Water Resource Planning: the Italian Experience[1]

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Like other natural resources, today water is an important "economic" good. In particular, in most industrialised countries, the increase in water consumption, generated by economic development, has given rise to very strong competition among areas, uses, users, present and future generations over the access to the resource. It has thus become urgent to draw up planning methodologies with the aim of rationalising the management of the water sector. This article analyses the water resource planning in the Italian experience from a theoretical and historical perspective, highlighting the link between principles and practical problems.

1. Introduction

1.1 In Adam Smith's lectures at Glasgow University water was considered to be in the same category as air; both were considered as non-economic goods because, according to Smith, they lacked the scarcity feature. In fact, in his famous paradox of water and diamonds, Smith (1987, p. 358) affirmed that "the demand for water exceeds that for any thing else whatever, but as the abundance is more than sufficient to answer all the possible demands water bears no price; whilst other things of no real value whose use we can hardly conceive, yet being but in very small quantities bear an immense price as becoming only the purchase of a few. This is the case with jewels and precious stones". Smith's view was commonly shared by the classical school of economic thought (Gill, 1969; Blaug, 1978).

[1] Paper delivered at the XIII International Economic History Congress, Buenos Aires, 22 - 26 July, 2002. The authors share the ideas and the responsibility for any conclusions contained herein. In any case, Sections 1.1, 2., and 3.4 are attributable to Silvana Cassar and Sections 1.2, 3.1, 3.2, 3.3, 4., 5. and 6. to Salvo Creaco. We are grateful to Giulio Querini for helpful comments on an earlier draft.

Perspectives have changed significantly since then, and a series of major studies published in 1870 began to revise classical economics which subsequently became known as "neo-classical economics". During the 1960s environmental pollution and over-exploitation of natural resources intensified and became more widespread, spawning new environmental ideologies. The wide introduction of natural resources into neo-classical models of economic growth occurred in the 1970s, when neo-classical scholars first systematically investigated the efficient and optimal depletion of natural resources on the basis that the world's resource stock is limited and contains a complex set of ecosystems that are mutually interrelated. Jointly, these events "caused economists to look afresh at a central economic idea: resource scarcity in relation to possible uses" (Pearce-Turner, 1990, p. 13).

Like other natural resources, today water is an important "economic" good. In particular, in most industrialised countries, the increase in water consumption, generated by economic development, has given rise to very strong competition among areas, uses, users, present and future generations over access to the resource. Such competition, owing to the distinctive features of the water sector, repeatedly called for interventions by the public sector, at an administrative, legal and at a legislative level, in order to regulate the use of the resource in different contexts. The growing economic and social importance of water resources has brought about changes in the juridical system, especially at a legislative level, aimed at overcoming the private and individualistic concept of the proper use of water. As a result we gradually came to the conclusion that measures more in line with the public interest concerning the use of water resources were needed, even though such an idea encountered a lot of resistance and was not always put into practice in a timely manner; neither was it totally suitable for economic and social development as a whole.

Another important aspect of the growing economic importance of water resources is the conspicuous amount of human and financial means that must be used in order to increase water supply. It has thus become urgent to draw up planning methodologies with the aim of rationalising the management of the water sector. And this has stimulated a growing

interest in general and specific issues linked to water resource planning, both among politicians and scholars. The latter (economists, political scientists, hydraulic engineers, and so on) have started to make greater use of the conceptual tools and the methodological principles of their own social disciplines in order to widen the perspective of the issues under investigation. This has led to the introduction of methodologies, techniques, and procedures aimed at improving the political choices in the field of water resource planning.

