sample of 14 Reclamation Boards, located in nine Regions. Accounting data have been normalised and translated in a reclassified profit and loss account. A negative gross operational margin (EBITDA) means that direct revenues (from associates and market activities) do not allow break-even. This situation still occurs in the South and Islands Regions, while in Northern and Central Italy margins are positive, witnessing the capacity to self-finance at least a share of capital expenditure. User charges generally allow recovery of maintenance expenses, while public contributions fund new investments.

On the other hand, the construction of Italian irrigation network took place along a period of many centuries; most of it is fully amortised now. New investments do not fund extensions of irrigated surfaces and by no means imply further abstractions; rather, they concern incremental improvements of water use efficiency (e.g., substitution of open-air canals with pumped pipelines; introduction of drip irrigation and sprinklers to replace submersion), maintenance of river corridors, greening of water infrastructure and so on).

In fact, absolute water volumes used by agriculture are seemingly declining, in line with the overall reduction of agricultural activity. Estimates provided by past studies (IRSA-CNR 1999) considered theoretical requirements and licensed volumes rather than effective consumption and actual abstractions. Evidence from river district plans shows that consortia use only a fraction of licensed use rights. The latest survey available estimates a total abstraction of 2.1 billion m^3, 22% less than previous estimates (Zucaro 2011).

Metering and volumetric charges are still exceptional in the North, where associates pay a fee based on irrigated surface; however, this does not prevent to take into account water demand: surface fees can be differentiated according to cropping choices; guaranteed supplies and water-on-demand may imply extra charges. Even in the North, metering is increasingly adopted especially in areas characterised by high value-added crops and more unreliable sources of water supply, as in the case of Northern Apennines in Emilia-Romagna. Moving south, metering and volume charging becomes more frequent and widespread.

Although no systematic studies exist, evidence from case studies shows that the state-of-the-art, although non-optimal according to orthodox economic theory, is not completely unreasonable, given that significant investments would be required in order to adopt metering on a systematic basis, and these are not necessarily justified.

Table 17.9 provides the result of an original study we have carried out using the database collected by CREA (the national Institute of Agricultural Economics). The

Table 17.9 Average, minimum and maximum irrigation charges in 2012 (breakdown per macro-regions)

	North-West	North-East	Centre	South	Islands	Italy
Total surface associated to reclamation boards	949,410	3,805,119	2,362,702	3,916,712	1,148,181	12,182,124
Of which: Irrigated	58%	15%	6%	5%	5%	13%
Irrigation technology						
Submersion	80%	40%	17%	14%	12%	48%
Sprinklers	19%	49%	71%	42%	64%	38%
Drip	1%	12%	12%	44%	23%	14%
Water distribution technology						
Gravity	91%	64%	60%	63%	45%	76%
Pumped	9%	36%	40%	37%	55%	24%
Water use						
Average (m^3/ha)	8226	4078	3765	4823	5555	4931
Length of irrigation period (days/year)	141	164	188	208	196	180
Availability						
On demand	26%	65%	96%	48%	60%	51%
By turns	74%	35%	4%	52%	40%	49%
Charging method						
Surface	39%	49%	37%	50%	41%	45%
Volumetric (binomial)	39%	49%	37%	50%	41%	45%
Mixed	21%	3%	27%	0%	19%	10%
Charges per ha (surface only)						
Average	123	78	140	169	220	127
Min	35	17	55	45	170	17
Max	304	220	400	500	270	500
Charges per m^3 (binomial)						
Average fixed charge per ha	82	67	36	44	178	68
Average charge per m^3	0.12	0.24	0.14	0.20	1.57	0.31
Min charge per m^3	0.00	0.02	0.01	0.01	1.56	0.00
Max charge per m^3	0.24	0.86	0.22	0.40	1.57	1.57

Source: own elaboration on CREA

database, still under construction, collects structural and economic information for each consortium. Although the survey is still incomplete, it is useful for a general overview. At present, it covers 92 consortia (out of 136) and an irrigated surface of 1.5 million ha (57% of the total).

Where surface charges are applied, the average value is around 120–130 €/ha, with high fluctuations either among areas or within each area. Binomial charges typically entail a fixed charge (68 €/ha on average, again with significant fluctuations) and a variable charge, whose value is again quite variable. Only in the Islands we have found values around 1.5 €/m^3, while elsewhere the typical charges are 0.2–0.3 €/m^3 or lower.

On average, Zucaro (2011) calculates that the contribution per ha ranges from 40–60 €/ha in the North to 100–120 in the South. In Sicily, direct charges amount to around 50 €/ha, but public contributions reach more than 80% of total costs.

Massarutto (2003), for example, argues that most crops are actually not very responsive to marginal price, at the existing water price level, given the high value-added of crops. A case study in Friuli (North-East) shows that the frequency of drought events should be lower than one every 3–5 years to justify a systematic change of actual patterns of agricultural water use.

On the other hand, we must say that the use of economic instruments is still in its infancy. Many studies argue that incentive pricing for irrigation cannot automatically induce more sustainable patterns of use, whilst superior results could arise from a combined use of different economic instruments, such as water markets and insurance schemes (Mysiak et al. 2013; Cornish et al. 2004; Massarutto 2003).

In the Italian context, this is particularly true, especially if we consider that irrigation-driven water stress is not necessarily linked to high water consumption, but rather to the intensive use of water in high-value crops in water-stressed sub-regions, as happens in the southern reach of the Po basin (Massarutto and de Carli 2009; Viaggi et al. 2010). Poor design and scant political acceptance hamper at present a more widespread use of economic instruments.

We can argue that agriculture – as for PWS – awaits a more widespread use of economic instruments more for the sake of increasing the level of self-financing than to provide incentive to a more efficient use of water for irrigation. On the other hand, the problem of unsustainable extractions and guarantee of environmental flows seems to require institutional instruments (stakeholders' cooperation) rather than exclusively using economic instruments (water pricing and markets). Nonetheless, economic instruments could have a further role to play in the design of compensation schemes that could alleviate the burden of measures aimed at improving sustainability and reallocating water endowments. Evidence shows that willingness to pay of farmers – especially in the high value-added areas – is much higher than actual charges; whereas the capacity of the public budget to continue supporting investments is diminishing.

17.5.2 Experiences with Industrial Pricing

As discussed in Sect. 17.2.2, water services dedicated to industrial premises may be a part of the IWS or as separate activities. As already said, the latter case represents the least known part of the Italian water industry, with lack of systematic surveys. Evidence on a spot basis seems to show that these undertakings operate on a cost-recovery base, even if they might have benefitted from some public funds in the past, especially at the time of the initial investment, through direct injection of subsidies, soft loans, etc.

Industrial premises connected to the IWS pose, in turn, a number of issues that have recently attracted the attention of the national regulator.

A first important issue concerns the case for cross-subsidies. This is generally not the case for water supply. We have already pointed out that industries for which water represents an input in the production process normally rely on self-supply from direct abstractions, for which they pay the abstraction charge, but do not receive a service. Industrial and commercial premises connected to the IWS are normally doing so for sanitary purpose. This justifies treating them as any other commercial premise. In turn, the national legislation explicitly foresees the possibility of introducing a cross-subsidy in favour of domestic uses, and especially for low-income customers.

For industrial sewerage, the pricing structure is rather different from civil uses. According to Decree of the President of the Republic of 24 May 1977, the formula for calculating industrial charges was a function of pollution potential (Eq. 17.1):

$$T_2 = F_2 + \left[f_2 + dv + K_2 \left(\frac{O_i}{O_f} d_b + \frac{S_i}{S_f} d_f \right) + da \right] V \tag{17.1}$$

with T_2 = tariff; F_2 = fixed charge; f_2 = unit cost of collection; dv = average cost of primary treatment; O_i, S_i = chemical oxygen demand (COD) and suspended solids (SS) of the concerned effluent; O_f, S_f = total COD and SS treated in the facility; K_2, da = parameters capturing special features. Regions, which inherited regulatory functions, often introduced further parameters.

This scheme was supposed to apply to each treatment facility. This favoured a wide differentiation of tariffs for the same effluents even in the same territory. Figure 17.7 provides an example of the range of variability throughout the Country: while a difference among sectors is normal, given the different polluting potential, differences within the same industry is entirely due to the variability of cost between different facilities (Fig. 17.7).

Whilst being originally inspired to the polluter-pays principle, this formula has encountered criticism for many reasons. First, it does not take into account technological change occurred since 1977, charging the same price regardless the efforts aimed at reducing pollution (thence, contradicting the PPP). Second, charges are specific for each installation, with the result of generating rather different tariffs for similar effluents even in the same territory. Third, the structure does not include any

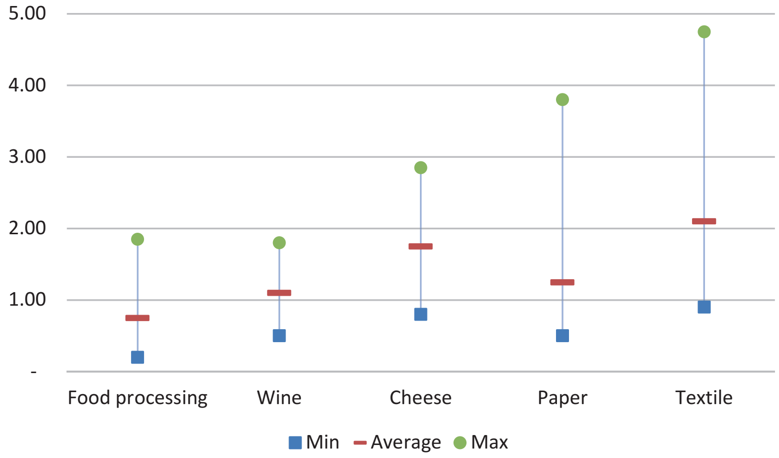

Fig. 17.7 Range of variation of industrial sewerage charges for selected industries in a sample of ATOs in 2010 (€/m^3)
Source: REF Ricerche (2014a)

fixed charge, resulting in an unfair pattern of cost allocation. Furthermore, the same rate applies to collection and treatment, which is probably unfair (collection has the same cost regardless pollution).

As already said, ARERA has introduced a uniform approach, at least for discharges into public sewage treatment plants. The new tariff will apply the same rates within any ATO; will apply a uniform rate for collection and a specific one for treatment, considering pollution abatement costs in a more effective way.

17.6 A Still Unfinished Puzzle

Although many pieces of the puzzle still must fall into place, the picture of the Italian water sector is beginning to assume its new shape. In a paper written over 10 years ago, we argued that the policy strategy initiated by Law no. 36/1994 was too radical and ambitious, and a more balanced strategy was needed (Massarutto 2012). The aim of the reform was, in short, to create a modern water industry, financially self-sufficient and entirely relying on financial markets leveraged by tariffs.

When the reform was launched, water tariffs were very low and barely visible in family budgets; neo-liberalism dominated the economic policy debate, globalisation was at its apex, and the "Washington Consensus" model inspired the debate among water experts. Treating water as a commodity like the others did not sound scandal.

This dream proved to be unrealistic: first, because it undervalued the need to accompany price increase with a more widespread adoption of modern regulatory tools and a closer attention to equity, meaning either fair cost-sharing rules and attention to affordability issues. Second, because it overvalued the capacity of financial markets to provide reliable sources or sufficiently cheap finance. Third, because it failed to reckon with political consensus, assuming that the deal could generate a "win-win" outcome for the largest majority; despite quasi-unanimity vote in the Parliament in 1994, the unsolved knots brought to the equally unanimous plebiscite with which Italians rejected the very idea that water should be treated as a commodity and sold for profit.

Some "cunning of reason" provided in order to avoid that the popular vote could bring Italian water back to the unsustainable model that legislation had tried to abandon; but made it clear that it should be substantially improved and completed.

The financial structure that the water industry is assuming is clearly taking advantage of acknowledging these weaknesses. Full-cost recovery continues to be a precondition of financial viability, but it has been recognised that this is not a synonymous to 100% relying on financial markets; recovering of capital cost is not a synonymous of easy profits milked from natural monopolies. Nor can cost recovery be trivialised in a sort of ex-post guarantee of matching costs with revenues.

With great difficulty Italy has managed to recover its water investments to a barely dignified 50 €/inhabitant, while other EU countries invest twice as much. Mobilising further resources is possible but requires an innovative financial alliance between the private and the public sector (Massarutto et al. 2008). Some innovative devices such as the FoNI have eased the access to credit; it seems possible to dare more sophisticated financial architectures, involving some degree of cost-sharing at wider territorial scales.

An opportunity in this sense is offered by the consideration of environmental and resource costs. These could be charged on the operator; whereas their transfer in the water bill may be limited according to the policy objectives (for instance, allowing to transfer only a given part of the abstraction charges, corresponding to the target level of leakage). A promising possibility concerns the use of water taxes, based on abstractions and/or pollution, either as an incentive to water users or as a complementary source of finance (Andersen et al. 2011; OECD 2013; Barraqué et al. 2018).

Once financial equilibrium has been restored, new challenges are on the horizon. Investment costs must be recovered, thence the issue of efficient capital endowment assumes paramount importance. A decisive step in this direction could be the resolute orientation towards performance-based regulation, launched by ARERA in the new regulatory period; yet this is just a first step in the right direction. An approach based on rewards and penalties should be extended to the achievement of water policy targets and not limited to commercial and technical quality (REF Ricerche 2014b; Conte et al. 2012).

Environmental policy and the emerging "circular economy" paradigm call for a more deeply entrenched integration between water policy and other domains – energy, waste, public works among others – and innovative interconnection between segments of water policy that remained so far independent – agriculture, industry, hydroelectricity, PWS.

At the same time, water pricing means using economic instruments to provide signals to water users. The debate about reforming water pricing structures is still confined to academic audiences and, at best, informs the policy recommendations issued by multilateral institutions. Proposals have been made, for example, to introduce more explicit incentive schemes, such as lump-sum rebates on fixed charges to promote water saving or pollution abatement. Installation of household equipment has demonstrated to be more sensitive to capital incentives than to marginal savings in the variable cost (Conte et al. 2012).

Affordability and water poverty are not yet a real issue at present, since annual family expenditure is still rather low compared with other EU countries, and one of the lowest in the OECD. However, projections of further increases show that this might not be true in the future once all investment costs will be transferred to consumers. Recent policy developments have attempted, quite successfully so far, to prevent affordability problems, insisting on targeted measures (such as the "water bonus"), but also continuing to rely on costly and relatively ineffective solutions such as the universally available subsidised block (Massarutto 2020).

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Chapter 18
Environmental and Resource Costs Assessment and the Case for Reforming the Italian System of Water Abstraction Charges

Vito Frontuto, Silvana Dalmazzone, Paolo Mancin, Alessia Giannetta, and Davide Attilio Calà

Abstract This chapter describes the design of a reform scheme for public water abstraction charges aimed at implementing the Water Framework Directive principles of (i) internalising the externalities associated with water use (or at least recover the cost of measures implemented to protect water resources); (ii) inducing an efficient allocation among competing uses; and (iii) achieving water and environmental protection without excessively hampering economic activities. We provide a simulation of the resulting water pricing systems based on data from the Piedmont Region, in north-western Italy. The reform design grounds water charges on the impacts on ecosystem services caused both by subtracting resources to freshwater ecosystems and by returning water to ecosystems, after human use, in a qualitatively degraded state. The system takes into account that the marginal damage of water uses may also depend on the quantitative and qualitative status of the concerned water body, and controls for incidence of the resulting charges.

Keywords Water pricing · Environmental and resource costs · Ecosystem services · Monetary evaluation · Affordability

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18.1 Introduction

The State of Water Report by the European Environment Agency (EEA 2018) shows that only 38% of the European Union (EU) surface water bodies are in good chemical status and just 40% in good ecological status – a substantial distance from the objectives of the Water Framework Directive (WFD). Compared to the 2009–2015 cycle, progress has been limited. Among a set of varied and complex underlying causes, a key role is identified in a delay by Member States to design and implement effective policy measures. While Article 9 of the WFD explicitly requires Member States to implement pricing policies that provide incentives to use water efficiently and recover costs for water services (including environmental and resource costs), virtually no Member State appears to have yet implemented comprehensive water management and pricing reforms, and in the majority of contexts there is not even sign of ongoing reform planning. Available reviews of water pricing in the EU are somewhat updated but, according to the EC (2012) *Water Blueprint*, only 49% of River Basin Management Plans (RBMPs) are preparing to change the pricing system to foster a more efficient use of water; and only 40% include measures to improve water metering – a pre-condition for any incentive-based pricing policy. This is particularly true for the most water-consumptive sectors: Rey and colleagues report that no Member State in Southern Europe has implemented an agricultural water pricing reform that integrates the principles of cost recovery, polluter-pays and affordability required by the WFD (Rey et al. 2018).

Among the very first attempts to make a step beyond this state of things, the Piedmont Region, in the North-West of Italy, introduced in July 2017 two additional ex-ante conditionalities to access funding from the EU's Common Agricultural Policy (CAP): (i) the "harmonization of the methods for quantifying irrigation water withdrawals and effective collection, communication and management of this data", including the compulsory adoption of metering devices; and (ii) the "introduction of environmental and resource costs in the calculation of water prices", to an extent consistent with the affordability principle (Regione Piemonte 2017). This amounts to an explicit choice by the Regional Government (consistent with the Italian regulation[1]) to link access to CAP funds for agricultural firms to compliance with the principles required by the WFD – an unprecedented move towards the real implementation of the Directive.

This chapter provides a comprehensive description of the approach which has been followed to design the above-mentioned reform of public water abstraction charges. The proposed reform concerns all economic sectors that make use of public water, that is, water from out-of-network abstraction points. This includes the agricultural sector, the largest user of public water, employed mainly for irrigation; the industrial sector, which may use both network and out-of-network water supplies,

[1] Decree of the Minister of the Environment no. 39 of 24 February 2015 ("*Regolamento recante i criteri per la definizione del costo ambientale e del costo della risorsa per i vari settori d'impiego dell'acqua*").

depending on production processes and location; and the commercial sector, for which the use of out-of-network water is generally residual (e.g., fire-fighting systems, garden watering). The analysis also includes the very small share of households that hold a licence to withdraw water out of the integrated water service, because either living in remote out-of-network areas, usually served by village aqueducts holding a collective abstraction licence, or maintaining traditional rural wells in addition to the network.

The underlying principles draw directly from the WFD: water charges should (i) internalise the externalities associated with water use (or at least recover the cost of measures implemented to protect water resources); (ii) induce an efficient allocation among competing uses; (iii) achieve water and environmental protection without excessively hampering economic activities. In turn, the internalisation of externalities brings with it the principle of fairness in the contribution, that is, a system meant to proportionally spread the cost of conservation among uses according to the pressure they exert on water resources and on the environment.

Grounding water pricing on the environmental and resource costs entailed by water use requires, first, quantifying such costs in monetary terms. In the simulations presented in this chapter, we adopt a cost-based approach, consistent with the guidelines published by the Italian Ministry of the Environment,[2] to associate monetary values to the changes in ecosystem services impacted by water abstraction and use.

In this way, we implicitly assume that the value of avoided damages or the cost required to restore degraded ecosystems represent a proxy of the value of the services provided by those ecosystems. Monetary values of ecosystem services obtained through a cost-based approach underestimate the total economic value, since they quantify only the use value, and only that subset of it for which restoration interventions are technically feasible. This notwithstanding, we believe they convey a useful quantification of the minimum certain value for socio-economic costs associated with water use. In any case, a full recovery of environmental and resource costs would imply, in most circumstances, disproportionate costs, that is, costs to be imposed on economic activities that would be considered unsustainable and politically unfeasible (Galioto et al. 2013; Jensen et al. 2013; Klauer et al. 2016). The WFD itself admits, in the face of disproportionate costs, the possibility of derogating from the principle of full cost recovery. Moreover, from a practical point of view, cost-based valuations are also reasonably straightforward to implement in those contexts where recovery or replacement costs have actually been disbursed or at least included in RBMPs.