1.2 From a theoretical and historical perspective, the first issue is especially important. Although the underlying theory of cost-benefit analysis can be traced back to the welfare economics of the Pigouvian school (PIGOU, 1920), the practical way of assessing the desirability of projects has a longer history. As early as 1808 Albert Gallatin, U. S. Secretary of the Treasury, "was recommending the comparison of costs and benefits in water-related projects" (Hanley-Spash, 1993, p. 4). This prescription precedes the cost-benefit writings of Jules Dupuit (1844), a French inspector of bridges and highways who had been seeking an economic criterion for the construction of the public works in his jurisdiction for about 35 years (Prest-Turvey, 1965). Whilst Dupuit's paper mainly referred to the transport sector, cost–benefit analysis found a further application in various pieces of U. S. legislation on water resources. In this context, however, the analysis was seen as an administrative tool owing nothing to economic science and adapted only to a particular kind of federal activity – the improvement of navigation. The *River and Harbour Act* of 1902 required a board of engineers to report on the desirability of the Army Corps of Engineers' river and harbour investments, taking into consideration the share of trade benefits and the value of the corresponding cost. Moreover, another Act required an evaluation of special benefits as a means for charging local interests with part of the cost. In this context, the Corps of Engineers devised evaluation procedures that were strictly limited to tangible costs and benefits.

In the 1930s, with the *New Deal*, the idea of broader social justification for expenditure projects occurred. The *Flood and Control Act* of 1936 thus authorised federal participation in flood-control investments "if the

benefits to whomsoever they may accrue are in excess of the estimated costs". As the precise nature of a "benefit" still remained an obscure issue and the various U.S. agencies concerned with water-development projects commonly employed different and sometimes imprecise evaluation procedures, the U. S. Federal Inter-Agency River Basin Committee (1950) produced the celebrated *Green Book*, as an attempt to codify the general principles of project evaluation. The *Green Book* was noteworthy as bringing the language and the philosophy of welfare economics within the enumeration and evaluation of all the relevant costs and benefits of projects. This handbook was quickly followed by another attempt at codifying in the U. S. Bureau of Budget's *Circular A-47* of 1952. Leaving aside the measures adopted in the following two decades, about twenty years later, in accordance with section 104 (a) (6) of the Federal Water Pollution Control Act Amendments of 1972, the U. S. Environmental Protection Agency conducted a symposium to determine and advance the state of the art of cost-benefit analysis and water quality. The papers resulting from this symposium were appended to a report to the Congress of the United States (U. S. Senate, 1974), which can be considered an important intermediate stage in the development of cost-benefit analysis, which argued that the social costs and social benefits of a project could not be adequately expressed by market prices or could not be traded through market prices at all, as in the case of public goods. *Table 1* expands the several classes of benefits for measuring the economic impact of water projects.

TABLE 1. Classes of benefits of water projects

Type of benefit	Examples
• Marketed	
- No spillovers	Municipal water
- Spillovers	Water and wastewater treatment
• Not marketed	
- Divisible and measurable	Flood control
- Public good and measurable	Water pollution abatement
- Public good and nonmeasurable	Aesthetics

Source: Archivio di Stato di Firenze, *Mediceo*, 2328.

From a theoretical viewpoint, the next steps in the development of cost-benefit theory and tools are aimed at producing expenditure decisions which are better than those that would have been obtained by a simple political choice. In this process towards a better understanding of the social nature of the public investment decision-making, water resource development has come into prominence among economists and cost-benefit analyses are widely used for the appraisal of hydro-electricity schemes, irrigation, water pollution control programmes and policies, general water-supply programmes, the prevention of flood damage and so on.

With regard to implementation, today cost-benefit analysis is generally used for evaluating projects in various sectors (which are not linked to each other) of public intervention in the economy and in various institutional contexts, either as an essential part of the planning process in countries with long and medium-term plans aimed at integrating the qualitative and quantitative aspects of sustainable development or as an evaluation technique in developing countries where official assistance is sought from the World Bank, the United Nations, and other international financing agencies.

2. Historical roots

2.1 In Italy, the issue of water management has always been influenced by the country's distinctive geomorphological and hydroclimatological features and conditions. From a historical perspective, we may identify various stages of development. The first period, or Roman stage, may be considered a basic milestone in the history of Italian water management during which the ancient *jurisconsults* and the public authorities helped to create a juridical system which was capable of satisfying the needs of both private and public interest, in the general interest of the population. Although the juridical and political management of water resources was considered a matter of vital importance in the Roman world and was regulated in various ways, Roman legislation seemed to fall substantially within two main spheres, the one concerning the traditional distinction between public and private water and the other the juridical system concerning the different types of water resource.