Among the numerous challenging questions faced by these pioneering attempts, two appear particularly crucial. The first is how to find the right balance between, on the one hand, socio-economic affordability with respect to local specificities and socio-economic features of the economic sectors involved and, on the other, proportionality between environmental costs caused by economic activities and financial

[2] *Ibid*.

costs imposed by water pricing. The second is the issue of whether (and how) to consider water balances, rather than simply withdrawals, as a base for water pricing. In the conclusions of this chapter we discuss both questions, with reference to the unfolding experience of its case study.

18.2 Designing Public Water Pricing

18.2.1 The Piedmont Region Context

The Piedmont Region, located in the northwest of Italy, is entirely part of the Po river basin district, the largest and most relevant Italian water district. The Region comprises the upstream of the Po River and other relevant water bodies (rivers, lakes and aquifers).

The most significant anthropic pressures on rivers and lakes derive from morphological alterations of the soil (63.8% of superficial water bodies are subject to significant pressures), discharges of urban wastewater (significant pressures on 36%t of superficial water bodies) and release of pesticides, fertilisers and sludge due to the activities of the agricultural-livestock sector (significant pressures on 19% of superficial water bodies). For groundwater, the main factors contributing to quality deterioration are nitrates, pesticides, volatile organic compounds (VOCs) (27.5% of ground waters under significant pressures), metals such as nickel or chromium and chlorinated solvents.

The Region has historically been water-abundant, with an estimated annual average availability of 14 billion m^3. Nevertheless, it has recently experienced droughts, both in winter and summer seasons, due to the combination of low precipitations and significant withdrawals from surface waters. The causes of these drought events are most likely due to climate change, but also show a clear correlation with the increasing trend of withdrawals.

In the last 60 years, precipitation has not shown significant differences in mean values, while there has been an increased frequency of extreme events, both intense precipitation and drought. In 2017, total precipitations were roughly 25% less than the average cumulated value referring to the period 1971–2000, with the most critical situations in the south-eastern area of the Region. The pluviometric deficit worsened in the first months of autumn, reaching a peak of 36% in October. The pressure on water resources due to withdrawals is well-known by local authorities and stakeholders: in 2015, almost 40% of surface water bodies were subject to significant pressure. The most consistent quantitative pressure is exerted by the agricultural sector, that uses about 80% of the total volumes withdrawn. It is estimated that about 5 billion m^3 of water per year are derived from surface water bodies for irrigation, most of which are used for rice fields in the north-eastern area of the Region and for the irrigation of corn in the remaining lowlands. Seasonality exacerbates the pressure of agriculture, which peaks during summer, from April to September, when the natural water runoff of rivers and torrents is at its minimum.[3]

Regional authorities are in charge of issuing water abstraction rights and set the corresponding prices, with the national Government and the Po River Basin Organization playing a monitoring and coordination role among Regions within the basin. Under the current water abstraction regime, licenses are issued by the competent authorities (Provinces) for long periods, up to a maximum of 40 years. Prices are set on a per-area basis (average charge: 1.22 €/ha), or based on the average flow rate capacity of the licenced derivation (0.56 €/ls for the agriculture sector, 2.37 €/ls for households,[4] 175.94 €/ls for industrial uses), or on the installed capacity for the hydroelectric sector (29.89–44.05 €/kW), with heavy price differences across sectors. Table 18.1 provides a complete overview of the current pricing regime.

Table 18.1 Piedmont Region, current water pricing. (Source: Regione Piemonte 2019)[a]

Sector	Type of charge	UoM	Charge
Irrigation and agriculture	Charge 1	€ per l/s	0.56
	Charge 2	€ per ha	1.22
	Min.	€	31.37
Commercial	Charge	€ per l/s	11.72
	Min.	€	143.61
Household	Charge	€ per l/s	2.37
	Min.	€	59.85
Energy	> = 3.000 kW	€ per kW	44.05
	1.000 kW e <3.000 kW	€ per kW	39.86
	> = 220 kW e <1.000 kW	€ per kW	37.76
	> = 20 kW e <220 kW	€ per kW	34.61
	<20 kW	€ per kW	29.89
	Min.	€	165.49
Industrial	Charge	€ per l/s	175.94
	Min. 1	€	2357.72
	Min. 2	€	1196.81
	Min. 3	€	694.17
	Min. 4	€	

[a]The source uses a finer disaggregation of sectors. We decided to focus our attention on the most relevant ones and made some aggregations in order to replicate standard classifications and allow international comparisons. For the industrial sector, the minimum payment increases with the dimension of the licenced flow rate

[3]Data on quantitative and qualitative status of water bodies have been collected for 2001–2016 period by the Regional Environmental Protection Agency (ARPA) and used as the informative base for the last Water Protection Plan (Regione Piemonte 2018).

[4]As mentioned in the introduction, the almost totality of households receive water from the network, and are therefore subject to the tariff system of the integrated water service. The "Household" category appearing in this analysis refers only to the small number of families holding a public water abstraction licence.

Since their introduction in Italy in 1933, water prices have been determined mainly on the ground of the ability to pay of different sectors, without consideration of the quantities consumed – a scheme resulting in an implicit subsidisation of water-intensive sectors. Considering withdrawals and revenues from the sectors for which we have a measure of the licenced water amount, in Piedmont industrial uses account for 9% of licenced withdrawals and 55.2% of revenues; household and commercial uses are entitled to 3% of licenced water and generate 12.2% of revenues; agricultural use accounts approximately for 87% of water use and originates 32.6% of revenues. Water licences to industry, households, commerce and agriculture generate revenues for 10.7 million € annually, 18.8% of total revenues from water charges. The remaining 81.2% is generated by the hydroelectric sector, not included in the above shares because its water charges are defined in €/kW rather than in l/s, and hence the database of licences for water abstraction does not allow us to quantify withdrawals (Regione Piemonte 2019).

18.2.2 The Reform Structure

The reform presented in this chapter aims at overcoming the current system and to link charges to actual water resource use. Crucial features informing the reform design are that the system for determining charges must be: (i) standardised and replicable; (ii) strictly connected to objective criteria (official and publicly available indicators and assessments of resource state in the RBMPs); (iii) dynamically flexible to accommodate revisions and updates in subsequent planning cycles.

The first crucial requirement of the transition is moving towards a fully metered system. Water use in Piedmont is entirely metered only for households and commercial uses that are connected to the network of the integrated water service. In all other sectors, despite a mandatory requirement for large users established in 2007 (Decree of the President of the Regional Council no. 7/R of 25 June 2007), the implementation of a system for metering public water abstraction is currently at different degrees of completion depending on contexts and uses.

The reform under way calculates water charges based on the financial and environmental costs associated with the quantity of water withdrawn and the quality of the water returned. In this way, the financial and environmental costs are spread among users in proportion to the pressure they exert on water resources. In order to avoid disproportioned costs and warrant affordability, the system then sets a cap in terms of the cost recovery ratio to be obtained.

The objectives set by the WFD for Member States are in terms of a good status of water bodies to be pursued and maintained over time. One could argue, therefore, that the implementation of the WFD requires incentive-based water pricing only for water bodies that do not reach a good status: where the natural system has the capacity to assimilate pressures, one could be induced to consider externalities deriving from water use equal to zero. Such a regulation-centered approach, however, would fail to consider dynamic effects and the potential for spillovers of pressure from water bodies with a poor status, where water charges would impose a heavier burden on economic activities, towards water bodies with higher environmental quality. A conservation-centered approach would rather suggest assigning economic value to water regardless of the state of the water body on which the pressure insists. This would avoid biases and spillovers, and aim at improving water quality where it is degraded while protecting it where it is good or higher. It is also consistent with the concept of solidarity and concurrent responsibility in resource use, which entails sharing responsibility among competing uses in reaching adequate quality status at the water body, sub-basin and basin level.

Total user costs for water resources are typically subdivided in three main components – financial, environmental and resource costs:

$$C^T = C^F + C^R + C^E \tag{18.1}$$

Financial costs (C^F) are the costs incurred for the supply and management of water uses and services (see Decree of the Minister of the Environment no. 39 of 25 February 2015). They include capital, operating and maintenance costs for water supply. For the integrated water service, financial costs are determined by the Italian Regulatory Authority for Energy, Networks and the Environment (ARERA) through a standardised Water Tariff Method (*metodo tariffario idrico* – MTI). For all other uses (irrigation, hydroelectric, out-of-network industrial), we could consider them equal to zero, since they are internalised in the users' production function.

Resource costs (C^R) are defined in the guidelines for the implementation of the WFD by the Ministry of the Environment as those generated by inefficiencies in the allocation of water resources among competing uses. They arise if the difference between the value of net benefits of current uses and the value of the best current or future available alternatives is negative (*ibid.*).

Environmental costs (C^E) are the loss in the value of water resources as a consequence of degradation in water ecosystems due to anthropic uses: "[…] the costs linked to damage that water uses may impose on the environment, ecosystems or other users, as well as costs linked to changes in water ecosystems functioning or to resource degradation due both to excessive abstractions and to lower water quality that represent a source of damage for water bodies or the welfare deriving from non-use values of the resource" (*ibid.*). Damages may weigh on two dimensions – quantitative and qualitative – and are associated to modifications with respect to the resource estimated or expected "natural values'", that is, those prevailing in the absence of human use.

The water pricing reform proposal chooses not to include in the base for calculation of user charges the cost of allocation inefficiencies. It simply quantifies the environmental cost of water use as the sum of costs linked to the quantity of resource abstracted and of the costs linked to the altered quality of the returned water due to point or non-point pressures. The estimate of the environmental cost arising from water use (C_i^E) for any of the N abstraction points is thus based on four different dimensions: (i) a physical measure of resource abstraction $\left(Q_i^A\right)$; (ii) indicators of the qualitative and quantitative status of the source rivers and aquifers (α, β, ε, γ);

(iii) a monetary measure of the cost of abstraction (C^A); and (iv) a monetary measure of the external costs associated to qualitative deteriorations in the returned water (C^P):

$$\sum_{i=1}^{N} C_i^E = \left(1+\alpha_i+\beta_i+\varepsilon_i\right) Q_i^A C^A + \gamma C^P \tag{18.2}$$

18.2.2.1 Metering

As mentioned in Sect. 18.2.1, the incumbent system for the allocation of public water adopts different criteria depending on sectors. The quantity of water that users are allowed to withdraw is set at the stage of issuing the licence and is based on self-reported user needs validated by the regulator, and on an evaluation of the impact of new withdrawals on the water body, taking into account already issued licences.

However, these nominal quantities are very weak measures of actual water consumption and can be source of inefficiencies, in terms of allocation, incentive power and information available for policies and management. A proper incentive-based pricing scheme would require the progressive transition from the current structure to a fully metered system, with water pricing uniformly defined in €/m^3.

While the adoption of meters spreads, a transitory first phase of the reform can implement water pricing on the nominal water quantities licenced to each user in each extraction point, determined on the ground of average theoretical flows, rather than on measured withdrawals. Obvious limitations of this phase include uncertainty as to the relation between licenced quantities and real water consumption (made worse by frequently oversized concessions) and a limited incentive capacity towards reducing water use and wasteful behaviour.

After a transitional period meant to allow users to adopt metering devices, water charges should start being calculated either on measured abstractions or, where meter adoption has not occurred, on maximum (rather than average) nominal flow. It has been shown in several contexts that metering alone can generate virtuous behaviour and reduce withdrawals by up to 40% (Sardonini et al. 2011). Transition from pricing on nominal flows to measurement of real abstraction is consistent with the principles of concurrent responsibility in resource use and incentive pricing.

18.2.2.2 Weighing Water Pricing by Availability and Ecological Status of Sources

Correcting the cost of abstractions as a function of the quantitative and qualitative status of the water body allows us to introduce the spatial and temporal dimensions in the water pricing system. The quantification of the physical state of water bodies is made, by expressed choice, with reference to the indices used in water planning and environmental monitoring by regional authorities, in implementation of the WFD.

The first parameter, α, in Eq. (18.2) corrects the cost of resource abstraction on the ground of the quantitative status of the source water body. For surface water bodies, α is calculated by normalising between *0* and *1* the status of the water body measured by the Index of Alteration of the Hydrological Regime (IARI) or by the Water Exploitation Index (WEI+). WEI+ is an indicator of pressure that human activities exert on water resources calculated with reference to a specific territory (basin or sub-basin, or aggregation of basins and sub-basins). It is used to identify the areas potentially subject to water stress, with reference to the actual availability of the resource, to the observed withdrawals and to an appropriate time scale. The index, expressed as the ratio between actual withdrawals and the average natural range on the period 2000–2016, has been simulated on different scenarios of precipitation rates. In years with scarce precipitation, most cases of water stress concentrate in summer (in July, and to a lesser extent in April, May and September). In years with moderate precipitation water stress concentrates in June, July and August. In both scenarios, a strong correlation emerges between water stress and the irrigation season (Regione Piemonte 2018).

For underground water bodies the parameter α is estimated based on the quantitative status of water basins periodically reported by Regional authorities, as requested by the WFD. Monitoring over the period 2005–2017 reports, on average, a stable time path of the Region's aquifers, with a few situations of declining quantitative trends that require careful consideration.

The second parameter, β, corrects the environmental cost on the ground of the qualitative status of the water body affected by the abstraction. The determination of parameter β is based on the classification of water bodies according to the WFD: for surface water bodies it measures both the Ecological Status (ES) and the Chemical Status (CS), while for underground water bodies it measures only the CS.

The monitoring activities carried out by ARPA show that, in 2015, only 55% of Piedmont rivers had a good or higher ES, while 95% of them had a good CS. The Overall State (OS), given by the worst result between the ES and CS, was good only for about half of the rivers (134 out of 248, or 54%). With regard to lake water bodies, only 4 out of 11 (36%) exhibited a good OS, mainly due to bad ES. For groundwater, only the CS is used: a poor status was recorded in 112 points out of 268 (41.8%) for the shallow water table, while in the deep strata 32 points out of 132 (24.25%) were in poor state. If we consider the state of the superficial groundwater basin, only 2 superficial aquifers out of 17 (11.8%) had a good state.[5]

The parameters α and β are updated with the six-year classification of water bodies status as required by the WFD. They can be modified when relevant new information or new indicators become available.

[5] The aquifer model of Piedmont is able to distinguish data pertaining to superficial and deep aquifers, as it has adequately identified the groundwater divide.

The third parameter, ε, weighs on abstractions of resource designated "for human use" (deep aquifer) for purposes different from drinking use. According to the Italian law (Article 96 of Legislative Decree no. 152/2006), this triggers an additional burden on the water charge for non-priority uses of groundwater. In Piedmont, using the Regional dataset of public water licences and water charges GE.RI.CA. (*Gestione Riscossione Canoni*),[6] we observe that 1871 users out of 17,885 (almost 10% of total licences) do exert withdrawals from deep aquifers for non-priority uses. The most involved sector is agriculture with 1321 licences, or 7% of the total.

18.2.2.3 The Weight of Pollution: Calibrating Water Pricing by Quality of the Returned Water

The second addend of Eq. (18.2), γC^P, captures the environmental cost linked to altered chemical-physical characteristics of the returned resource and hydromorphological changes: for instance, the addition of solvents, nutrients, pesticides, and sediments, changes in water temperature, speed or turbulence, or any other change with respect to the qualitative features of the resource in its natural state that may cause harm to the ecosystem where water is returned.

Returning altered water does not have equal consequences in all water bodies. The parameter γ plays the role of correcting the environmental cost of returning degraded water on the basis of the quality status of the water body where the abstracted water is returned. For uses with diffuse water restitution (non-point sources), such as agriculture, the median value of the sub-basin where the abstraction takes place is used as representative value of the ecological status.

18.2.2.4 Seasonality

Since water diversion from rivers in flood season does not entail environmental costs, in contexts where the water flow regime is heavily affected by seasonality it may be appropriate to consider a variant of the above formula:

$$\sum_{i=1}^{N} C_i^E = \left[\left(1+\alpha_i+\beta_i\right)F+\varepsilon_i\right]Q_i^A C^A + \gamma C^P \tag{18.3}$$

where F is a switch that water authorities may use to derogate from charging users for abstraction during water-abundant months (similar to when the regulatory obligation to safeguard the environmental flow is waived during periods of drought). In those periods, the residual price of water would include only the components

[6] GE.RI.CA. is the geo-localised database of licences of water abstraction in Piedmont. It is used to determine charges according to sector, type of withdrawal and any applicable reduction.

associated with the qualitative deterioration imposed on water by human use and the withdrawals for non-priority uses.

18.2.2.5 Affordability

The overall environmental cost of water use thus calculated ($\sum_{i=1}^{N} C_i^E$) is – together with financial and resource costs – one of the components of the total cost that the WFD requires Member States to recover through water pricing. Context-specific results should then be evaluated in light of the affordability principle. If disproportioned costs arise, the system provides for a maximum ceiling, by setting a cap in terms of the cost recovery ratio to be obtained.

18.3 Quantifying the Cost of Abstraction and Pollution: A Simulation for Piedmont

This and the following sections implement an empirical simulation of the above structural reform of water pricing using data from Piedmont. The simulation considers out-of-network industrial, commercial, household, and irrigation and agricultural uses. Energy uses are not included because water charges for hydroelectric plants are connected to the amount of generated energy rather than to the amount of water used, and there is no general conversion factor between the two, depending it on the height of the water jump between source and turbines. The Piedmont Region will address the issue of water charges for energy uses as part of the reform of hydroelectric concessions, in compliance with national Law no. 12/2019.

In Eq. 18.2, as we have seen, C^A is the monetary value of the cost associated with the abstraction of a unit of water from ecosystems. C^P measures the cost of the degradation occurring in the quality of water being used for human purposes.

To quantify C^A and C^P we propose to adopt a cost-based approach, in line with what suggested by national and international guidelines – see, for example, the Common Implementation Strategy by the European Commission (EC 2003). This approach, which takes the form of methods for estimating recovery costs, replacement or more generally avoided costs, presupposes that the costs of avoiding damage or replacing degraded ecosystems represent a measure, albeit partial and hence approximated by default, of the value of the services provided by ecosystems. All cost-based methods are hence based on the supply curve for ecosystem services, so that strictly they do not measure utility. In other words, these methods do not provide information on the underlying demand curve for the relevant sets of ecosystem services, and therefore cannot provide comprehensive measures of total economic value, nor do they necessarily convey complete information about social welfare. On the other hand, they do not suffer from the hypothetical bias affecting, for example, stated preferences techniques, and are very practical, reliable and cost-effective in contexts where restoration or replacement interventions have actually been realised or at least included in the budget of water management plans.

The value of C^A can be estimated as the unit cost of interventions required to ease the pressure on water resources induced by abstractions; we consider, in this exercise, the building cost of multi-purpose reservoirs (a cost-efficient measure). We consider 19 different projects for water storage with heterogeneous features and designs (small, large, and inter-company reservoirs) within the Po river basin. We compute the annualised value by calculating depreciation with the following assumptions:

- 2.85% remuneration of capital (the return rate of 50-year Italian Government bonds);
- different discount rates (5, 6, 7%) to test for sensitivity of results;
- cost in €/m^3 of considered infrastructures calculated on the ground of the volumetric design of the single reservoir. Mean and median of these values have been calculated by excluding tails of the distribution (5°–95° and 10°–90° centile).

The resulting cost of building a water storage system is between 0.05 and 0.084 €/m^3, depending on the discount rate used and on the measure of central tendency employed (Table 18.2). As said above, this estimate should be considered as only an approximation of the environmental unit cost of withdrawals and can be affected by future technological change and exogenous factors.

In order to identify the total annual cost imposed by water abstraction on ecosystems, we do not consider total annual water abstractions taking place in the Region, but only the unsustainable share of them, measured by the water deficit – the excess of water demand over sustainable water supply within each year (satisfied by reducing the stock of non-renewable groundwater in deep aquifers).

The estimate of water deficit is obtained for Piedmont by the MIKE HYDRO Basin simulation, a mathematical representation of river basins defined by including the configuration of river and reservoir systems, catchment hydrology and water user schemes (Regione Piemonte 2018). We consider two different scenarios, for years with average and scarce precipitations.[7]

Table 18.3 reports the values of C^A for different discount rates and of the total annual cost of unsustainable water abstraction for the years with average and scarce

Table 18.2 Replacement costs: simulations (€/m^3)

Discount rate	5%	6%	7%
Mean (€/mc)	0.084	0.072	0.063
Median (€/mc)	0.066	0.057	0.05

[7] The outputs of MIKE HYDRO simulations are available at: www.regione.piemonte.it/ambiente/acqua/dwd/PTA/e_allegati_tecnici/II/IIh01.pdf

Table 18.3 Total cost of water abstraction (C^A) under different scenarios of water deficit

			Water deficit (€)	
Discount rate		C^A	Average precipitation year	Scarce precipitation year
5%	Mean	0.084	57,957,068	161,499,466
	Median	0.066	45,739,144	127,453,778
6%	Mean	0.07	50,039,163	139,435,937
	Median	0.06	39,490,411	110,040,461
7%	Mean	0.06	43,813,215	122,087,108
	Median	0.05	34,576,955	96,349,936

Table 18.4 Cost of water protection measures in Po RBMPs (2015–2021)

	Total cost (€)	Covered costs (€)	Cost to be recovered (€)
Integrated water service	58,565,031	58,475,031	90,000.00
Irrigation	360,824,465	353,527,165	6,754,300
All uses	16,011,403.00	398,000	15,613,403
TOTAL	435,400,899	412,002,196	22,457,703

precipitations. The resulting value of total cost is between 34.5 mln € and 161.5 mln €, depending on average annual precipitation and discount rate.

Let us now consider the cost associated with the qualitative deterioration of the water returned to ecosystems after human use. C^P can be estimated on the basis of mitigation costs specific for categories of pollutants available in the literature (for example, EC 2003). Alternatively, a convenient approximation for the externality associated with altered returned water is the cost borne by water authorities for implementing the water protection measures included in the Water Protection Plan of the Piedmont Region. Monetary measures can be updated every six years, together with the RBMPs, to take into account new adopted measures and/or variations in costs. In the simulation presented here, we adopt the latter approach. In order to implement the polluter-pays principle, we spread the cost of measures among different uses based on the volumes of withdrawn resource.

In theory, the cost of the measures implemented to protect and restore water quality converges to the monetary value of the environmental damage when the measures adopted cover all damages and are sufficient to internalise them completely. Otherwise, as in the present simulation and most real-world contexts, the obtained estimate is an approximation by default.

Table 18.4 presents the cost of measures included in the Regional Plan for Water Protection for the period 2015–2021 (Regione Piemonte 2018). These measures are designed to reduce a variety of pressures on water resources, from pesticides and nitrates abatement to watershed vegetation buffer zones, control of erosion and so on. Some of them are directed to specific uses (in particular in the fields of the integrated water service and agriculture), whereas other have general objectives and pertain to all uses.

In a cost-recovery perspective, the cost of altered returned water to be included in the calculation of water pricing is only the quota of the total cost not yet covered by external resources (i.e., from EU or national funds) or revenues from the tariff of the integrated water service. The aggregate value of C^P turns out to be approximately 22.5 mln €. The share of it originated by irrigation is approximately 30%.

18.4 Proportionality Measures and Affordable Charges

The process of reforming water pricing cannot disregard socio-economic sustainability, through an in-depth analysis of direct and indirect distributive impacts. This requires measuring elasticity of demand and elasticity of substitution of different uses, as well as propagation of impacts within the economic system.

As mentioned in the introduction, one of the principles guiding our approach is identifying methods of analysis and policy design that are replicable without external support within local governments. With this objective in mind, we develop a simple analysis of financial sustainability and distributive impact relying on:

(i) the Benefit-Cost Ratio (B/C) to define the proportionality of the estimated annual total cost associated with the unsustainable share of water abstraction calculated in Table 18.3; and
(ii) the ratio between the expected variation in water charges and the average net income within each category of use in order to verify the ability of users to face any given simulated increase in water charges.

18.4.1 Assessing Proportionality

In order to verify the proportionality of the costs of the measures adopted to contain pressures on water resources, it is necessary to perform a monetary valuation of the environmental benefits resulting from their implementation.

Environmental valuation methods can be distinguished between those with a direct approach and those with an indirect approach. The indirect, or revealed preference, methods (Hedonic Prices, Travel Cost Method) are generally more suitable for assessing the direct use value, whereas techniques with a direct, or stated preference, approach (Contingent Valuation and Discrete Choice Experiments) are the only ones capable of capturing also non-use values and hence to offer a measure of total economic value.

All these methods require carrying out primary studies that are generally expensive and in certain contexts difficult to implement with a good level of reliability. For these reasons, secondary techniques, such as Benefit Transfer (BT), are increasingly employed in the economic valuation of environmental goods and ecosystem services. BT consists in transferring information available for a given context (monetary valuations from primary studies) to other contexts, after appropriate corrections to account for heterogeneity: factors such as geographical location, economic situation (average income, employment rates) or the availability of water in a particular moment in time generally influence the valuation result.

Monetary values for the loss of ecosystem services associated with water uses have been estimated in different contexts (e.g., Bateman and Langford 1997; Brouwer 2006; Milon and Scrogin 2006; Raggi et al. 2009; de Groot et al. 2012; Ramajo-Hernández and Salazar 2012; Russi et al. 2013). The appropriate willingness to pay for individuals living in Piedmont has been identified through an extensive literature review. The study selected as the most appropriate was conducted by Raggi and colleagues on the Po and the Reno basins (Raggi et al. 2009). Their study investigates the value, as perceived by the population, of allowing water to serve ecosystem uses, specifically, avoiding withdrawals for agricultural, industry and energy uses. The estimated willingness to pay is about 38€ per family per year. Considering the number of households resident in Piedmont (2011 census) and adjusting for income differentials between the original area of study and the whole Region, the aggregate benefit (AB) can be computed as:

$$AB = \overline{WTP} \cdot WTP_0 \cdot \ N_{HH} = \cdot \Delta_I = € \, 68{,}414{,}247 \tag{18.4}$$

with $\overline{WTP}$ the average WTP, WTP_0 the percentage of families stating zero WTP in the survey, N_{HH} the number of families living in Piedmont and Δ_I the weight to correct for income differentials.

As all estimates of environmental benefits, this value is affected by the general limitations of environmental monetary valuation techniques, and particularly of those based on the elicitation of individual's willingness to pay – incomplete information by the survey respondents, hypothetical bias, protest bias, scope effects (Hanley and Czajkowski 2019).

Table 18.5 presents the results of the B/C analysis: benefits are the outcome of the BT method described above, whereas costs of abstraction are the aggregate value from Table 18.3. The results show that the precipitation scenario turns out to be a crucial assumption. In the case of a year with moderate precipitation, the ratio B/C is always greater than one, implying that the benefits overcome the costs. In years with scarce precipitation, the ratio is always below 1, independently of the discount rate used – implying (given our BT estimate of benefits based on individual willingness to pay) disproportionate costs.

Table 18.5 Proportionality measure: benefits over costs

			B/C	
Discount rate		C^A	Average year	Moderate year
5%	Mean	0.084	1.18	0.42
	Median	0.066	1.50	0.54
6%	Mean	0.07	1.37	0.49
	Median	0.06	1.73	0.62
7%	Mean	0.06	1.56	0.56
	Median	0.05	1.98	0.71

18.4.2 Assessing Affordability

The affordability of different levels of water charges is assessed by computing the expected change in average income that would occur as a result of the calculated cost-recovery water charges.

For agricultural users we employ the EU-RICA dataset (INEA 2014),[8] which reports average value added, net income and costs of production per hectare for different crops in the Region. We assume a standard agent with a withdrawal rate of 1 L/s per hectare for the irrigation season (one semester per year). The calculated incidence ranges between 22% and 36% of net income (Table 18.6): abstraction charges recovering the whole environmental costs of water use, although approximated by default as done on this exercise, would not be affordable for agricultural firms.

The analysis of incidence for the industrial and commercial sectors faces heavy informational requirements: it would require data on average incomes for different sub-sectors with very different water intensity; in addition, the water licence database does not allow us to match the licenced water amount with the sub-sector of the corresponding company. We therefore use the agricultural sector, which would face both the heavier load and the most significant revision in water charges, as a benchmark for the overall affordability analysis.

An in-depth literature review on the affordability of water pricing (among others, Galioto et al. 2013, which referred to the context of the Po river basin) returns as affordable levels of incidence for productive and commercial sectors values ranging between 0.5% and 3% of net income. Table 18.7 reports the corresponding levels of annual water charge per L/s. We selected as affordable the incidence level of 1.5% of net income. In the agricultural sector this would correspond to an annual water charge equal to 54.86€ L/s (0.014€/m^3 on average).

This rescaled value of water charges, although very far from the level ensuring a full cost recovery (estimated in 788.80 € L/s for farmers and 1577 € L/s for the other sectors) is 100 times higher than the current charge paid by the agricultural sector.

Table 18.6 Incidence analysis (agricultural sector)

Discount rate		C^A	Full cost recovery (€/L/s)	Incidence on average net income of farmers (€)
5%	Mean	0.083	1322.17	36%
	Median	0.066	1043.44	29%
6%	Mean	0.072	1141.54	31%
	Median	0.057	900.89	25%
7%	Mean	0.063	999.51	27%
	Median	0.050	788.80	22%

[8] Data are available at: www.regione.piemonte.it/agri/area_statistica/agridata/dwd/webpie12.pdf

Table 18.7 Simulated annual water charges per L/s versus incidence on net income (agricultural sector)

Incidence level	0.5%	0.75%	1.00%	1.25%	1.50%	1.75%	2.00%	2.50%	3.00%
Mean	€ 18.29	€ 27.43	€ 36.57	€ 45.72	€ 54.86	€ 64.01	€ 73.15	€ 91.44	€ 109.72
Median	€ 10.69	€ 16.03	€ 21.37	€ 26.71	€ 32.06	€ 37.40	€ 42.74	€ 53.43	€ 64.11

Table 18.8 Piedmont region, revised water pricing

Sector	Type of charge	UoM	Current charge	Revised charge			
				C^A	C^P	Total	Minimum
Irrigation and agriculture	Charge 1	€ per L/s	0.56	54.86	1.42	56.42	100
	Charge 2	€ per ha	1.22	54.86	1.42	56.42	
Commercial	Charge	€ per L/s	11.72	110	0.89	110.89	
Household	Charge	€ per L/s	2.37	110	0.89	110.89	
Industrial	Charge	€ per ls	175.94	110	0.89	110.89	

For the other sectors, assuming a new charge of 109.72€ (obtained using the same water price, for the case of a licence of 1 L/s per firm, but for the entire year), the charge increases around 10 times for commercial activities and 55 times for the domestic sector. Only in the case of the industrial sector the new charge would be lower than the current one.

The final rescaled water charges are shown, by sector, in Table 18.8. The total revised charge is the sum of C^A, as simulated in Table 18.7, and C^P, that is the cost of water protection measures (Table 18.4) spread among uses according to their water use.

Finally, minimum payments are standardised for each use at 100 €/year. This value has been identified by the Regional authorities as the annual administrative cost for the management of each licence.

18.4.3 Revenues Simulation Under the Water Charges Reform

Using the database containing the complete population of the water abstraction licences and water charges of the Piedmont Region (GE.RI.CA.), we calculate the revenues under the current scheme of water charges and the reformed one. This is done here as a static exercise, without considering the elasticity of water demand. In reality, the very objective of reforming water charges is inducing a water-saving change in behaviour; the change in the burden that water charges impose on economic activities is therefore expected to increase in reality less than calculated in this section. A simulation of distributive impacts taking into account also water consumption and crop portfolio adjustments is done by Sapino and colleagues (Sapino et al. 2020).

Using the average flow rate of current licences as a proxy of 2017 water abstraction levels and under the assumption of inelastic demand, annual revenues would increase, in aggregate, from 57 mln € to 82 mln € (Table 18.9), potentially generating a substantial fiscal space to finance new measures for the protection and restoration of water resources.

Agriculture, responsible for the largest use of water, is the sector most affected by the charge increase. Annual revenues collected from irrigation licences would increase from 3.5 mln € to 26 mln €. On average, agricultural companies would face an increase in annual water charges of +17.12% with respect to 2017. The strongest increase affects consortia or farmers associations holding licenses for large quantities of water then shared among associates. The burden increases very slowly, due to the system of minimum payments, for farmers up to the 70th percentile in terms of water consumption (Fig. 18.1).

The burden of out-of-network water charges, in terms of overall collected revenues, remains almost unchanged with respect to 2017 for the other sectors considered here. For the industrial sector we measure an average increase of 0.43%, 0.67%

Table 18.9 Current and simulated revenues

Sector	Revenues 2017 (€)	Simulated revenues (€)	Average difference (€)	Average variation (%)
Irrigation and agriculture	3,512,602	25,973,720	6395.45	17.12
Commercial	282,301	318,646	19.68	0.13
Household	1,030,374	2,970,673	1170.97	0.67
Energy	46,266,146	46,266,146	0	0
Industrial	5,944,309	6,367,245	390.31	0.43
Total	57,035,732	81,896,430	1522.87	13.68

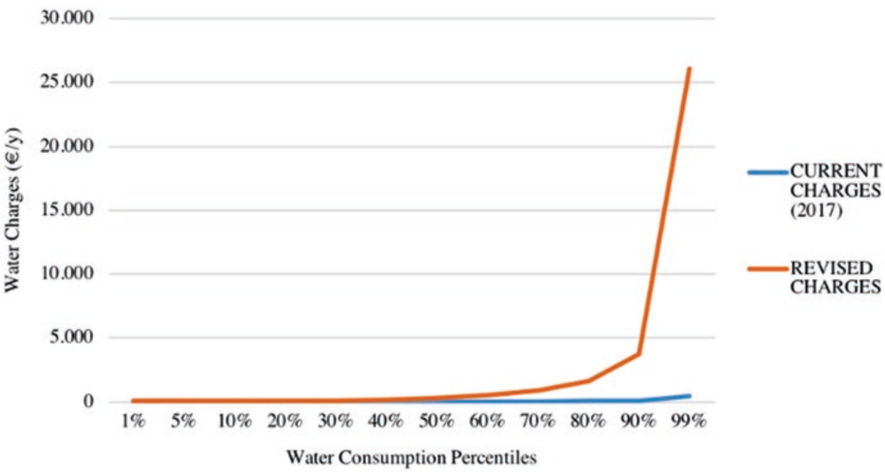


Fig. 18.1 Annual water charges by consumption percentiles

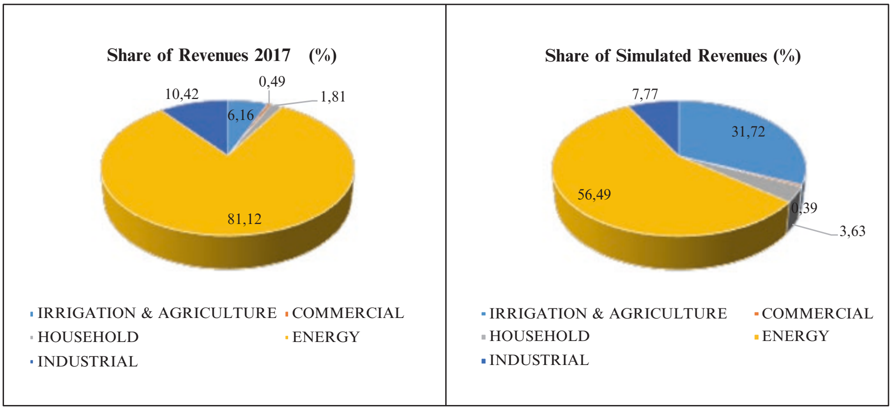


Fig. 18.2 Current and simulated revenues

for households, and 0.13% for commercial uses. As mentioned in Sect. 18.3, the simulated reform is not implemented on the energy sector, the revenues from which in Table 18.9 and Fig. 18.2 are kept constant to 2017.

As discussed in previous sections, the reform proposal described in this chapter is inspired by the objective of linking water charges to water use in order to provide an incentive to virtuous and sustainable behaviour. The shares of revenues from water pricing resulting from the revised system would indeed reduce the distance between withdrawals and contribution characterising the status quo. In 2017, irrigation and agriculture accounted for 6% of total revenues from water charges; under the reform scenario, with the same level of use they would account for almost 32% of revenues. If water charges for energy uses remained unchanged, the relative weight of the energy sector on total revenues would be reduced from 81% to 56.5%; it should be recalled however that also a reform of hydroelectric concessions is under way, in compliance with Law no. 12/2019. All other sectors, that would be affected negligibly in terms of payments, would observe a reduction in the share of total revenues they generate (Fig. 18.2).

18.5 A Spatial Analysis of Pressures and Revenues

We developed a comprehensive geo-localised dataset of water abstractions, water quality and revenues from water charges in order to conduct a spatial analysis of the status quo, in terms of both withdrawals and revenues, and to compare it with the reform scenario. Specifically, we analyse the spatial correlation between pressures and revenues to assess the consistency of the reform design with the user/polluter-pays principle. The spatial analysis also provides some insight into the appropriate scale for water management policies. We show that the introduction of the proposed scheme for determining water charges would substantially improve compliance with the WFD, particularly with respect to the recovery of environmental costs connected with water resource use.

Results from the spatial analysis are then validated by a statistical analysis that demonstrates a correlation between nominal withdrawals and overall payments for water higher under the revised scheme than with the current scheme of water abstraction charges.

Figure 18.3 portrays the spatial distribution of public water licenses (abstraction points). We notice that the greatest concentration of withdrawals is in the plains in the southwestern part of the Region, where we find the urban area of Turin and agricultural land devoted in particular to the intensive cultivation of corn. In the northeast of the Region, where we find a dominance of rice crops, we observe a lower concentration of abstraction points. Nevertheless, if we move from the number of points to the intensity of use (the flow rate per point, Fig. 18.4a), the picture changes substantially.