As regards the first aspect, Roman law did not introduce a sharp distinction between the two categories: water was considered public only in the case of main and continuous watercourses, while all other waters were considered public or private depending on whether the land through which they flowed legitimately belonged to the *populus Romanus* or to a *civitas*, that is to single, private owners (Brugi, 1889; Costa, 1919). The great extension of publicly-owned property determined a corresponding increase in the quantity of waters destined for public use compared to privately owned waters. The laws concerning the uses of public water were very important and included extraction for private consumption, household use, drinking, hygiene purposes, field irrigation and industrial purposes and other technical needs (Greco, 1983, p. 62). The sources for Roman law were mainly derived from natural constraints and the socio-economic needs of the Roman environment and ancient Italy, and also by the size of the Roman Empire in the Eastern and Western Mediterranean regions, which gave rise to a specific branch of learning (Segrè, 1927-1930).

What lay at the core of this science was concern over the harmful consequences more than concern about the useful effects of the waters, be they river, spring or rain waters (defence of private property through the *actio aquae pluviae arcendae*, that enabled upper riparians to prevent lower riparians from impeding the natural flow of water through their fields and, conversely, allowed lower riparians to prevent the upper riparians from increasing or limiting that natural flow). With the exception of a limited number of cases, no generalised system of licensing existed and, therefore, the use of water resources was basically free for all and only subject to limitations and prohibitions aimed at avoiding possible misuses or harmful behaviour. Besides, the natural location of the watercourses (in great numbers and with rather large flows of water) and even the political organisation, mainly based on small city-states did not foster the concept of water resources as a centralised asset (Bonfante, 1922, p. 7).

While preserving the basic principles of this legal system, the post-classic and Justinian law, with the generalisation of the state licences system (Longo, 1966, p. 159) introduced some important changes which

were "determined, not only by the development of statutory centralisation, but also by the ever increasing importance of water in the urban and agricultural economy, which called for the construction of grandiose aqueducts and, above all, by the different conditions that prevailed in other parts of the Empire, especially in Eastern regions, whose economy depended on big rivers, such as the Nile, the Tigris, the Euphrates, which were subject to frequent flooding and which were regularly used for irrigation by means of a major canal network" (Astuti, 1958, p. 349).

On the whole, the Roman experience provides useful insights about water resources in relation to general collective interests as opposed to individual and private users, and especially in conjunction with the fact that the great majority of waters were public compared to privately owned waters. Undoubtedly this experience foreshadowed many aspects of the subsequent evolution of modern water regimes.

2.2 During the Middle Ages, following the barbaric invasions, an early development in water management was the progressive transfer of all water resources under the control and ownership of feudal lords. With Lombard rule, and even more so with Carolingian rule, public waters started to form part of the royal estate just like other properties. However, the increasing concentration of royal and imperial power was countered by the growing usurpation of feudal lords, which made the distinction between public and private waters even more confused (Astuti, 1958, p. 373-375).

The law regulating water underwent a fundamental change in 1158. With the *Constitutio de regalibus*, enacted by Fredrick I in the *Diet of Roncaglia*, the identification of public waters was established through the criterion of their navigability and was no longer dependent on their having a permanent flow of water, and the Emperor's rights were asserted (Loncao, 1913). Afterwards, when imperial power considerably weakened, medieval law eventually integrated the two criteria, to the benefit of feudatories, communes and principalities, which were able to extend the exercise of their "regalia" rights over watercourses (Astuti, 1958, p. 380).

In the sixteenth and seventeenth century, due to the influence of

the monarchy and foreign rule and also due to the growing fiscal needs of a number of states, the concept of public and royal rights in relation to water resources became more marked. Public waters were extended to include watercourses which were not good for navigation. New limitations for the general public use of water were introduced and the licence regime became more widespread. Generally speaking, in most parts of Italy, the greater consideration of the social importance of water resources led to a more rational use of the good, to the advantage of agriculture. In this respect, the legislation of Venice and the Kingdom of Savoy was particularly significant[2]. The situation was very different in the Kingdom of Naples, where, with the exception of the larger rivers, public waters were still controlled by the dominant feudal lords until 1806, when Bonaparte abolished the feudal system and all water resources became public property (Greco, 1983, p. 71).