We employ an interpolation technique, the Inverse Distance Weighting (IDW) method, to obtain a snapshot of the spatial distribution of water withdrawals at the

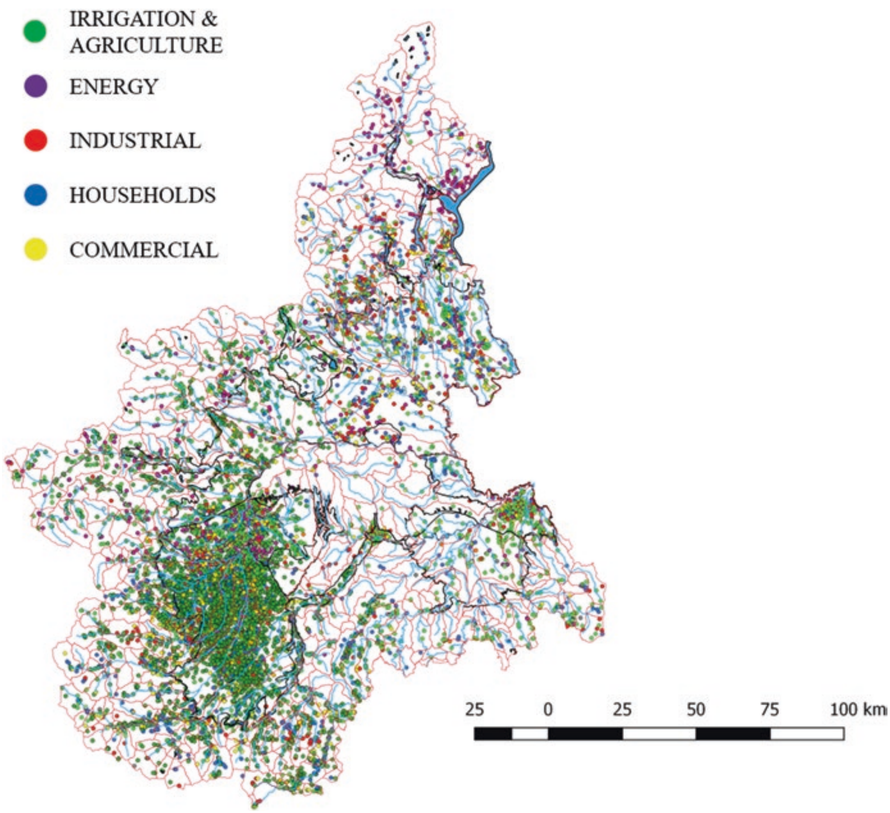
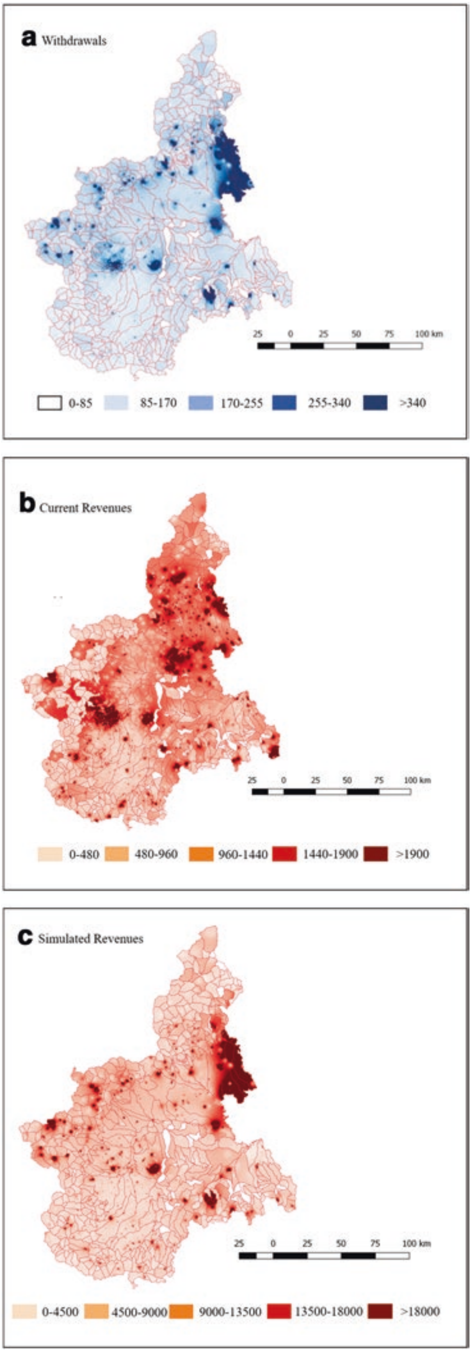


Fig. 18.3 Spatial distribution of abstraction points

Fig. 18.4 (**a**) Spatial distribution of withdrawals, L/s; (**b**) current revenues, €/year; (**c**) simulated revenues, €/year



Regional scale. Immediately evident is the very large use of water resources in the northeast, near the border with Lombardy, in correspondence with the rice production area cultivated with the traditional seasonal flooding technique.

Figure 18.4b presents the spatial distribution of revenues with the current system of water charges (excluding energy), highlighting a concentration of large contributors in the industrial districts of the metropolitan area of Turin in the centre of the Region (automotive), of Biella in the northeast (chemical and textile) and of the Crescentino area in the east (mainly chemical). Figure 18.4c (simulated revenues with the proposed water pricing system), compared with Fig. 18.4a (water withdrawals), highlight the move towards a closer compliance with Article 9 of the WFD.

This insight is statistically confirmed by a correlation analysis between water withdrawals and the current and reformed revenues (Table 18.10). The Pearson index shows that there is a strong positive correlation (0.944) between withdrawals and the revised water charge.

An alternative way to measure the degree of compliance of the water pricing system with the user/polluter-pays principle is by constructing Lorenz curves relative to average values (at the water basin level) of nominal withdrawals, and of current and revised revenues (Fig. 18.5). A perfect alignment of the revenue curve with withdrawals (in black) would represent a perfect correspondence between the pressure exerted by users on water resources and their payments for water abstraction.

The distribution of the proposed revised charge (in green) moves closer than that of current charges (in red) to the distribution of abstractions. A perfect alignment is

Table 18.10 Correlations measures and user/polluter-pays principle

	Current charge	Revised charge
Pearson index	0.284	0.944
Confidence interval (95%)	[0.270; 0.298]	[0.942; 0.945]
p-value	0,000	0,000

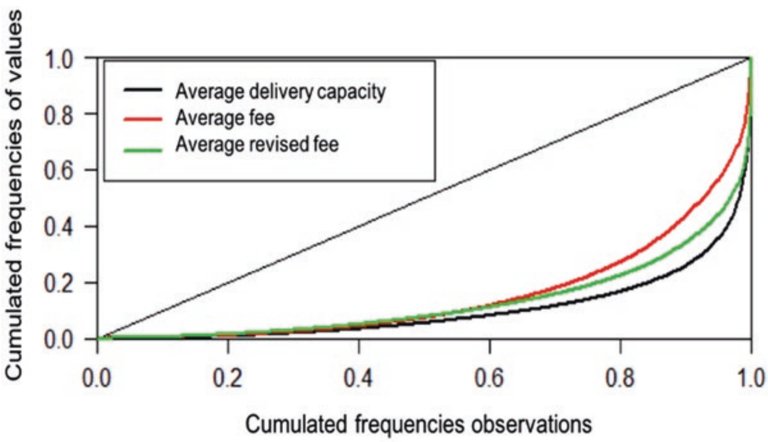


Fig. 18.5 Lorenz curves

prevented by the presence of minimum payments and the weights introduced in Eq. (18.2) to take into account the qualitative status of water bodies.

18.6 Conclusions

This chapter describes the pioneering attempt by the water authorities of the Piedmont Region, in the northwest of Italy, to envision a system of public water abstraction charges based on the assessment of the environmental costs entailed by water use. The reform design endeavours to face and explore the practical difficulties and constraints that arise when implementing Article 9 of the WFD in the real world, and to work as a testing ground for more general reforms of the Italian system of water pricing.

The fundamental point in the proposed system is to make the burden of water pricing proportional, for users, to the impact their use of water imposes on the environment. Such impact arises from the environmental cost both of subtracting resources to freshwater ecosystems, where they provide a variety of supporting, regulatory, and recreational services; and of returning water to ecosystems, after human use, in a state qualitatively degraded with respect to the original one, harming aquatic life and environmental quality. In addition, the reform design takes into account that the marginal damage caused by abstracting water and by returning it polluted also depends, in turn, on the quantitative and qualitative status of the concerned water body.

Precondition for implementing any incentive-based pricing reform is the diffusion of flowmeters to measure the actual abstraction by each licence-holder: efficiency of water use is attainable to the extent the pricing method affects the demand for water.

Water abstraction controls, technically feasible and in place in several parts of the world, still have little diffusion in Italy. In Piedmont, some progress is under way after they have been made compulsory by a Regional regulation issued in 2017 as ex-ante conditionalities to access funding from the EU's CAP. There is probably scope for EU and national level policy guidelines in this domain.

Reforms of abstraction charges such as the one presented here, however, do not necessarily need to wait for a complete adoption of metering devices before being introduced. A transitory phase with water charges calculated on nominal withdrawals rather than on the actual quantities withdrawn would not be able to elicit the full potential incentive to use water efficiently, but would still represent a progress towards the internalisation of the externalities of water use. In addition, it could itself serve the purpose of fostering the diffusion of meters – for example, by using the maximum rather than the average flowrate of licences as the base for calculating water charges for users who have not installed a metering system, or by allowing charge reductions as incentive for the transmission of water abstraction measurement data in real time.

Moving from the theoretical determination of an efficient water charging scheme to its practical implementation requires quantifying the value of the environmental damage associated with water use, and we have shown with this work that, despite data limitations that forced several approximations, it is doable. More sophisticated options for monetary valuation are available, and can be explored in further research and case studies. Here we have chosen, at several junctions, the option that would lead to approximate environmental costs by default. This notwithstanding, the estimate of the costs imposed on the environment by the current patterns of water use points to monetary values that would be considered, if we decided to recover them through water pricing, a disproportionate share of net incomes, particularly for agriculture. The same result was found by Galioto and colleagues for the case of the Emilia-Romagna Region (Galioto et al. 2013).

On the ground of the affordability principle, the final step of the designed water pricing system provides for a rescaling of the environmental-cost-recovering water charges compatible with the maximum incidence a community deems appropriate. In our simulation, we set a cap for the incidence of water charges at 1.5% of net annual incomes. It is very unlikely that this would represent an unaffordable burden for companies using public water as an input in their production process, in any sector. Yet, it represents a move towards recognising water as an essential collective asset of high economic value, which requires to be protected from depletion and degradation, and whose use in economic activities should respect the same logic of efficiency and minimisation of wastage that apply to the use of energy or any other productive input.

The significant rescaling made necessary by the affordability analysis conserves nonetheless the proportionality of users' contribution to the level of damage caused by their own extractions and by the qualitative state of the water as they return it to the environment. Where the state of the returned water is affected by non-point forms of pollution, as for example nitrates and pesticides, and hence environmental monitoring authorities cannot ascertain a direct connection with specific sources, the median value for the ecological status of the sub-basin where the abstraction takes place is used to determine water charges for users in that area. This introduces a principle of joint responsibility among users of a common resource.

The objective of revising water pricing is not raising revenues, but introducing a well-defined and specific incentive to conserve and protect a precious resource. For it to be effective, a crucial point is the elasticity of demand for water. A correct estimate of how the demand for water reacts to price increases is necessary to better investigate the distributive impacts, but even more to understand how large the margin for improving water efficiency is. If water requirements and polluting discharge were substantially a rigid constraint for the economic activities involved, then the proposed system would merely imply a redistribution of resources from users/polluters to the larger society. This would still represent a move towards the implementation of Article 9 of the WFD and would help generate fiscal space for environmental protection and restoration measures, but would have limited incentive potential for changing water use behaviour.

The system design aims at being simple enough to facilitate implementation and transparency, but also adaptive to specificities of local contexts. The calculated licence charge can be modulated through reductions for particular categories of activities, such as, for example, agricultural activities classified as High Nature Value Farming or with organic certifications, industrial activities with environmental certifications (e.g., EMAS), activities of particular socio-economic significance (e.g., activities in mountain environment or other marginal areas, or contribution to management of flood events).

Last, but not least, are the questions of consumptive versus non-consumptive uses and of the relationship between irrigation and groundwater recharge. In Piedmont the most employed irrigation techniques are irrigation by flow (66.62%) and submersion (29.89%) (INEA 2011). Moreover, 96.5% of the Regional irrigation is considered to be of low efficiency. There appears to be potential for increases in water efficiency through a reform of water pricing. However, the transition from a low-efficiency to high-efficiency irrigation systems optimizes the use of water by plants and leads to water saving, but in doing so it decreases the quantity of water that percolates into the aquifers and contributes to their recharge. This, in turn, in some contexts, may impact negatively on feasible groundwater abstraction rates and reduce the dilution of groundwater NO3 concentrations. The ideal system of water pricing, towards which we should be working in the future, ought to be formulated in terms of water balances, rather than withdrawals – although maintaining a focus on the qualitative features of the returned water.

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Chapter 19
Public Participation in the Implementation in Italy of the Water-Related Directives

Elena Fasoli, Massimo Bastiani, and Francesco Puma

Abstract Public participation is one of the most important trends in international environmental law in the last 30 years, since the adoption of Principle 10 of the 1992 Rio Declaration. The European Union's acquis has been influenced by this trend so that today many of its directives and other instruments contain provisions on the need to conduct public participation. In the water sector, the key legislative sources of public participation (that includes information supply, consultation processes and active involvement) are Article 14 of the Water Framework Directive and Article 9(3) of the Floods Directive. The chapter explores the way Italy has implemented these provisions with a reference to practical cases and by considering the relevant levels of government (State, river basin districts and Regions). Special attention is also devoted to the study of the so-called "river contracts" negotiated between institutions and the general public – a practice that has now a solid history in Italy.

Keywords Public participation · River basin management plans · Flood risk management plans · River contracts

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19.1 Public Participation in Environmental Matters: The International Background

The key international source of public participation in the environmental decision-making is Principle 10 of the Declaration from the United Nations Conference on Environment and Development of 1992:

> Environmental issues are best handled with participation of all concerned citizens, at the relevant level. At the national level, each individual shall have [...] the opportunity to participate in decision-making processes. States shall facilitate and encourage public awareness and participation by making information widely available [...].[1]

According to Pallemaerts (2008, p. 153), Principle 10 gave the impulse for "a global movement towards the further elaboration and affirmation, in both soft law and hard law, of procedural environmental rights". Indeed, despite being a non-legally binding (soft law) provision, Principle 10 has contributed to the elaboration of legally binding (hard law) obligations in this field, such as, for example, the 1998 Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters (Aarhus Convention).[2] The Aarhus Convention is a regional instrument adopted within the framework of the United Nations Economic Commission for Europe (UNECE). It constitutes a key step in the path of integrating human rights concerns with environmental protection. In order to contribute to the protection of the right of every person of present and future generations to live in an environment adequate to his or her health and well-being, the Aarhus Convention recognises three procedural environmental rights: access to information, public participation in decision-making and access to justice in environmental matters.[3] These rights entail corresponding duties upon the Parties to the Convention.

As far as the addressees of public participation are concerned, the Aarhus Convention distinguishes between, on the one hand, the "public" (i.e., natural or legal persons and, in accordance with national law or practice, also organisations, associations and groups that can request for environmental information under Article 4), and, on the other hand, the "public concerned" (i.e., those who are

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[1] *Report of the United Nations Conference on Environment and Development*, UN Doc. A/CONF.151/26 (Vol. I), https://www.un.org/documents/ga/conf151/aconf15126-1annex1.htm. In general, see Ebbesson (2015).

[2] United Nations Treaty Series vol. 2161, p. 447. Amongst the rich literature on the Aarhus Convention, see particularly Pallemaerts (2011), Ebbesson (2009). In the Italian literature with specific regard to the water sector, see Louvin (2018, pp. 163–165).

[3] The Aarhus Convention establishes the minimum standards in environmental procedural rights that the contracting Parties must guarantee to the members of the public through regulatory, legislative and other necessary measures. The provisions detailing them are articulated on three so-called "pillars", namely access to information (Arts. 4, 5), public participation in decision-making (Arts. 6–8), and access to justice in environmental matters (Art. 9). These pillars form the basis of the Convention and are strictly linked to each other. Only the application of all three of them can grant a successful implementation of the Convention and establish a firm regime of environmental democracy. For further details on the provisions of the Aarhus Convention see Fasoli (2017).

affected or likely to be affected by or having an interest in the environmental decision-making, who could, for example, be informed by the public authorities of a particularly dangerous activity in the process of being authorised under Article 6(2) of the Convention).

One has to note, though, that beyond procedural rights in favour of the public/public concerned, the Aarhus Convention stops short of providing a substantive right of every person to live in a healthy environment.[4] Indeed, to the contracting Parties of the Aarhus Convention, complying with such a legal right must have appeared too burdensome.[5]

The existence of a human right to a clean and healthy environment is currently debated at the international level.[6] In this regard, a brand-new binding regional instrument seems to constitute a step forward in the direction of the recognition of the existence of such a right. The 2018 Escazù Agreement on Access to Information, Public Participation and Justice in Environmental Matters (Escazù Agreement) adopted in the context of the United Nations Economic Commission for Latin America and the Caribbean (UN-ECLAC),[7] is modelled on the Aarhus Convention. However, it differs from the latter in so far as it formulates the right of every person to live in a healthy environment not just as an "aspiration", but as a legal obligation

[4] It is worth noticing that no absolute dichotomy exists between procedural and substantive environmental rights. Rather, they exist on a continuum. Procedural rights are in fact entrenched in themselves with elements of substance, if not in letter, at least, in practice. The exercise of procedural environmental rights substantiates to a certain degree a theoretical right to a clean environment. On the relationship between procedural and substantive environmental rights see, for example, Boyle (2012), Marin-Duran and Morgera (2013).

[5] Upon signature and ratification of the Aarhus Convention, the UK, significantly concerned about "substantive interpretations" of the Preamble and of Art. 1 of the Convention, made a declaration to the effect that the reference to "a right to live in an environment adequate to his or her health and well-being" represents only an aspiration which motivated the negotiation of the Convention, whereas the legal rights are limited to the rights of access to information, public participation in decision-making and access to justice in environmental matters.

[6] The only two other (regional) instruments that have explicitly provided for a human right to a healthy environment are: the African Charter on Human and Peoples' Rights and the Additional Protocol to the American Convention on Human Rights (the so-called San Salvador Protocol). The right to live in a healthy environment contained in the latter instrument under Art. 11 does not have enforceable character, though. It cannot be subject to an individual petition to the Inter-American System on Human Rights (Art. 19(6)). However, a recent (November 2017) Advisory Opinion of the Inter-American Court of Human Rights could open the doors to a different interpretation (see http://www.corteidh.or.cr/docs/opiniones/seriea_23_esp.pdf). In essence, the Court stated that the right to a healthy environment protects the environment *per se* and that, therefore, it would not be necessary to prove its connection to other human rights. According to the Court, even though Article 11 is not enforceable through individual petitions, the right to a healthy environment would be justiciable under Art. 26 of the American Convention on human rights on "progressive development".

[7] The Agreement has not entered into force yet. See the status of ratification at https://treaties.un.org/Pages/ViewDetails.aspx?src=TREATY&mtdsg_no=XXVII-18&chapter=27&clang=_en

for Parties.[8] In other words, within this new regional instrument, the Parties have agreed to make sure that environmental decisions are not only taken after having included public consultation, information provisions and access to review procedures, but they also have committed to a higher level of protection, namely, that of guaranteeing that every person within their jurisdiction lives in a healthy environment.[9]

19.2 Public Participation in European Environmental Law with a Specific Focus on the Water Framework Directive and the Floods Directive

The international context on public participation, both in its soft law and hard law components, has influenced the European Union (EU)'s acquis,[10] including the EU legislation on water protection.

Whilst the present contribution will focus mainly on the public participation provisions contained in the Water Framework Directive (WFD)[11] and in the Floods Directive (FD),[12] it is worth mentioning that, as far as the legislative technique is concerned, the EU has assumed obligations with regard to the participation of the public in environmental matters through the adoption of dedicated legislation,[13] as

[8] Art. 4(1) provides that "Each Party shall guarantee the right of every person to live in a healthy environment and any other universally-recognized right related to the (present) Agreement".

[9] It rests to be seen, once the instrument will be entered into force, to what extent the Parties to the Escazù Agreement will comply with this provision. On the progressive recognition of a right to a healthy environment see also *Human Rights Council, Report of the Special Rapporteur, Issue of human rights obligations relating to the enjoyment of a safe, clean, healthy and sustainable environment*, UN Doc. A/HRC/40/55 (8 January 2019), https://ap.ohchr.org/documents/dpage_e.aspx?si=A/HRC/40/55

[10] According to Article 10(3) of the Treaty on the European Union (TEU) "decisions in the Union shall be taken as openly as possible and as closely as possible to the citizens" and "every citizen shall have the right to participate in the democratic life of the Union".

[11] Directive 2000/60 establishing a framework for Community action in the field of water policy [2000] OJ L327, 22.12.2000, p. 1. The WFD is considered by legal doctrine as a "governance mode" directive that leaves Member States a great degree of discretion in its implementation. On the difference between this type of directive and the "classical" ones see particularly van Holten and van Rijswick (2014). For a recent assessment of the results brought by the WFD 15 years since its adoption, also in the field of participation, see Voulvoulis et al. (2017).

[12] Directive 2007/60 on the assessment and management of flood risks [2007] OJ L288, 6.11.2007, p. 27.

[13] Such as, for example, Directive 2003/4 on public access to environmental information, [2003] OJ L41, 14.12.2003, p. 26; and Regulation 1367/2006 on the application of the Aarhus Convention to its institutions and bodies, [2006] OJ L264, 25.9.2006, p. 13.

well as by adding public participation provisions in already existing instruments, including directives related only indirectly to the water sector.[14]

As far as the WFD is concerned, the relevant provision on public participation (even though the expression "public participation" does not appear in the text itself) is Article 14 on "public information and consultation".[15] In essence, Member States (MSs) shall encourage the "active involvement" of "all interested parties" in the implementation of the WFD, in particular, in the production, review and updating of the river basin management plans (RBMPs) that set out the actions that MSs have to take in order to improve water quality (note the use of the formula "shall encourage"). In addition, MSs shall ensure that, for each river basin district (RBD),[16] they publish and make available to the "public", including "users", a set of schedules and documents for the preparation and review of the RBMPs (this phase is called "consultation"). MSs shall also give access to background information upon request (this is called "information supply": here the formula is "shall ensure"). Article 14 WFD is then compounded by two other provisions contained in the preambular paragraphs of the Directive, whereby it is referred to "information, consultation and involvement of the public, including users" (Recital no. 14) and to the "involvement of the general public" in the decision-making (Recital no. 46).

As far as the FD is concerned, the relevant provisions are Articles 9(3) and 10. Here, the text explicitly refers to the need to coordinate the "active involvement" of the "interested parties" with the public participation process undertaken under the WFD. The coordination of the two processes testifies to the existence of a holistic managerial approach in the water resource management, also known as Integrated Water Resources Management (IWRM).[17]

More specifically, under the FD the consultation process requires that MSs shall make available to the "public" a list of documents including the flood risk management plans (FRMPs) (note the use of "shall make available"), and that they shall encourage the "active involvement" of the "interested parties" in the preparation and review of the FRMPs (note the use of "shall encourage").

It follows from the foregoing that in both the WFD and in the FD public participation is made of three components: information supply, consultation processes (that are to be *ensured*), and active involvement (that is to be *encouraged*).

[14] This is the case, for example, of Directive 2003/35 providing for public participation in respect of the drawing up of certain plans and programmes relating to the environment and amending with regard to public participation and access to justice Council Directives 85/337/EEC and 96/61/EC [2003] OJ L156, 25.6.2003, p. 17; and of Directive 2010/75 on industrial emissions (integrated pollution prevention and control), [2010] OJ L333, 17.12.2010, p. 17.

[15] In legal doctrine, see Newig et al. (2005), Howarth (2009), Luporini et al. (2018), Jager et al. (2016).

[16] As provided for under Art. 2(15) WFD, a "river basin district" is the area of land and sea, made up of one or more neighbouring river basins together with their associated groundwaters and coastal waters.

[17] For a detailed analysis of the application of the IWRM principle to the public participation provisions of the WFD see, for example, Ker Rault and Jeffrey (2008).

The absence of a common understanding as to the meaning of the terms used in the WFD and FD, potentially leading to difficulties in the implementation of these directives, made the EU Commission engage in a "clarification exercise" taking place entirely outside their legal framework. In 2003, the Commission adopted a Common Implementation Strategy (CIS) – which is a non-binding document (soft law)[18] – dedicated to the interpretation of the provisions on public participation specifically.[19]

The 2003 CIS clarifies, for example, the difference between the consultation process and the active involvement. In the former, the public authorities ask the views of the people and of the interested parties about a certain activity or project, even though they do not have to "take on board" necessarily these views. The latter is the highest level of participation in so far as the interested parties participate more actively in the planning process.[20]

The CIS on public participation also shows the standard of due diligence against which the conduct of MSs under Article 14 should be assessed. In essence, the reference to "shall ensure" means that "consultation [and information supply] is an obligation, which has to be performed"; whereas the reference to "shall encourage" means that MSs have to make a clear effort to promote and facilitate the active involvement of the interested parties.[21]

Whilst these phases build on each other in so far as active involvement implies that the public authorities have already conducted consultation (and, in turn, consultation implies that the authorities have guaranteed information supply),[22] recent case-law demonstrated that maintaining a distinction between these phases bears some significance.

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[18] CISs are adopted through the cooperation of the EU Commission and the public and private actors, including stakeholders and experts. See Bogaart (2014, p. 61).

[19] *Common Implementation Strategy for the Water Framework Directive (2000/60/EC), Guidance Document no. 8*, http://ec.europa.eu/environment/water/water-framework/facts_figures/guidance_docs_en.htm

[20] More precisely, consultation is when "administrative bodies consult people and interested parties (stakeholders) to learn from their knowledge, perceptions, experiences and ideas. Consultation is used to gather information or opinions from those involved to develop solutions based on this knowledge. Reports, scenarios or plans are presented and people are asked to comment. The process does not concede any share in decision-making, and professionals are under no formal obligation to take on board people's views". Active involvement means "participation in the development and implementation of plans. Interested parties participate actively in the planning process by discussing issues and contributing to their solution". By way of example, the 2003 CIS suggests that MSs could encourage that water use sectors could be represented in river basin organisations (*ibidem*, p. 13).

[21] *Ibidem*, p. 18. This is confirmed by the Court of Justice of the EU: Art. 14 WFD is intended to confer on interested parties and, more widely, on the public, a right to be actively involved in the implementation of the Directive and, in particular, in relation to the RBMPs (Judgment of the Court (Third Chamber), 30.11.2006, case C-32/05, para. 80).

[22] *Common Implementation Strategy for the Water Framework Directive (2000/60/EC), Guidance Document no. 8*, p. 13.

In 2015, in a case involving the possibility for environmental associations to have access to justice in water law proceedings, the Court of Justice of the European Union (CJEU) clarified that "active involvement" in the implementation of the WFD (Article 14, first sentence) is meant to encompass a broader variety of processes – therefore, not only those related to the preparation or updating of RBMPs.[23] The Court has stated that active involvement should be encouraged also in relation, for example, to a permit released by an Austrian public authority to abstract water from a river for the purposes of producing snow for a ski resort, being this activity potentially a cause of deterioration of the status of a body of water. Here, the Court noted that even if the provision of Article 14, first sentence, does not contain "actual obligations" in so far as it is "somewhat aspirational in nature",[24] at the same time, it calls MSs to respect the very substance of the article, namely, the "obligation to encourage all relevant parties actively to participate in the implementation of that directive".[25] Within the latter, the Court meant to include also processes for the granting of permits in respect of particular projects that may cause the deterioration of the status of water without involving necessarily RBMPs.

Be that as it may, the WFD contains a very strict schedule in relation to RBMPs. This includes the publication of a timetable and work program 3 years before the beginning of the period to which the RBMP refers (Article 14(1)(a)); of an interim overview of the significant water management issues that will be identified in the river basin 2 years before the same period to which the RBMP refers (14(1)(b)); and of a draft copy of the RBMP at least 1 year before that period (Article 14(1)(c)). In addition, the documents used for the development of the draft copy should remain open for comments for at least 6 months (Article 14(2)).

Finally, still in relation to the meaning of the provisions contained in the WFD and FD, one should note the interchangeable use of a plurality of terms (for which no definition is provided in the text) to describe the addressees of the public participation processes: e.g. "interested parties", "public", "general public", even "users". This is in stark contrast with the provisions contained in the instruments adopted at the international level. The Aarhus Convention, for example, refers to (and appropriately defines) the "public" and the "public concerned" only.[26] In this regard, the 2003 CIS on public participation offers some clarification. With reference to consultation and background information, it specifies that the relevant addressee is the public (including general public and users), whereas in relation to the active involvement, the relevant actors are the interested parties also called "stakeholders". The latter have to be properly selected by the public authority applying factors such as the likelihood of being potentially affected by the environmental decision-making.[27]

[23] Judgment of the Court (Second Chamber), 20.12.2017, case C-664/15.

[24] *Ibidem*, para. 74.

[25] *Ibidem*, para. 75.

[26] See *supra* Sect. 1.

[27] *Common Implementation Strategy for the Water Framework Directive (2000/60/EC), Guidance Document no. 8*, pp. 15–16.

Therefore, despite the plurality of terms used in the two Directives, these terms can be eventually traced back to the distinction between public and public concerned as contained in the Aarhus Convention.[28]

After analysing the relevant provisions on public participation contained in the WFD and in the FD, in the next section we will address how (and to what extent) these provisions have been implemented within the Italian legal system.

19.3 Public Participation in the Water Governance in Italy

In Italy, the Code on the Environment[29] contains requirements for public participation in the water sector, both at the level of RBDs and at the regional level.[30] Article 66(7)(a) of the Code provides that the RBD Authorities promote the active participation of all interested parties in the elaboration, review and updating of the RBMPs. This is also reflected in Article 117(1), whereby "in the preparation of the managements plans, the River Basin Authorities have to ensure the participation of all the institutional actors that are competent in the specific sector". Similar provisions apply to the preparation, review and updating of flood risks management plans.[31]

The public authorities ensure that, for each RBD, the public (i.e., one or more natural persons or legal persons, as well as their associations, organisations or groups),[32] including "users", are granted a period of at least 6 months to present written observations in relation to (a) the schedule for the presentation of the plan, including a declaration of the consultative measures at least 3 years before the period that the plan is referring to; (b) the preliminary overall assessment of the main issues related to water management that can be identified in the river basin district at least 2 years before the period that the plan is referring to (the next one being the period 2021–2027); (c) the copy of the project for the river basin plan, at least 1 year before the period that the plan is referring to.[33]

[28] See *supra* Sect. 1.

[29] Legislative Decree no. 142/2006.

[30] For the earlier stages of the legislation and practices of public participation in Italy see, particularly, Massarutto et al. (2003). For a broader overview about the evolution of water management and protection in Italy see particularly Alberton and Domorenok (2012).

[31] This is provided for by Art. 10 of Legislative Decree no. 49/2010 referring to the implementation of the FD.

[32] Article 5(u) of the Code on the Environment. This definition is in line with that contained in the Aarhus Convention and in the Directive 2001/42/EC on the assessment of the effects of certain plans and programmes on the environment [2001] OJ L197, 21.7.2001, p. 30. See *supra* Sect. 2.

[33] Each RBMPs is then adopted in the context of a "permanent institutional conference" that brings together the representatives of the Regions involved in the respective RBD with representatives of national ministries, such as environment, agriculture and transport. To this conference can be also invited to participate two members of the most relevant agricultural organisations in the country and one representative from the national association for the management and protection of the water for irrigation (*Associazione Nazionale Consorzi di gestione e tutela del territorio e acque*

These provisions clearly transpose Article 14 of the WFD with one exception. The Italian legislation essentially refers to review and updating of the RBMPs and does not transpose the part of the WFD (i.e., Article 14, first sentence) where the MSs would be required to make a clear effort to encourage all relevant parties actively to participate in other processes involving, for example, projects that may cause the deterioration of the status of water, not necessarily related to the preparation or updating of RBMPs.[34]

Be that as it may, compliance with the above provisions has required quite some time. As also highlighted by the legal doctrine, as of 2012, the majority of these deadlines was still not met and the only formally fulfilled procedure was the six-month period for sending written comments on the first draft documents.[35] At least in relation to this aspect, things seem to have slightly changed in the context of the RBDs that appear more virtuous. As it will be shown in the next sub-section, in the RBD Authority of the Eastern Alps, for example, the schedule for the presentation of the FRMP, including a declaration of the consultative measures to be undertaken, has been made available in December 2018, therefore, 3 years before the completion of the first update of the FRMP which will have to be made by December 2021.[36]

The procedural provisions on public participation have to be read against the broader institutional setting of the Italian water governance. In this regard, already in 2015, the EU Commission was highlighting significant flaws in the administrative arrangements, particularly in relation to the coordination between Regions and the RBD Authorities. According to the Commission, this lack of coordination could affect the activity of reporting to the Commission which Italy is bound to under Article 15(3) WFD.[37]

Flaws in the water governance, with specific regard to the broader institutional setting, had indeed been stressed by legal doctrine already,[38] and now also experts

irrigue or ANBI) (Art. 63(5) of the Code on the Environment). The RBMPs become legally binding once approved by the President of the Council of Ministers (Art. 57(1), of the Code on the Environment).

[34] See *supra* Sect 2.

[35] According to Alberton and Domorenok (2012, p. 403), this was due to the fact that the "former basin authorities were asked by the Ministry of Environment to prepare management plans a few months before the time period set by the WFD expired".

[36] See <http://www.alpiorientali.it/direttiva-2007-60/pgra-2021-2027/partecipazione.html>

[37] Amongst the recommendations addressed to Italy the EU Commission included the need to: "improve coordination between regions and RBD authorities and improve reporting to make it more integrated at RBD level (it is essential to clarify the respective roles of the Regions and RBD authorities and give further detail on the integration and coordination of regions, RBD and the national level for reporting)" (*Commission Staff Working Document, Report on the progress in implementation of the Water Framework Directive Programmes of Measures, Brussels, 9.3.2015 SWD(2015) 50 final*, p. 118).

[38] By way of example, Alberton (2012, p. 389) was referring to a "general institutional resistance to change and to the strong influence of political actors whose interests have not been aligned with the strategy envisaged by the [WFD], against a fragmented and conflictual legislative background".

have confirmed the existence of a high degree of fragmentation in the Italian water governance.[39]

This fragmentation has an impact also on the way Italy fulfils the public participation provisions that have been described above. Already in 2012, the EU Commission was highlighting the importance to introduce “a clear governance structure that would encourage public participation in both the development and delivery of necessary measures to deliver sustainable water management”.[40] In that regard, the Commission was recommending that “the transition of the RBD Authorities from a provisional to a permanent system should be completed”.[41]

Including with a view to address this specific aspect, in December 2015 Italy adopted Law no. 221/2015 that integrated the Code on the Environment and introduced a permanent system of RBD Authorities replacing the temporary one based on a decentralised system of national, inter-Regional and Regional river basin Authorities.[42]

The RBDs are currently seven. Law no. 221/2015 also introduced a new delimitation of the territorial boundaries of the respective districts. For example, the RBD Authority of the Po river now includes river basins that were previously under the responsibility of other RBD Authorities.[43] In essence, the new Law was aiming at granting RBD Authorities a more prominent role in relation to the preparation of RBMPs and FRMPs that have European relevance.[44]

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[39] Interview on 24 January 2019 with Daniele Rossi (RBD of Eastern Alps) and Rocco Scolozzi (LIFE FRANCA, a European project focusing on flood risk anticipation and communication in the Alps). According to the experts, the high fragmentation in the institutional water governance could create confusion about, for example, who the competent authority is, including for the public participation processes. There are too many different institutional entities that one could potentially refer to: next to RBD Authorities, *Genio Civile*, *Consorzi di Bonifica*, river contracts, ARPA (Regional Environmental Protection Agency), Municipalities, amongst others.

[40] *Commission Staff Working Document, Member State: Italy, Accompanying the document Report from the Commission to the European Parliament and the Council, on the Implementation of the Water Framework Directive, Brussels, 14.11.2012, SWD(2012) 379 final*, p. 53.

[41] *Ibidem*.

[42] Art. 3 of Ministerial Decree no. 294/2016 provided that, starting from February 2017, all the RBD Authorities had to take up all the functions of the national, inter-Regional and Regional river basin Authorities.

[43] The river basin of *Fissero-Tartaro-Canal Bianco* was previously under the Authority of the Eastern Alps.

[44] Whereas, with a specific focus on the quality and quantity of the water body, the preparation, for example, of the Water Protection Plans (*Piani di tutela delle acque*), and the public participation thereto, as part and parcel of the process to adopt the RBMPs, still falls under the competence of the Regions. To that effect Art. 122 of the Code on the Environment provides that the Regions “promote the active participation of all the interested parties in their elaboration, review and update”. In addition, upon request duly motivated, the Regions authorise the access to the background documents for the preparation of the plan, and they also make publicly available a) the schedule for the presentation of the plan, including a declaration of the consultative measures at least 3 years before the period that the plan is referring to; b) the preliminary overall assessment of the main issues related to water management that can be identified in the river basin district at least

These modifications in the governance structure did not go unnoticed. In the new assessment of the second RBMPs in February 2019, the EU Commission acknowledged the fact that Italy "has taken steps to strengthen the role of the RBD authorities and [has] improve[d] coordination among regions within each RBD, setting a clearer hierarchy between RBMPs and regional plans".[45] Yet, if one looks carefully at the provisions contained in Law no. 221/2015 it does not seem that the problems of coordination between the different entities are overcome fully. How should one interpret, for example, the provision according to which "the Ministry of the Environment, also with the assistance of ISPRA, will orientate the RBDs and their coordination" under Article 63(2) of the Code on the Environment? What is exactly the role played in this regard by ISPRA (*Istituto Superiore per la Protezione e la Ricerca Ambientale*), which is a public research body under the supervision of the Ministry of the Environment? The silence of the Law on these operational aspects increases the risks of further fragmentation of the water governance.

Leaving the institutional governance aside, the most recent assessment of the EU Commission has also detected that in some RBDs the timetable provided for in the WFD for adopting and publishing the RBMPs has not been respected.[46] Evidently, Italy is still struggling with these procedural requirements.

Another point that has been highlighted by the EU Commission is that the extent of consultation undertaken has varied greatly across the RBDs.[47] For example, whilst in 2012 the RBD of the Po Basin was championing alone under this aspect,[48] the 2019 assessment shows that consultation is on the increase throughout the other RBDs,[49] even though the level of this consultation varies greatly. The Commission reports that there is a lot of variation in the mechanisms to inform the public and the interested parties.[50] There are major differences also in the stakeholder groups

2 years before the period that the plan is referring to; c) the copy of the project for the river basin plan, at least 1 year before the period that the plan is referring to".

[45] *Commission Staff Working Document, Second River Basin Management Plans – Member State: Italy, Accompanying the document Report from the Commission to the European Parliament and the Council, on the Implementation of the Water Framework Directive and the Floods Directive, Brussels, 26.2.2019 SWD(2019)51 final,* pp. 11, 34.