During Napoleonic rule, Italy, like France, was divided into departments, which were established according to catchment basins, seas, mountains and lakes. In this phase, in which major canal works were carried out, the distinction between private and public rights to use public waters was re-established. By extending the French model to Italy, the navigability of rivers was acknowledged as a distinctive criterion for public waters, even though the lack of a comprehensive regulation of water management in many instances hindered its proper exploitation. Once Napoleonic rule was over, two different tendencies emerged in legislation regarding public waters. Laws based on the Napoleonic code were counterbalanced by those in line with the Albertino code; they both put aside the concept of navigability of the rivers, and extended state ownership over all major watercourses (Giorgi, 1892). Although these codes derived from a feudal tradition which implied that all water resources of a certain entity should be subjected to the rule of the prince, their use for production purposes was guaranteed in a more satisfactory manner.

[2] While the Venetian legislation is of interest because it is the source of principles and institutions which are still valid today, the Kingdom of Savoy legislation is important because it shows the change in the way sovereign rights over public waters was viewed with the general assertion of public rights over water resources. A historical analysis of Venetian legislation to provide solutions to the problem of control over water, especially with regard to land reclamation, has been carried out by Escobar (1980).

2.3 In the early post-unification years, Italy's legislative and governmental bodies had to face an extremely varied socio-economic situation. To build a solid image of the new State and to strengthen central power, they felt that the need to create a sound juridical and administrative apparatus was a priority. Not only were prefectures, barracks, road and railway tracks built with great haste (De Bernardi–Ganapini, 1996, pp. 77, 300-302), but also a thorough revision of national law was carried out with urgency. In a short span of time, from 1861 to 1865, the government took decisive steps to eliminate the confused administrative, legislative and financial systems.

In the economic sphere, the government began to unify the laws regulating agriculture and commerce (Fumi, 1993, p. 212-213). As regards public and private waters, the unification of laws was accomplished in 1865. In that year, the new Civil Code, which was based on the Napoleonic code and the Albertino code, set out important principles on water management and Law number 2248 of 20 March 1865, defined state-owned waters within a legal framework that dealt with the administrative unification of the kingdom. Both laws came into force almost simultaneously (Manetti, 1992, p. 112-113).

The Civil Code declared that only rivers and torrents were public property, while for minor watercourses riparian landowners were entitled by law to use freely waters for field irrigation or for industrial purposes on their own property, without being obliged to apply for administrative licences which was necessary for eligibility to use state-owned waters. Like the French Code, the Italian law established that riparian landowners had to ensure that waters used for such purposes were returned to their original course before leaving riparian land, while the courts had the power to settle water disputes by balancing private interests with those of agriculture and industry. Unlike the French model, however, both navigable and non-navigable streams (rivers and torrents) were declared public and a controversy ensued with respect to the definitions of torrents which were considered by the doctrine to include either perennial, small or all streams, whether perennial or not.

The following law of 20 March 1865, number 2248, which dealt

with public works, defined ditches, creeks, public drains and lakes as public waters in addition to rivers and torrents. This law placed state-owned waters within the broader framework of public works with the main aim of ensuring the efficient management of public watercourses and of regulating extractions and uses. Implicitly, the law established the principle that all waters suitable for satisfying public interest constituted public waters and that a licence was to be obtained for their use. The freedom of riparian landowners to use waters other than those indicated in the law of March 1865 together with the water from rivers and torrents in accordance with the Civil Code was considerably limited. Subsequent provisions approved the regulations for the extraction of public waters (Royal Decree of 8 September 1867) and the regulations for the defence and safeguard of rivers and torrents (Royal Decree of 15 February 1870).

Public waters came under a separate discipline following Law number 2644 of 10 August 1884 (and the corresponding Law of 26 November 1893, number 710) which regulated water use through the introduction of the temporary licence. Nitti, who understood the importance of the hydroelectric industry for the Italian economy due to the abundance of watercourses, supported the idea of a revision of the 1884 law as far as restriction-control and productivity were concerned (Barone, 1993, p. 204-205). In the case of public waters, he considered nationalisation as an efficient factor of stimulus for economic development (Nitti, 1902). That is why, in 1902, he proposed the free entry of the State on the expiry of the licence contracts, which were supposed to be granted to private enterprises for very low rents and for a period of time long enough to allow for amortisation of the capital invested. Nitti's proposal was severely criticised, particularly by Omodeo (1902), above all because of the foreseeable incapacity of the State to take on entrepreneurial functions in a sector of the economy in which far-reaching and sudden technological changes occur (Mori, 1989, p. 93).