[46] *Ibidem*, p. 11.

[47] A word of caution is in order here: the assessments made periodically by the EU Commission, including regarding the way public information and consultation for the RBMPs and FRMPs are undertaken in the different RBDs, are based on MSs' own reporting, integrated by the information posted on the official websites of the RBDs. Therefore, the assessments do not necessarily reflect the way public participation is conducted in each case.

[48] *Commission Staff Working Document, Accompanying the document Report from the Commission to the European Parliament and the Council, on the Implementation of the Water Framework Directive, Brussels, 14.11.2012 SWD(2012) 379 final*, p. 8.

[49] This is also thanks to the practice of the river contracts as it will be explained in Sect. 4.

[50] The Commission, for example, reports that media (such as papers, television or radio) were used in three RBDs (Serchio, Central Apennines and South Apennines); printed material was used in two (Padan and Central Apennines); and social networks (for example, Twitter, Facebook) in one RBD (Northern Apennines) (*Commission Staff Working Document, Second River Basin Management Plans – Member State: Italy, Accompanying the document Report from the*

involved in the development of the RBMPs,[51] and in the mechanisms for the active involvement of stakeholders.[52]

A fragmented picture appears also with regard to the first assessment of the FRMPs. The EU Commission flags out the active involvement of the interested parties in all FRMPs (essentially through public meetings), but also a certain degree of variation in the level of the information provided.[53] For example, for several FRMPs, the public was given limited information on the approach to consultation or on its effects.[54]

Against the above background, in the next section we will make a brief reference to a specific RBD. We will describe some of the public participation practices undertaken in relation to the FRMPs of the RBD for the Eastern Alps.[55]

19.3.1 Public Participation in Relation to the FRMPs of the Eastern Alps

The RBD Authority of the Eastern Alps undertakes planning activities for the anti-flood defences, for the development of the flood hazard maps and flood risk maps, as well as for the protection of water resources and aquatic environments.[56]

Commission to the European Parliament and the Council, on the Implementation of the Water Framework Directive and the Floods Directive, Brussels, 26.2.2019 SWD(2019)51 final, p. 28).

[51] The Commission, for example, reports the involvement of NGOs/nature protection groups (in all RBDs but Sicily); of consumer groups (in all RBDs but Padan, the Northern Apennines and Serchio); of universities and research centres (in the Eastern Alps, Padan, Central Apennines and Southern Apennines RBDs) (*ibidem*).

[52] The Commission, for example, mentions the establishment of advisory groups in three RBDs (Eastern Alps, Padan and Central Apennines), involvement in drafting in three RBDs (Eastern Alps, Padan and Sardinia); regular exhibitions in three RBDs (Eastern Alps, Central Apennines and Southern Apennines); and formation of alliances in three RBDs (Padan, Southern Apennines and Sicily) (*ibidem*, pp. 28–29).

[53] For example, only some of them (those for the Eastern Alps, Central Apennines and Puglia/Ofanto) identify stakeholders that were actively involved, including both private groups such as businesses and NGOs, as well as public bodies, such as Civil Protection authorities (*Commission Staff Working Document First Flood Risk Management Plans – Member State: Italy, Accompanying the document Report from the Commission to the European Parliament and the Council on the Implementation of the Water Framework Directive and the Floods Directive, Brussels, 26.2.2019 SWD (2019) 81 final*, p. 20).

[54] *Ibidem*, p. 22. The Commission in fact eventually recommended that the "FRMPs should consistently provide information on the process for public participation and active involvement of stakeholders or indicate where this information is available" (*ibidem*, p. 24).

[55] Above n. 39.

[56] See the website at www.alpiorientali.it.

Under the new delimitation of the territorial boundaries of the RBDs, the RBD Authority of the Eastern Alps now operates on the river basin of the Adige, Alto Adriatico, Friuli-Venezia Giulia and Veneto and Lemene.[57]

At the time of writing (August 2019), the RBD Authority of the Eastern Alps is in the process of preparing the first update of the FRMP by the end of 2021.[58] As showed above, the publication of the schedule for the plan, including a declaration of the consultative measures to be undertaken, have to be undertaken 3 years before the starting of the new plan.[59] To this effect, the new schedule for the RBD of the Eastern Alps, containing measures for public consultation, has been adopted and made available since December 2018.[60] As it emerges from this schedule, public participation in the RBD of the Eastern Alps, amongst others things, aims at promoting the dialogue as a strategy for the elaboration of the FRMP; at acknowledging the legitimacy of all the positions represented during the process; at highlighting common points and envisaging solutions to resolve potential conflicts; and at encouraging a better cooperation between public authorities and private ones in the elaboration of the FRMP.[61]

In terms of the identification of the actors involved in the participation process, the RBD Authority of the Eastern Alps undertakes a selection based on the following factors: the importance and role played by the stakeholder in relation to the specific water management issue; who they represent with regard to the issue at stake; the social context within which the participation takes place; and the capacity of the stakeholders to participate.[62] In practice, a preliminary selection is made of stakeholders who are invited to the kick-off meetings of the consultation phase (for example, citizens affected by environmental decision-making, but also public authorities' representatives, professionals or academics) and these actors are asked, in their turn, to identify additional stakeholders to be involved in the process, which is also open to those asking to participate (so-called "auto-configurazione dei soggetti da interessare").[63]

In 2019, the EU Commission has flagged out some good practices with specific regard to the RBD of the Eastern Alps. Amongst these, there are the methods used

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[57] Art. 51(5) of Law no. 221/2015.

[58] Art. 14(3) of Directive 2007/60/EC. The previous FRMP (*Piano di gestione del rischio alluvioni 2016*) is available at http://www.alpiorientali.it/dati/direttive/alluvioni/fd_20160309/PGRA_Relazione%20di%20Piano_Allegati_I_II_III_V.pdf

[59] The updating process also includes other necessary documents such as the environmental objectives, the use of the territory, a cost and benefit analysis (Arts. 4–7 of Legislative Decree no. 49/2010), as well as the strategic environmental assessment (Arts. 12–18 of the Code on the Environment).

[60] *Piano di gestione del rischio alluvioni, Primo aggiornamento, Calendario e programma di lavoro, Misure in materia di informazione e consultazione pubblica*, *dicembre 2018.* The document is available at http://www.alpiorientali.it/images/Calendario_Misure_in_materia_di_informazione_e_consultazione_pubblica_PGRA_e_allegato.pdf

[61] *Ibidem*, p. 4.

[62] *Ibidem*, p. 4.

[63] *Ibidem*, p. 6.

to inform the public and the interested parties of the process of adoption of the first FRMP.[64] The RBD of the Eastern Alps appears to have been amongst the few districts describing the methods used during the actual consultation process.[65] The EU Commission also remarked that the RBD of the Eastern Alps provided information about the groups of stakeholders who actually participated in public meetings,[66] as well as about the results of the consultation.[67]

The experts of this RBD who have been consulted by the present authors[68] have pointed their attention to the way the public has "perceived" the usefulness of the measures that the public authorities have presented in order to cope with flood risks.[69] In this regard, it should be recalled that Recital no. 14 of the FD refers to the fact that the FRMPs should focus on prevention, preparedness and protection aspects (these entail adopting an *ex-ante* approach), rather than on "remedial measures" that usually intervene *after* the occurrence of floods. Here, some distinctions have to be made with regard to the *ex-ante* aspects. Prevention and preparedness usually entail the adoption of non-structural measures (prevention is, for example, adopting legislation that limits building in certain areas that could be flooded, and preparedness is, for example, introducing improved tools for forecasting the floods).[70] Protection aspects, on the other hand, involve structural measures and

[64] The first FRMP refers, for example, to a number of 50 meetings that have been held. These meetings both informed the public about the existence of a consultation process and also provided forums for active involvement (*Commission Staff Working Document First Flood Risk Management Plans – member State: Italy, Accompanying the document Report from the Commission to the European Parliament and the Council on the Implementation of the Water Framework Directive and the Floods Directive, Brussels, 26.2.2019 SWD (2019) 81 final*, p. 64).

[65] It is reported that "a series of public meetings were held in seven provincial capitals: topics included the types of measures under consideration and the plan itself, participants were invited to help define priorities among the measures. A final set of meetings (outside the consultation period) just before the publication of the final FRMP presented the observations that had been received and the changes made in response to these modifications" (*ibidem*, p. 65).

[66] The stakeholders who were identified and invited were the following: "fishermen, professional associations, environmentalists and electricity producers. The FRMP discusses, in addition, coordination with government bodies – national ministries and authorities, regional governments, basin authorities and irrigation bodies are identified as relevant stakeholders" (*ibidem*, p. 67).

[67] The presentation on the results of the consultation is available at http://www.alpiorientali.it/files/convegni_2015/2007_Bisaglia_Baruffi_Udine_02_12_15.pdf. Here the EU Commission reports, though, that the document is not detailing what has been changed as a result of the consultation (*ibidem*, pp. 69–70). This is also confirmed in *Commission Staff Working Document European Overview – Flood Risk Management Plans, Accompanying the Document Report from the Commission to the European Parliament and the Council, Brussels, 26.2.2019 SWD (2019) 31 final*, p. 42.

[68] Above n. 39.

[69] It is important to highlight that the perception of the public about the usefulness of the various measures is informed by factors such as a different level of technical knowledge; different perceptions about the state of the territory and about the socio-economic situation; and different levels of environmental consciousness, amongst others.

[70] See *Guidance Document No. 29, Guidance for Reporting under the Floods Directive (2007/60/EC)*, 2013, pp. 66–68. This approach to the classification of the measures has been followed also

consist in, for example, managing watercourses through strategies of sediment containment.[71] According to the experts, the consultation that eventually led to the adoption of the first FRMP of the Eastern Alps showed that the perception of the public about the usefulness of the measures that potentially could be adopted was that the *ex-ante* aspects (therefore, the measures of prevention and preparedness) should have been prioritised over the protection ones. In other words, the stakeholders suggested that the public authorities should focus on measures located at the earlier stage of the *ex-ante* aspects (i.e., prevention and preparedness). At the same time, the experts have warned that this outcome could have been influenced by the way the possible options were presented to the public. Prevention and preparedness are in fact the aspects that the competent authority tend to emphasise more when interacting directly with the public. Interestingly, if the public authorities eventually opt for a solution that is different from that perceived as the most useful by the stakeholders, they are not obliged to state the reasons for this refusal.

After the analysis of the public participation practices within a specific RBD, the chapter now turns to the study of the so-called "river contracts" negotiated between institutions and the general public – a practice that has now a solid history in Italy.

19.4 River Contracts: A Form of Participative Process

Development of "soft law" instruments at local scale (e.g., river contracts) and "effective public participation" (i.e., sharing information and conducting joint assessments) are two strategies that aim at stakeholders' active participation. In recent years, a growing backlash against top-down approaches to environmental management has occurred throughout the world, because of their tendency to prioritise and solely appreciate professional and scientific "expert" knowledge. This gives such approaches a potentially exclusive and paternalistic nature, which can be alienating to local people and their internal resource management schemes. Hence there has been a growing acceptance of bottom-up approaches that characteristically both appreciate and incorporate local people and their knowledge, skills, needs and experience.

The river contract (but also the lake, lagoon, and coast contract) is an example of how to contribute to ensuring improvement of water quality, protection against flood risks, as well as implementation of the WFD and FD through the voluntary development of programmes and action plans that can be applied in an effective manner to water management (Bastiani et al 2011). River contracts began to spread all over Europe in the late 1990s and early 2000s, also through cross-border cooperation programmes. Operationally, this approach has allowed to start considering

by ISPRA, the Italian Institute for Environmental Protection and Research, for the preparation of the guidance document for reporting under Art. 15 FD. The document is available at http://www.isprambiente.gov.it/pre_meteo/file/NOTE_db_access_FRMP_gennaio2016.pdf

[71] *Piano di gestione del rischio alluvioni 2016*, above n. 60, p. 91.

watercourses as “homogeneous hydrographic” entities able to traverse territorial affiliations and borders between States.

In Italy, river contracts have been introduced in 2003 through an EU cooperation programme (between Italy and France), but larger diffusion was achieved with the creation in 2007 of a National Table of River Contracts (*Tavolo Nazionale dei Contratti di Fiume*), that provided crucial support to the development of river contracts, by making it possible to coordinate efforts and compare experiences to build a culture of participatory collective governance. Institutional recognition came almost a decade later, with the introduction of Article 68 *bis* in Legislative Decree no. 152/2006 by means of the amendment made by Law no. 221/2015. Such recognition is a key passage for the development of river contracts and the requalification of river basins in general. In particular, the new provision has strengthened the contribution of river contracts to the definition and implementation of spatial planning instruments at the level of districts and hydrologic catchments and sub-catchments; river contracts are therefore no longer only voluntary agreements among actors but are recognised by the legislator as official policy instruments.[72]

In the same year Article 68-bis was adopted, through the activity of a working group coordinated by the National Table of River Contracts together with the Ministry of the Environment and ISPRA, the guidelines “Definitions and Basic Quality Requirements of River Contracts” were drawn up. These can be considered as complementing the abovementioned provision, since it was created to promote, on the basis of the experiences already made, the methodological harmonisation of river contracts throughout the national territory.

Since their introduction in 2003, more than 2500 municipalities have been involved in the river contract processes in Italy. Indeed, local communities are considered a vital resource, active partners rather than passive elements from which to extract consensus on decisions that have already been taken (Bastiani 2014). In such contracts, local communities lie at the centre of a participatory and governance process; they become the main actors in protecting rivers as collective resources, in discontinuing the degradation and disappearance of natural landscapes, in maintaining biodiversity and the environment more generally, and in achieving a more efficient use and sustainable management of these valuable resources.

[72] Lombardy Foundation for the Environment (2018), Case study reports on the mainstreaming of climate adaptation – Case Study Report: Italy – “Upper Adda” River Contract, https://www.alpine-space.eu/projects/goapply/results/results_revised/goapply_d.t2.1.1_wp2_case-study-report_italy_upperadda_fla_oct-2018.pdf, p. 6.

19.4.1 River Contracts at the Crossroads of Soft Law and Hard Law

To enhance the governance in water sector, different but complementary management mechanisms must be integrated, such as binding ("hard law") and non-binding instruments ("soft law"), as well as formal and informal cooperation. The binding instruments create legal obligations, while non-binding documents, mainly composed of declarations and recommendations, provide, as a rule, guidelines and principles and mostly impose moral obligations. These soft law instruments, such as the river contract, operate in a grey zone between law, politics and social needs and may influence the development of national laws and practices.[73]

Hard law as well as soft law instruments are often developed or implemented through programmes and action plans, which are policy documents containing the steps that should be taken. These different approaches, with their respective advantages and disadvantages, are not mutually excluding. Solutions integrating both binding and non-binding approaches are often successfully implemented, especially if they are grounded on economic incentives and cultural actions and, of course, based on public participation of the citizens. Adopting this approach can become especially profitable when hazards (e.g. flood risks or water pollution) are not foreseeable, their return periods are long and equally difficult to foresee, and their impact is "out of scale".

Voluntary initiatives sustained by public participation strengthen the capacity to deal with a number of formidable challenges such as climate change adaptation or, more simply, make possible to enhance the efficacy and scope of existing regulations, as in the case of the implementation of the WFD and the FD.

Soft law can therefore support international and national binding instruments, and through public participation it can facilitate their implementation. Supranational soft law facilitates common policy-making without making too many inroads into the States' competences, whilst maintaining an adequate margin for joint action (Korkea-aho 2013). At the national level, too, for an effective water policy an equilibrium between soft law and hard law instruments is needed (Fig. 19.1).

In this context, the river contract is an example of soft law instrument, that contributes to ensuring the improvement of the water quality, the protection against flood risks, as well as the implementation of the WFD and FD through the voluntary development of programmes and action plans that can be applied in an effective manner to water management.

[73] The relation between river contracts and soft law instruments has been specifically addressed in a study commissioned by the Permanent Secretariat of the Alpine Convention within the scope of the activities of the project AlpGov for the implementation of the objectives of the Action Group 6 of EUSALP. See Bastiani et al. (2018).

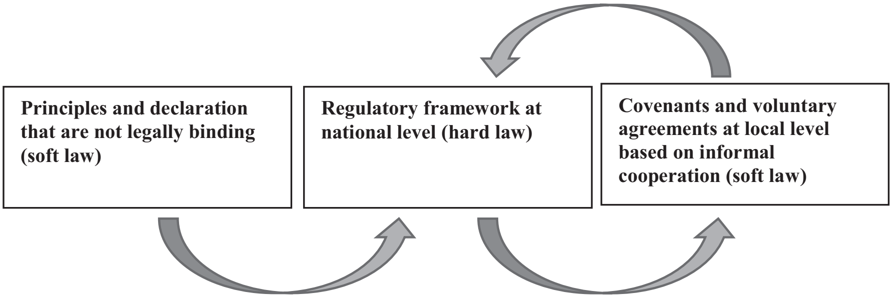

Fig. 19.1 Interaction between soft law and hard law instruments

19.4.2 River Contracts in Italy

In Italy, river contracts respond to the need for introducing new forms of governance as well as forms of voluntary cooperation that are requested by EU directives and guidelines in order to implement an integrated management of water, land and landscape[74] in a shared and subsidiary manner. Currently in Italy more than 190 river contracts have been announced or are being developed, and about 30 of them have already been signed and their action programmes are under implementation.[75] Among the Regions with the largest number of contracts signed we find Lombardy (seven contracts already signed out of 11 processes activated), Piedmont (six contracts signed out of nine activated), the Autonomous Province of Trento (eight contracts signed), and Marche (three contracts ongoing subscription out of ten activated processes). Recently, a significant development of river contracts has also taken place in Southern and Central Italy. In Lazio a regional office for river contracts has been activated and thanks to a call of proposals, 19 processes have been supported; in Calabria there are 19 processes, either announced or activated.

Among the Regions where river contracts are least-developed we find Molise, Liguria, Sicily and Aosta Valley. In Sicily, for example, compared to 24 contracts announced in the last 5 years, only two have actually gone ahead. The advancement of these processes has probably been held back by the lack of investment by the Sicily Region in this field. Aosta Valley is the only region where there are no river contracts at all. The reason is probably to be found in the conflicts related to hydropower production, which have made local authorities particularly cautious towards participatory processes.

River contracts are voluntary tools of strategic, negotiated programming that pursue the protection and proper management of water resources as well as the

[74] Art. 1 of the European Landscape Convention, adopted by the Council of Europe on 20 October 2000, defines “landscape” as “an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors. Therefore, landscape has diverse characteristics, ranging from areas of ecological importance to dryland, from urban areas to farmland.

[75] To get a more detailed picture of the Italian experience, see Bastiani et al. (2015).

safeguard of river basins from hydraulic risk, also contributing to local development. The parties to the contract define a shared Action Programme and commit themselves to its implementation through the signing of an agreement. This contributes to the definition and application of the district planning policy tools at the basin and sub-basin scale, in particular the FRMPs and the RBMPs.

The strength of river contracts lies in their prioritisation of direct consultation with a broad multi-stakeholder group. Projects under these contracts are often implemented through public-private partnerships, which grant greater efficiency and enable job creation. Global public-private partnerships are expected to grow in importance in the future, covering a broad spectrum of issues such as standard setting and law enforcement in the field of environmental protection. Importantly, collective governance such as this is increasingly associated with successful efforts towards sustainable development. Local communities lie at the centre of such governance, as they are the main actors in protecting rivers as collective resources, stopping the degradation and disappearance of natural landscapes, maintaining biodiversity and safeguarding the environment, and achieving more efficient use and sustainable management of these valuable resources (Bastiani et al. 2015).

Lombardy and Piedmont, in the Po river basin, are the Regions that pioneered the process, by implementing a great number of contracts for the protection of spring systems, the environmental rehabilitation of flood detention basins, the enhancement of secondary hydrographic networks (e.g. channels, creeks) and the improvement of agricultural systems. This is noteworthy, as the Po river basin is of great economic, industrial and environmental importance for the area, which extends over about 71,000 km^2 and include six Regions (Lombardy, Piedmont, Liguria, Veneto, Emilia-Romagna, Tuscany) and the Autonomous Province of Trento. Thus, covering almost one-fourth of the national territory, the basin hosts a resident population of about 17 million people and accounts for 40% of the country's GDP.[76]

In May 1989, the Italian Parliament approved Law no. 183/1989, which introduced a fundamental reform in the field of soil protection and water management by singling out a single centre with respect to the different sectorial policies for the water cycle. Indeed, the law established the hydrographic basin as the environmental reference system within which all regulatory actions by different institutional bodies had to be coordinated: soil protection, water pollution abatement, and water resources management for the purpose of a rational social development. The Italian territory was therefore divided into basins, considered as unitary ecosystems and classified as being of national, interregional and regional importance. For the nationally significant basins, Law no. 183/1989 set up Basin Authorities (*Autorità di bacino*), bodies aimed at fostering the cooperation between State and regions, and

[76] The description of the basin is based on the data provided in the report "Caratteristiche del bacino del fiume Po e primo esame dell'impatto ambientale delle attività umane sulle risorse idriche" (2010), authored by the RBD Authority of the Po river: www.adbpo.it/download/PdGPo_24febbraio2010/PDGPo_ELABORATO_01_CaratteristicheDistretto/PdG_Po_ELABORATO_1_10_03_11.pdf

entrusted with the task of managing basins through spatial planning tools (the Basin Plans).[77]

The most important Basin Authority is arguably that of the Po river (for the abovementioned reasons), which in 1992 started the drafting of the plan, according to a strategic planning model that envisaged, in the face of a complex reality, gradual and flexible intervention tools, adaptable to the specific needs of the various territorial areas. The first cycle of the planning process, which turned out to be longer and more difficult than expected for various reasons related to the starting conditions, ended at the beginning of the new millennium.

As regards the participation of the public and stakeholders in the choices made by the Basin Authority, Law no. 183/1989 provided for a specific procedure for sharing information and collecting observations in the preliminary drafting phase of the plan. Immediately, this procedure proved to be a tool that was not entirely adequate for the effective involvement of the general public and stakeholders.

To respond to this problem, a Consultation Committee was set up in 1994 composed of representatives of local authorities, major trade unions, agricultural and industrial associations, land reclamation and irrigation consortia, energy companies, and the largest environmental associations and natural parks. The Committee participated in the preparation of the main planning instruments of the Basin Authority through the formulation of opinions and by promoting conventions and conferences. Over the years, it has produced numerous documents on the plans of the Authority, analysing and taking a stance on different aspects relating to the governance of the basin, also in connection with important calamitous events and crises. In short, the Committee has acted not only as an expression of the interests of the territory, but also as a respected interlocutor of the Basin Authority, focusing on the problematic and conflictual profiles of planning. Moreover, the observations and opinions of the Committee have been addressed not only to the governing bodies of the Authority, but also to its technical bodies, as well as to national, regional and local authorities, and other public and private stakeholders. With the start of the drafting of the RBMPs, the activity of the Committee has been included in the wider public participation process required by the WFD (Puma and Poggi 2013).

At the beginning of the millennium, at the end of the first planning cycle, profoundly influenced by the "urgencies" determined by the particularly serious flood events that had affected the Po river basin, a pause for reflection was deemed necessary to consider the role that the Basin Authority should play in territorial planning, also in the light of the WFD that in the meantime had been approved. The outcome was primarily the identification of the activity of the Basin Authority as a "guiding idea" in the recovery of river environments. In order to achieve this goal, the need was clear to establish a more effective presence on the territory, to get a greater and more qualified relational and coordination capacity, and to strengthen and rationalise co-planning activities. In following this course, since 2004 the Basin Authority of the Po river has signed numerous agreements with institutional and

[77] The history of river basin management in Italy is summed by Alberton and Domorenok (2012).

non-institutional actors (Alberton and Domorenok 2011). Among such agreements, of particular significance are those that are meant to promote participatory planning processes in the matter of river redevelopment – that is, river contracts.[78]

The new approach is not limited to promoting participation in the official planning activities, as it has also led to the establishment of a permanent network for exchanging and debating ideas. In 2010, the RBMP of the river Po, approved under the WFD in order to address the criticalities of the basin, identified the river contract as an implementation tool of the programme of measures to be adopted as per Article 11 of the Directive (Puma 2012). As of 2019, in the Po RBD, over 50 river contracts are active.

19.5 Concluding Remarks

The implementation in Italy of the public participation provisions contained in the WFD and in the FD has raised a number of issues.

First of all, the reforms introduced by the Italian legislator – the last one being that of 2016[79] – have not resolved fully the flaws in the administrative arrangements that the EU Commission had highlighted already in 2012, particularly in relation to the poor coordination between the Regions and the RBD Authorities. The existence of a certain degree of fragmentation in the Italian (institutional) water governance has a bearing on the way the country fulfils the public participation provisions contained in the Code on the Environment. The analysis has showed that, whilst the public participation processes are on the increase, the deadlines and procedures set by the WFD and FD are still not fully complied with in all RBDs. From the analysis, it also appears that the level of this consultation varies greatly amongst the various districts. In such a context, the public participation processes that are being conducted in the RBD of the Eastern Alps, at least in relation to the adoption of the first FRMP, seem to contain positive elements and, thus, to represent a good model for other RBDs.

Amongst the factors that might have contributed to an improvement in the public participation processes in Italy are the "river contracts", voluntary agreements negotiated between institutions and the general public. They have contributed to the realisation of (and the enhancement of) the objectives of the provisions on public participation contained in the WFD and implemented by the Italian Code on the Environment.

Our analysis has shown that river contracts are at the intersection between soft law and hard law instruments. At the international law level, non-binding Principle 10 of the 1992 Rio Declaration gave impulse to the adoption of binding

[78] On the participatory planning processes in the Po Basin see, on the website of the relevant Basin Authority, *Piano di gestione del distretto idrografico del fiume Po*, https://pianoacque.adbpo.it/il-piano-di-gestione-acque-2010/

[79] Above n. 42 and corresponding text.

international agreements, such as the 1998 Aarhus Convention and the more recent 2018 Escazù Agreement. A similar interaction can be detected also at the EU level, in the practice of adopting guidance documents outside the legal framework of the WFD and with the participation of both public and private actors.

Overall, whilst some improvements cannot be denied, a coherent and full implementation in Italy of the public participation provisions contained in the WFD and in the FD seems to be still to come.

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Part V
Conclusion: A View on Italy from Within and from the Outside

Chapter 20
A View from the Outside: What Italy Can Learn and Teach in the Field of Water Policy

Bernard O. Barraqué

Abstract In the Renaissance, Italy brought to Europe the re-invention of Roman law as applied to water, and it kept its surface waters as common pool resources, thus allowing the existence of irrigation communities which were models for Europeans in the nineteenth century. More recently, political decentralisation made it difficult for the Country to develop river basin institutions before they were adopted at European level with the Water Framework Directive. So, it was rather in the area of water supply and sanitation services that the most important reforms were adopted. However, these sparked a struggle between proponents, who took inspiration from the English privatisation and tariff regulation, and opponents, who claimed that water should remain a local issue and a common good. As the public-versus-private debate goes on at global level, there is in Europe a variety of management models for both water resources and water services, which could inspire Italy in finding its own way towards a sustainable water policy.

Keywords Water resources · Water supply and sanitation · Common goods · Europe · Inter-country comparison

The first thing Italy did which influenced some other European countries was to re-discover the ancient Roman law at the time of Renaissance cities. This is how the water legal system was again based on three categories: public and private waters, plus common pool resources. The concept was transferred by Italian lawyers to the monarchies in power in other Latin States, while northern Europe States remained with water rights systems based on Germanic customs: typically the riparian rights

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system in England. After the French Revolution invented the Civil Code, more countries developed public and private categories of water. But in all such systems, usually small watercourses remained the common thing of their riparians, including in France where the initial idea to have only public and private waters was long discussed in the preparation of the rural code starting in 1808: 90 years later, in the 1898 framework law on the regime and allocation of water, small watercourses remained in theory a common good, and there should have been a board of riparian landowners for each of them.

Similarly, in the first half of the nineteenth century, when the development of agriculture was the most important water governance issue in the face of navigation and proto-industry, Italy and Spain were considered models for irrigation institutions, when the Netherlands and south-east England were pioneering modern drainage systems. Italy was indeed one of the first places where engineers wanted to domesticate water and transform marshy areas in productive ones: the *bonifiche* inspired the concepts of land reclamation in the US and of *aménagement* in France. But northern Italy also was the locus of successful ancient irrigation systems and scholars of many other countries came to learn from them, as was witnessed personally by Giacomo Giovannetti and Carlo Cattaneo in the middle of the nineteenth century. In these systems, the landownership rights were mitigated by the "right of aqueduct", that is, the obligation for a landowner to let water cross his property to irrigate another property. In Piedmont in particular, collective irrigation was institutionalised.

In the twentieth century, national governments became more powerful and decided to interfere in the economy through the realisation of large hydraulic infrastructure. While this move started at the end of nineteenth century in the United States, it quickly came to Italy's *mezzogiorno* (the southern part of the Country), even before the fascist regime came to power. It was however questioned at the end of the second World War, while it really grew in Spain and Portugal starting from the 1950s with American support. In Italy, the comeback of democracy implied a return of the power of local authorities, that is, the development of water supply systems at that very local scale (*l'acqua del sindaco*, the mayor's water). It was also the case in France and in Belgium, except that in those two countries fragmentation of services was partly overcome through the development of joint boards (*intercommunales*), and in France, in addition, through the awarding of contracts to powerful private companies: frequently, the same company had separate contracts with neighbouring municipalities or joint boards, but it pooled its intervention.

In the 1960s, there was a move towards decentralisation at regional level in many countries. There were in particular discussions between Italy, France and Switzerland, when the two first countries tried to understand the benefits of regional policies. At that moment, the French also adopted the river basin as the best territory for water resources management, after discovering what the *Ruhrgebiet* in Nordrhein-Westfalen had been doing already for more than 50 years. While metro France was split in 22 regions, water policy was entrusted to 6 river basin districts unrelated with administrative boundaries. This did not happen in Italy, and after years of debates, water management was entrusted to the 20 administrative regions in 1976 with the so-called Merli Law. The delays in implementing the regional water plans gave an opportunity to introduce river basin management in 1989 with Law no. 183/1989, in the aftermath of several dramatic natural catastrophes. But new river basin institutions remained weak (in terms of funding) and split between at least two different levels of government. Italy had to wait the implementation of the Water Framework Directive (WFD) after 2000 to finally see its hydrographic districts put in place.

It is also noteworthy that Italy started to develop river contracts in 2003, through some EU cooperation programmes with France. But in France these contracts had started back at the end of the 1970s. In addition, it seems that in Italy contracts are between the river basin institution and one local authority, so that there are many possible river contracts in one district; in France, in contrast, all the potentially concerned stakeholders are gathered under one single contract at catchment level. Moreover, in 1992, a water law proposed to increase the institutional strength of river contracts through their transformation into opposable plans: the *Schémas d'aménagement et de gestion des eaux* (SAGE). Now the idea of contracts has been extended to other territories than rivers, so they are now grouped under the single label "*milieux contracts*": 192 contracts are completed, 70 are ongoing, 12 are being elaborated, and 5 are just emerging. Only 10 were dropped, which means that it is a successful policy SAGE now apply (the plans and programmes of measures of the WFD). And there are now 149 SAGE being implemented, 32 in elaboration, 3 in the setting up phase and only one abandoned. Many of these SAGE are also being revised to take into account new policies like those under the WFD and the Floods Directive.

In Italy, even though the reform of water policy was slow on the side of water resources, it occurred on the side of water supply and sanitation: the idea was to put an end to the century-old tradition of both public and municipal management, which was a consequence of the 1903 law banning public service concessions to private companies (Law no. 103/1903). Indeed, in the Giolittian context of Italy's unification, these private companies were frequently foreign, under-capitalised and particularly criticised. While cities, in particular in northern Italy, usually adopted the formula of "*azienda municipalizzata*" or "*azienda speciale*", rural areas turned towards direct management without depreciating and recovering the investment costs.

The same happened in many European countries, under the lasting influence of the English model, where the incorporation of local authorities back in the middle of nineteenth century allowed them to take over water and gas services which were not well-managed by private companies. Waste water collection and treatment also remained outside of water bills and were rather funded through local taxes. Yet, as soon as the need was felt to replace ageing parts and modernise services, in many countries, traditional direct formulas were found unfit, and while the British consolidated their services at supra-local level, the Germans allowed cities to create private companies which they owned, and which finally ran several local services together (*Stadtwerke*); consolidation took place when the Government merged small municipalities in larger units in the 1960s–1970s. In France, facing the centralisation of governmental functions, local authorities resisted mergers and frequently preferred to delegate water supply to private companies under various forms of delegation contracts (management, lease, some concessions and, rarely, mixed economy). In the end, Italy and France both kept a very large number of water supply and sanitation (WSS) services management units, in particular where potable water was abstracted from groundwater; the difference of course was that in France local WSS services fragmentation was partly compensated by delegation contracts, which often resulted in some supra-local consolidation.

In the 1990s, a new English model appeared: after regionalisation of water policies (including services) in 1974, the WSS services provision was separated from resource management and fully privatised (while in France local authorities or their joint boards have always owned 95% at least of infrastructure). New and old water services companies which had survived were now to be regulated by three agencies: the drinking water inspectorate for health standards, the environmental agency for water police, and the Water Services Regulation Authority (Ofwat) to regulate pricing and investment schemes on a 5-year basis. This model was a modernisation of the American minority model of private management called “investor-owned”, where private companies provide the service and are regulated by a State agency (15% of American people are concerned). The main innovation was that Ofwat forced companies to apply a tariff formula based on both efficiency gains and price increase linked to investment.

This model gained a lot of support at the time when the World Bank and other international financial institutions supported privatisation as the best alternative to inefficient public procurement, as could be witnessed in post-Soviet countries. The model was exported to Global South countries, where it met fierce resistance and a strong symmetrical move in favour of public management. In continental Europe, things did not change much because even though WSS services were commercial services, they were provided by municipalities through joint boards or companies which they owned (Netherlands, Germany, Switzerland, etc.). In France there is now a move towards re-municipalisation, but it is limited to a few cities (Grenoble, Paris, Nice, Rennes, etc.); in addition, French consolidated local authorities are since 2010 at last allowed to create private companies which they own, or if you prefer mixed-economy companies with 100% shares in local public hands.

Italy in a way chose the English model but applied it rapidly and incompletely: in England and Wales local authorities had been out of the game of public services for 15 years when privatisation occurred and the Ofwat regulated private companies. In Italy, consolidation took place but without purely suppressing the role of local authorities in service provision. So, the successive regulation agencies were not regulating private companies but a tense and very political relationship between centre and periphery. The Galli Law reform was bound to meet fierce resistance, including many Italian activists picking up the very arguments that were valid in developing countries: water is a common good precisely where a significant fraction of the population has no reliable water services and must keep a direct link to water resources. But this is not the case of Italy, where the problem is rather to cover the long-term maintenance costs so that WSS services are kept functioning. The idea, which is also frequent in France, that one needs to introduce private companies to do the dirty job of significantly increasing the prices and take the blame, does not work, because sustainable water prices mean a big jump anyway. It is easy to see that water prices in Italy are the lowest in Western Europe, while the Germans and the Danes have the highest ones but being economically sustainable.

Portugal is certainly a different because smaller country, but its WSS reform is interesting to analyse: it was more respectful of the existing situation. Instead of regionalising services, the country created a national public company (*Aguas de Portugal* – AdP), which proposes neighbouring municipalities in problematic areas to create a mixed-economy company where they hold 50% of the stock, while AdP has the other 50%. This mixed-economy company, in turn, treats drinking water and waste water (the plants) and charges local authorities for the service. Each municipality remains responsible for its networks, and faces high costs to purchase water if they do not tackle the issue of leaks. It is indeed a subtle form of regulation because it accepts that local authorities and local democracy cannot be nullified for the sake of technical efficiency. The Portuguese are proud to qualify this reform as a public-public partnership.

In turn, since in Italy the consolidation reform was associated by the Government with an obligation to open tenders to private companies, it attracted a severe criticism by opponents, who managed to stop this through a referendum which was thought to ban the introduction of private capital, and even the remuneration of capital invested in WSS services. This would really be catastrophic from a European point of view, even for supporters of public management. It seems that in Italy in particular, the argument of "*acqua bene comune*" (water as a common good) was adopted as a romantic slogan keeping eyes shut on the sustainability issue. This attitude qualifying water as a common good of vital necessity and, therefore, unfit to any form of private involvement, is shared by many activist movements in other countries too. Yet it remains quite paradoxical that these movements do not understand that as long as water costs are covered by bills proportional to consumption, the service is indeed a commercial service, be it in public hands or private ones. Indeed, the mobilisation of the concept of common good could be understood after the fall of the socialist regimes in Eastern Europe, whose WSS services management was largely a failure. It was the best way to oppose the World Bank and supporters of privatisations without supporting Stalinist centralisation. But, unfortunately, using this expression led to amalgamate countries and natures of water: developing and developed countries; and water resources and WSS services. When a significant fraction of the population of a city or region is not or poorly connected to water, the relationship with water is with water resources, and these are free, so they are right in refusing to pay. But when everybody is connected to WSS services, costs have to be covered in a way or another: indeed, in the Netherlands waste water collection is paid through housing and land (local) taxes, and waste water treatment through family charges; only drinking water is paid by volumetric bills. In Belgium, catching up with the Urban Waste Water Directive implies now a dramatic increase in water bills, which triggers a wide reflection on social tariffs. It remains to be seen whether these new tariffs are not, in fact, unwillingly increasing the commodification of WSS services.

This is what Italian friends should think about: since the OECD itself has admitted that full cost recovery for services rendered by water should rely on the three Ts (tariffs, taxes and transfers), every society in Europe should think what allocation among the three is fair. Some tariffs, some taxes, and as concerns transfers, payments for environmental services, allowing to bridge WSS services with water resources allocation under renewed forms of participative democracy.

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Chapter 21
A View from Within: Concluding Remarks

Alessandro de Carli, Marco Pertile, Antonio Massarutto, and Paolo Turrini

Abstract A look into the future of Italy's water governance needs a systematic stocktake of the Country's strengths and weak spots. Although the reading of this volume may leave the impression that the latter are more than the former, a somewhat positive evolution of water management in many respects cannot be denied. The legal and policy landscape has changed a lot since the inception of the new millennium, and some reforms are still too young to be appropriately evaluated. Moreover, such an assessment requires that a multidisciplinary perspective be taken, so as to account for a complex reality where the uses, purposes, actors and impacts relating to water are varied. In this sense, these brief concluding remarks are also meta-observations, that is, observations on how water-related issues are studied now or would be studied best. In addition to recapping the most salient points of the analyses carried out in the book chapters, some final hints on the way forward are outlined.