Public waters were the subject of further definitions between 1916 and 1919. The opportunity came at the beginning of World War I, at a time when increased costs and the impossibility of importing coal from overseas made it clear that it was necessary to ensure the rational use of

water resources with the aim of substituting the production of thermal energy with hydroelectric energy on a large scale[5]. In 1916, the problem about the correct use of water resources became a national issue and demanded an immediate change in policy and the law (Scialoja, 1916, p. 58; Omodeo, 1916, p. 27).

Under pressure from industrialists and concerned about the exceptional rise in the price of coal after the beginning of the war and the urgent needs arising from war, the Salandra government set up a Commission to study and propose changes to the 1884 law (Civita, 1925, p. 636). A reform was implemented in November 1916 by means of a Decree enacted by Bonomi, Minister of Public Works, "which marked the start of a real reform of the law on the extraction of public waters of 1884, thus, finally regulating all the complex matter" (Ottolino, 1993, p. 467). The maximum duration of licences for water extraction, when water was used as a motive power, was fixed at 50 years while the duration of licences for drinking water, irrigation and restoration, extraction was fixed at 70 years. In the case of extraction for motive power, when the licence expired all the infrastructure of water collection, extraction and regulation would become the property of the State, which

[5] In practice, the problem linked to coal supply had drawn the attention of many observers even before Italy entered into the war (Luzzatti, 1915). On the eve of its entry into the war the problems increased, for a number of reasons clearly expressed by Porri (1915) and summarised by De Rosa (1993). Summarising briefly, we can say that before Italy's entry into the war, the production of coal, which was obtainable only at very high production costs, was so small that it covered only 6-10% of the quantity consumed annually in the country. With the economic and industrial development in Italy, the importation of coal (mostly from the United Kingdom) had risen from 1,747,746 tons to 10,834,008 tons in the 1908-1913 period. When the war broke out, since the main exporting country had to recruit thousands of miners into the army, it had to curtail coal production and therefore exportation; exports to Italy fell by more than one million tons. In the meantime, the spread of war had triggered a further rise in coal prices with an increase that was higher than that registered by other goods. Moreover, Germany, which had exported about 485,000 tons of coal to Italy, in the first five months of 1915, had all future consignments cancelled, after the breakdown in diplomatic relations with Italy. Neither France, which had lost control over its coal mines, nor the United States, even though their supplies to the country had increased, could offset such a substantial reduction in the production of coal. As a result, the increase in the price of coal seemed to be inevitable (Einaudi, 1915). For further details on the problem of searching for a valid substitute for imported energy sources in the country because of the war, see Giannetto (1993).

was not bound to refund any of these expenses, while the costs of all other buildings and plants were to be paid to the ex-licence holders at their market value.

The State could also pursue redemption before the expiry date by giving three years' advance notice (Decree Law of November 1916, number 1664, articles 11 and 12). In the case of public waters, a series of other measures followed the official publication of the 1916 decree, and in 1919 the reform of this sector was completed with a juridical provision which guaranteed state control over all waters in Italy, and provided for effective administration to achieve these objectives. As far as the validity of the licence was concerned, perpetual licences were abolished: licences had a maximum duration of 30 years for minor extractions, 60 years for major extractions for water used for motive power, and 70 years for water extractions used for drinking, irrigation and reclamation (Greco, 1983, p.112-113).

2.4 The 1916-1919 reform (culminating in the Royal Decree of 9 October 1919, number 2161, and the corresponding regulation of 14 August 1920, number 1285), acknowledged priority for public use rather than for private, individual use. Although with certain rules it endeavoured to accommodate private interests (Scialoja, 1916), the new law was justifiably criticised, because it was based on criteria which, tending to class most water resources as state property, were deemed detrimental to many lawful situations, and because preference was given to the hydroelectric industry rather than to industries which used water for other purposes, such as irrigation. These criticisms were founded on doctrines which were very influential at the time and which linked the ownership of water as a commodity to the right of ownership in general and with the social purpose of ownership. In this new legislation, socialist-type decisions could be seen which revolutionised the traditional understanding of private rights (Manes, 1922, p.25) and which gave rise to fears that the "nationalisation" of water would lead to "nationalisation" of land (Bonfante, 1919, p.461-462). As well as criticism of these issues of principle, there were other criticisms which pointed out the shortcomings in the organisational structure of the

public administration of water (Valenti, 1916, p.47; Scialoja, 1916, p. 66-67; Ratto, 1917, p.3-5, 18).

The first months of 1925 saw dangerous levels of dissatisfaction in the economic sector. Exasperation reached its peak after the crash of the Stock Exchange and various bankruptcies. There was a turning point in June 1925 when Mussolini decided to dismiss the then unpopular Minister of Finance, De Stefani, and replace him with Giuseppe Volpi, who, as well as having shown remarkable diplomatic abilities, was also one of the magnates of the electricity trust (Castronovo, 1986, p. 178-1180). With his already proven capabilities of conciliating private and public interests, it was believed that he could overcome the difficulties in which electricity industrialists, embittered by the cuts in public spending which had severely penalised this sector, had found themselves for some time (Ottolino, 1993, p.485-487).

The second half of the 1920s were the years which marked a decisive change in the course of the Italian economy and the government was the principal actor in a scenario which identified economic development as its top priority with the subsequent modernisation and expansion of industry. The agricultural sector was widely acknowledged in the regime's speeches, but in actual fact it was given a subordinate and functional role in relation to industry (Gualerni, 1994).This new phase saw the start of a marked presence of the State in the economy. The problem of the regulation of water was among the many issues dealt with: it was of fundamental importance, and a solution had to be found to age-old problems and to requirements which would be a consequence of the envisaged economic development.

With the Law of 18 December 1927, number 2595, the co-ordination and the regulation of the whole issue passed into the government's hands and the latter had the authority to implement the necessary changes. On the basis of such authority, with the Royal Decree of 11 December 1933, number1775, the Consolidation Act (*Testo Unico*) approved "provisions of the law on water and electric plants", which provided for the regulation of water as in the 1919 law, but with a further enlargement of the category of public water, which now included underground waters which were extracted by man, if they were for general public use. According to the

new law, all springs, rivers and lakes were to be considered "public waters" if they could be considered for any kind of public utilisation. Perpetual licences were abolished and a competitive system was set up for those who applied for new licences, while preference was given to those who presented the best plan for the utilisation of water or the plan which best served public interests. With the aim of satisfying public interests in the water resources sector, the Ministry of Public Works became responsible for all administrative and technical skills. The introduction of the Consolidation Act was accompanied by a heated debate on the limits of state control over waters and the rights of private owners.

This was taken into account in the preparation of the current Civil Code which, when dealing with water and the rights of private owners, constantly refers to the provisions of the special laws on public waters, reaffirming that most water belongs to this category. The Civil Code states that, when private owners use waters found on their property, any use is subordinated to the provisions of the special laws on public and underground waters (article 909), which classify as public waters those which are, or could be, in special listings, since they are, or could be, fit for use in the interests of the general public.

2.5 Until 1994, the 1933 Consolidation Act, together with the 1942 Civil Code and the special subsidiary legislation which dealt with particular necessities, governed water issues according to a single principle: the public ownership of water had to be explicitly declared by the public authority in every single case, thereby implying that all surface waters of some importance were to be considered public, and therefore required an extraction and user licence from the proper authority; whereas the use of underground waters was free and considered as part of the rights of landowners.

This basic principle, which already existed in the previous legislation although it was dealt with differently, marked a valid decision at an institutional level in that it paved the way for intervention by the public authority in order to achieve a rational administration of water resources.

In fact, the public authority's great discretional power in granting permission for water extraction was a necessary instrument, though not sufficient, to achieve the best agreement on the demand and supply of water within a planning process which took into consideration all the social and economic interests involved in the different forms of water use.