Keywords Interdisciplinary method in water studies · Water governance in Italy · Water management in Italy · Water economics · Water law and policy

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21.1 Water Is “One”, Uses and Perspectives Are Many

Water is a highly complicated matter. It is a natural resource that is vital for life, social and economic activities as well as the functioning of the ecosystem. But water is “one” and, at the same time, water-related uses, impacts and perspectives are many.

This book is probably a unique endeavour in the panorama of scientific literature on water resources (their use and misuse), water services (public services and environmental services as well) and water-related problems (floods, droughts and pollution) in Italy. The Italian water policy is here analysed from a multidisciplinary perspective: a large number of authors from several different academic and professional branches – engineers, economists, sociologists, political scientists, lawyers, ecologists, public officials and other experts – contributed to this “green book” on a number of water issues having Italy as their subject. This book is also an updated and in-depth literature review – a research handbook – on existing studies about water resources, water services and water-related risks in Italy.

21.2 The Evolution over Time in the Approach to Water Issues

In the last 160 years – which is how old the modern Italian State is today – attempts have been made to analyse the state of the art of selected water issues and to identify the best way to address them, but such efforts almost invariably took only one particular disciplinary (engineering, legal, etc.) or sectoral (urban water services, irrigation, hydroelectric power, etc.) approach.

Taking as an example the floods that have been regularly hitting the Italian territory since the birth of the Country, the Government set up two study commissions, first in 1870 (the Brioschi Commission) and then in 1967 (the De Marchi Commission), entrusted with the tasks of investigating the problem of water management at basin scale and proposing actions to mitigate the flood risk. In both cases, the approach was a purely technical one, based on engineering.

After about 30 years since the establishment of the latter commission, the Institute for Water Research of the Italian National Research Council (CNR)[1] published a book entitled “A future for water in Italy”,[2] with the aim of taking a photograph of the availability of water resources with respect to their different uses, as well as providing an analysis of the qualitative status of surface- and ground-waters, with a view to suggesting measures to be taken to overcome the existing trade-offs. This study, too, was mainly hard-science-driven, even though it demonstrated quite

[1] *Consiglio Nazionale delle Ricerche* – National Research Council.

[2] Benedini, M., et al. (1999). *Un futuro per l’acqua in Italia*. Rome: IRSA-CNR.

a broad vision by focusing on both quality and quantity of water, and by involving an economist in the analysis.

In the last 20 years, the production of documents on various aspects of water resources and water services in Italy has steadily increased, but a disciplinary or sectoral vision still prevails. Some public institutions (such as ISPRA,[3] ISTAT,[4] CREA[5] and ARERA,[6] in addition to the already quoted CNR) periodically produce documentation on the state of the art, the progress made and the existing criticalities. However, thus far a multidisciplinary and far-reaching opus on a wide array of water issues such as this book had never been published. The objective, it goes without saying, is not merely that of juxtaposing analyses on different topics from different perspectives, but that of creating a provisional forum where different scholars with different backgrounds can discuss with one another and gain a new understanding of things. If such an experience succeeds, chances are that the temporary bonds created by the editorial project are stabilised into permanent work relationships. At any rate, what really counts is to open durable channels not among scholars, but among their fields of expertise.

21.3 A Multitude of Points of View on Water-Related Matters

In several chapters of this book, descriptions are provided of the perceptions that different actors – from policy-makers to citizens, from farmers to users of the urban water service – have of water-related matters. To these perspectives, of course, those of the authors of the chapters of the volume must be added, as well as those of the scholars on whose doctrine the chapters are built. There is no such thing as a truly neutral observer.

On flood perception, for instance, in Chap. 2 Renzo Rosso argues that the concept of tolerable risk is hard to accept. Attitudes towards it depend on many factors: cultural level, how a society is organised and place of a person within it, individual and collective psychology, income and wealth. Man can effectively tackle flood risk only by mitigating its impact on riparian areas, after human life, which is an invaluable asset, has been made safe. The most effective measure to do so is by resorting to Civil Protection, whose activities should include not only emergency measures but also, and primarily, prevention. As a consequence, improving human ability to cope with floods will require a mix of diverse factors: *inter alia*, better knowledge

[3] *Istituto Superiore per la Protezione e la Ricerca Ambientale* – Higher Institute for Environmental Protection and Research.

[4] *Istituto Nazionale di Statistica* – National Institute of Statistics.

[5] *Consiglio per la ricerca in agricoltura e l'analisi economica agraria* – Council for Research in Agriculture and Agricultural Economic Analysis.

[6] *Autorità di Regolazione per Energia Reti e Ambiente* – Regulatory Authority for Energy, Networks and the Environment.

of the territory, an extended toolbox of engineering practices, a strong enhancement of land planning policies, and sustainable architectural approaches. In other words, what is needed is a multidimensional perspective and all-round social awareness.

Turning to the opposite of floods, during droughts economic actors declare that they have been damaged. In conducting an analysis from the point of view of social welfare, in Chap. 8 Antonio Massarutto and Dario Musolino highlight that, in some cases, the farmers of the Po river basin do not suffer a loss due to the effects of a drought. This is so because the drop in crop production is often offset by an increase in the price of agricultural products. Consumers are the actual losing party. As said before, on every question there are several diverging perceptions, each of them keeping a part of the truth – but this does not mean that some cannot be more true than the other ones.

Sociological research, too, can help provide additional keys to interpret water uses and misuses in the Italian context, and possibly inspire more effective responses to environmental concerns. Why is so much bottled water consumed in Italy, a country very rich in water? As stated in Chap. 4 by Filippo Oncini and Francesca Forno, the reason is found in its low cost as compared to other countries, rather than in an alleged lack of interest of Italians in the social and environmental value of water. On the contrary, water-saving practices seem to be quite common and this fact, read together with the poor conditions of hydraulic infrastructures that cause the loss of almost 50% of drinkable water, suggest that policy efforts should be taken to reduce the consumption of plastic-bottled water and fixing the water distribution network rather than promote domestic water-saving practices. Indeed, a look into the perceptions of social actors allows to understand where a problem lies and, as a consequence, which solution is preferable or, at least, more urgent.

21.4 The Governance of Water Resources: *Eppur si muove*[7]

Albeit not too distant from those experienced by many other States, Italy's problems in matters of water, and in particular those related to the provision of water services and the safeguarding of water resources, have been a stable presence in the lives of Italians during basically the whole twentieth century. Efforts to tackle such issues have been many, but most often than not (such as in the case of prevention of, and protection from, floods), the approach proved to be piecemeal and narrow-minded. This probably contributed to spoiling also those projects that had benefitted from non-negligible funding – which has not happened frequently, a lack of adequate financial resources being another issue in Italy.

Occasionally, intelligent law-makers have tied their names to important pieces of legislation, such as Law no. 319/1976 (*Legge Merli*) or Law no. 36/1994 (*Legge*

[7] This sentence, which can be translated as "And yet it moves", is a reference to the famous words allegedly uttered by Galileo Galilei to confirm his scientific convictions.

Galli), which, together with other good regulatory instruments such as Law no. 183/1989 and Legislative Decree no. 152/1999, represent milestones in Italian water governance. Results, however, have often been mixed. Other two problems may be stressed to explain this. On the one hand, sometimes reforms have been enacted at a fast pace, with a newer one superseding the older one even if the latter had not been implemented in full yet – or perhaps, right because of that, to deviate the reform path in order to meet different goals or avoid emerging problems. On the other hand, reforms that, on paper, seemed promising have been "hijacked" by the conflicts between different governmental bodies, such as the ones – which Mariachiara Alberton describes in Chap. 15 and Giulio Citroni and Andrea Lippi recount in Chap. 12 – that opposed the State to Regions for the allocation of competences in water-related matters and that saw local entities fighting to jealously preserve a space for autonomous action. These reasons, too, are manifestations of a fragmented system: too many laws on single aspects with no clear overall vision; too many laws on the same aspect, each amending or overriding the previous one; too many actors with no clear apportionment of competences or assignment of tasks.

This notwithstanding, the last 25 years or so have seen the enactment of a number of laws that have positively transformed the legal landscape of water governance in Italy. As Emanuele Boscolo underlines in Chap. 5, the abovementioned Law no. 36/1994 marks the start of a new conception of water resources, that are no longer seen as merely an economic good to be exploited but as an asset (social and environmental at the same time) to be safeguarded. This has brought about other important changes relating to the management of water resources, whose use and protection must be aptly and foresightedly planned in the long run, also by privileging the preservation of water bodies (which are collective goods) and their transmission to future generations over the immediate economic interests of concession-holders.

The European Union (EU) is not extraneous to the reforms made by Italian Governments in the last years. Although some such reforms pre-date analogous legislation by the Union, the presence of external constraints has provided a crucial incentive in improving the Country's water governance system. This is the case of the management of water services, at least to some extent, since, as Vera Parisio explains in Chap. 13, Member States are accorded wide leeway in choosing their approach to the provision of services, by means of public companies, private companies, or public-private partnerships. Italy's position has been, in this respect, moving between the two opposite poles of all-public management (till the 1990s) and all-private management (from the 1990s to the early 2010s), so that now the legal framework lacks coherence and the overall situation on the ground appears – needless to say – fragmented. But here, too, advances have been made. The recent choice of designating an independent authority (ARERA) as the actor responsible for regulating the integrated water service has led to improvements in the quality of the service and to healthier financial conditions of the whole sector, as Donato Berardi, Francesca Casarico and Samir Traini illustrate in Chap. 14.

The influence of the EU has also, and especially, been felt in the ambit of management of river basins, which is now in line with European obligations thanks to

Legislative Decree no. 162/2006 and its subsequent amendments (which in Italy are never lacking, as already stated). Implementation issues still exist, of course, and some of them can be traced back to the larger, multifaceted fragmentation problem hinted at few lines above, whereas other pertain to the dialogue, or lack thereof, between scientists and policy-makers (a topic on which Marta Martinengo, Antonio Ziantoni, Fabio Lazzeri, Giorgio Rosatti and Riccardo Rigon discuss in Chap. 16). But such issues cannot prevent an observer from saying that, irrespective of outstanding problematic aspects, something is moving in the right direction.

The same judgment can be expressed with regard to other facets of water governance. For instance, the qualitative status of water bodies is now protected against pollution by a recently-revised legislative framework that aims at punishing harmful activities not just by means of administrative penalties, as it was happening before, but also through criminal sanctions. This reform, which Giovanni De Santis and Matteo Fermeglia illustrate in detail in Chap. 7, has yet to demonstrate its adequacy, but it certainly represents a radical change in perspective. And a similar change has occurred with the introduction into the Italian legal order of a number of provisions that are openly meant to fulfil the right to water of Italian citizens (as Paolo Turrini and Marco Pertile tell in Chap. 11). In this case, too, external inputs revealed to be fundamental in the progressive development of domestic law. Once again, the presence of a central authority (ARERA) able to take flexible decisions whenever needed, often after consulting with stakeholders, has done the rest.

21.5 The Integration of Ecology and Economy

A rapid shift of paradigm is needed to promote a fruitful, action-oriented dialogue among disciplinary sectors, with a view to managing water resources properly and dealing with multiple challenges in the field of biodiversity protection and climate change mitigation and adaptation. The ongoing research on the ideas of natural capital and ecosystem services allows to take a holistic approach to frame socio-ecological issues.

Environmental issues cannot be solved efficiently by, and therefore should not be analysed exclusively in the light of, the free market. In fact, coping with such issues requires a public intervention that somehow "falsifies" market rules by introducing the environment's value among the production factors; this, in practice, translates into adding costs (internal and/or external ones) to the price of goods and services, so as to protect the aquatic environment by modifying the people's uses of water.

In a couple of chapters of this book, "new" economic instruments experimentally applied in Italy are described: payment for ecosystem services (PES) and water abstraction fees also covering environmental and resource costs. In Chap. 6, Riccardo Santolini, Tommaso Pacetti and Elisa Morri explain the concept of PES, which has increasingly got the attention of both scholars and decision-makers. PES schemes are voluntary transactions premised on the measurement of ecosystem services, so that a supplier can sell one such services to a buyer, provided that certain agreed-upon natural resource management practices are put in place. By introducing this idea, the turning of the polluter-pays principle (also enshrined in the EU Water Framework Directive) into the beneficiary-pays principle is made possible; this, in turn, promotes the valuation of ecosystem services, which have so far been denied adequate recognition. In Chap. 18, Vito Frontuto, Silvana Dalmazzone, Paolo Mancin, Alessia Giannetta and Davide Attilio Calà illustrate a pilot experiment carried on in Piedmont, whereby access to EU funds has been made contingent on both the adoption of metering devices and the recovery of environmental and resource costs by farmers. As agriculture takes a very large share of total water withdrawals, this reward-based policy might prove to be a very good way to achieve the objective of making a significant class of users pay for the environmental and resource costs relating to the exploitation of water resources. This is all the more important as these types of costs are usually ignored when devising a pricing mechanism. Italy – where, as Massarutto remarks in Chap. 17, abstraction charges do not represent a real incentive to water conservation – has recently issued guidelines on the recovery of environmental and resource costs, but the Country has yet to figure out a consistent and advanced way to use the economic leverage as a means to foster environmental rather than only financial sustainability. As noted above, the water service sector is now in better financial shape than before, but, as the author stresses, despite their difficult marriage, economy and ecology must become a more balanced couple, so that budgetary constraints, social equity, water management efficiency and concerns for nature are all given value.

21.6 Water-Related Conflicts and How to Spot and Defuse Them

Water is often a source of conflicts, within as well as beyond national borders. Quite often, a conflict has an economic justification linked to competing uses, both productive (for instance, hydroelectric power generation or crop irrigation) and non-productive ones (that is, recreational purposes such as navigation or tourism). But other causes can be identified, more political or principled in character. As described in this book, the water-conflict toolbox consists of numerous solutions, which can also be used in combination.

In the case of conflicts over international water bodies – for Italy, the Maggiore and Lugano lakes shared with Switzerland, or the Isonzo/Soča and Timavo/Timav rivers shared with Slovenia – the prevalent approach is the legal one, consisting in the negotiation and adoption of international agreements that define the framework for future joint action. As Mara Tignino and Benedetta Gambatesa show in Chap. 9, this process can be long and complex, and usually requires a constant dialogue and frequent adjustments in order to align the rules agreed upon in or through the cooperation agreement to the ever-changing needs of States – and of the shared water bodies, of course.

In the management of a conflict, or in order to prevent one, information – scientifically-based but at the same time accessible to all, professionals and ordinary citizens alike – plays a fundamental role. After all, it is not by chance that public participation is one of the cornerstones of the two main water-related instruments of EU law, that is, the Water Framework Directive and the Floods Directive. As Elena Fasoli, Massimo Bastiani and Francesco Puma illustrate in Chap. 19, amongst the factors that might have contributed to an improvement in public participation processes in Italy are the "river contracts", voluntary agreements at the intersection between soft law and hard law, negotiated between governmental entities and various other stakeholders. River contracts not only have contributed to realising (and possibly transcending) the objectives set out by the provisions on public participation of EU law, but they have also demonstrated that conflicts on water resources are best addressed by building relationships based on mutual trust and communication.

Law (agreements) and policy (participation) are great means to solve conflicts. However, as the subtitle of this volume makes clear, economics, too, has a role to play. Among its numerous functions, it can help detect hidden conflicts that might otherwise go unnoticed. This is the case of international trade in water-intensive goods, where conflicts are among competing water uses but also, potentially, among different communities. At the global scale, the notions of water footprint and virtual water trade can be applied to evaluate the pressure on freshwater resources caused by human activities, whereas at the national or regional levels, such concepts are able to explain the balance between imported and exported water with respect to local water endowments. In particular, the idea of virtual water can reveal the major role of agricultural export from water-scarce areas in exacerbating the pressure on water resources, with harmful consequences for the status of aquatic ecosystems and the availability of water to the autochthonous population. Despite the acknowledged limitations of such an approach, in Chap. 10 Stefania Tamea, Marta Antonelli and Elena Vallino argue that this methodology can contribute to building a comprehensive analytical framework for better water management at the national level. This proves, once again, the beneficial effects of creating synergies between different disciplines: one of them may provide the tools for seeing the problem, the other one may offer the tools for solving it.

21.7 A Forward-Looking Outlook

The purpose of this book was that of discussing a range of water issues in Italy, based on the studies that researchers and practitioners have carried on in recent years. Did we succeed? Hopefully, in part we did. Many chapters describe the integrated water service from different, complementary perspectives (Part III of the volume). A few authors analyse the water-agriculture nexus, either in terms of the value of water for crops (Chap. 3), the impact of droughts on farmers and other social actors (Chap. 8), or virtual water trade (Chap. 10). Other water uses, such as hydroelectric power generation or recreational activities, are here described in terms of the amount of water used (Chap. 1) or its economic value (again, Chap. 3). The multifarious industrial sector, too, has been hinted at in some parts of the book, but its complexity would have required a far more thorough investigation. This has not been possible because it has thus far been largely neglected by researchers themselves. Therefore, in the coming years it will be necessary to study in depth the issue of which business models are more environmentally sound and economically sustainable, especially in light of the already visible effects of climate change, that will make pressing the need to clarify the picture of future water availability in Italy. But, at any rate, the problems caused by a changing climate will leave no water-related issue unaffected, so this represents another fertile field for inter-sectoral and interdisciplinary studies.

Other aspects of water governance that for various reasons could not be included in the book would nonetheless have deserved to be addressed. For instance, it would have been interesting to examine the issue of water reuse, a practice that is also encouraged by EU institutions. Another area that is worth studying is certainly the one that connects water resources to the planning of territories surrounding them. Many are the topics that can be traced back to this field, some of them covered by the present volume: for instance, flood-risk management addressed in Chap. 2, and the organisational (spatial as well as institutional) structure of river basin governance dealt with in Chaps. 15 and 16. However, other valuable perspectives should be taken into account, such as that of urban planning and landscape preservation. In the future, it will also be necessary to analyse the role of nature-based solutions in solving difficult problems like diffuse pollution, in reducing flood risk and, again, in combating climate change.

In the end, by way of justification, we would like to point out that no editorial work can be final and complete. Perhaps, it should not even aspire to that goal. What matters most is the production of updated (and possibly innovative) knowledge that is able to integrate several points of view and, thus, give back a credible image of reality. This is, indeed, the most solid ground for good decision-making. This is also the reason why experiences like this one should be repeated over time in order to keep the adequacy of policy choices in check.

The burden, at any rate, does not rest solely on scholars, as their analyses need up-to-date datasets in order to adhere to facts and, thus, be effective. In this regard, Italy still lags behind. Problems are many and deeply-rooted in the Country's ill-prepared environmental governance system: the figures regarding water issues are sometimes dated and inaccurate; some major gaps exist as data are not collected on every relevant aspect; symmetrically, some data are gathered by multiple institutions at once in an uncoordinated manner. Additionally, owners of key data are typically non-governmental organisations representing operators (for instance, Utilitalia for the integrated water service, and ANBI[8] for irrigation); even if their published

[8] *Associazione Nazionale Bonifiche Irrigazioni* – National Association for Reclamations and Irrigations.

reports are usually the most reliable and updated sources for academics, the information they circulate is often too aggregate and too general, and most of it is kept confidential. Despite the significant investment efforts to create databases, these are most of the times accessible only to operators and public administration officers, rather than disclosed for purposes of open research. Therefore, the path that lies ahead must be charted also by inviting policy-makers to rationalise and modernise the way datasets are put together, as well as to ensure that information is made available to everyone. After all, if water is a public good, knowledge about it must be public, too. This book is our tiny contribution to this end.

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