3. Water plan and economic planning

3.1 The previous analysis has shown that in Italy, as in most industrialised countries, the legislation on water resources (in the period before and after Italian Unification) has gradually reflected their increasing economic and social importance. But already in the 1950s, the substantial increase in population, the uncontrollable spread of urbanisation and sustained economic growth, together with a general improvement in the standard of living, determined a rapid increase in water consumption. Such a situation emphasised the shortcomings of legislation safeguarding water resources, and especially revealed the need for more appropriate laws to protect the land, to safeguard water and contemporary economic development, based on planning strategies which aimed to rationalise the allocation of resources (Astuti, 1972). In response to the need for a systematic preservation of land and for a rationalisation of the use of water resources, from the 1950s onwards, the Italian public administration issued a series of laws which embodied some broad planning. In this context, the Law 129/1963 was of vital importance: it established the inception of a general plan for waterworks throughout Italy with the aim to satisfy demand (projected to 2015) for civil use in urban and rural centres.

The need to plan technically in order to implement a sound systematic water policy was subsequently underlined by the National Water Conference, in its conclusive document (Senato della Repubblica, 1972). The proceedings of the conference revealed the seriousness of the problems, linked to the rational use of water resources, and of course, included such issues as the defence against floods and water quality management. Moreover, strong emphasis was placed on the need to

include water policy once again in planning concerning socio-economics and land development.

This gave rise to a period of government intervention over water resources, a process characterised by increasing public interest in the conservation and the protection of water resources within the framework of a planning policy. This process appears to be closely linked to the changes in the way of implementing economic planning in Italy (Creaco, 1984). In the mid-seventies, because of the failure of the attempt at global planning, the most noteworthy interventions in the socio-economic field concerned sectoral programming. A typical example of the economic policy's new approach was the implementation of a wide-ranging group of legislative measures which, though being of a sectoral nature and not having an immediate connection with other issues, all refer explicitly to the region's planning activity. Law 319/1976 on water pollution control (better known as the Merli law) falls within these measures.

During this period of sectoral regional programming, local government reform also began in Italy. The implementation of the new regional plan strongly influenced the organisational aspects of water management and planning. In particular, though not referring explicitly to the situation envisaged in the Merli law, the Presidential Decree of 24 July 1977, number 616, modified the existing order, especially in the sector of water property management and the protection of the environment. Legislation regarding water resources, as modified by the Merli Law, stated that central government was responsible for harmonising all regional activities. In particular, as far as the issue of water quality is concerned, the State was to establish general technical rules to regulate this matter, to define the compatibility of regional plans for retrieving water in inter-regional hydrographical basins and to draw up, on the basis of the regional plans, the general plan for water reclamation. Within this general framework the regions had the responsibility for safeguarding the general public interest concerning water usage. In fact, the Presidential Decree number 16 of 1977 established that "all the operations linked to protecting and using water resources are devolved to the regions which are to carry them out within

the framework of national planning for the distribution of water resources and in compliance with central government directives, both general and sectorial, about water management".

These measures, together with others which followed concerning both the protection of surface waters which were meant to be used for drinking and the disposal of solid waste, enabled the regions to devise and implement a policy which took into consideration the various aspects of the reclamation and the protection of water resources within the broader framework of the natural environment. In short, local authorities were asked to protect water at a practical level. The role of the provinces was limited, since they merely had to collaborate in safeguarding resources. On the contrary, the municipalities and the mountain communities, which were responsible for the actual running of the public waterworks services, drainage, water conditioning and the disposal of mud, participated in the regulation and the control of waste products. In actual fact they were the regions' main partners in the planning of works and the infrastructures required for the above-mentioned services.

3.2 Within the plan outlined by the Merli Law, which aimed to solve the issue of water waste overall, the role of the regions was extremely important, since they had to draw up and manage the regional plan for reclaiming water which is the principal means for safeguarding the quality of water resources. It must be added that these planning tasks were given to the regions at a time when planning was part of general policy and was embodied in the role that had been given to the regions and in the need to coordinate regional system planning, sectoral planning and budgeting by the committees involved in the planning.

The practical implementation of the Merli law, therefore, held the regions responsible for carrying out an arduous task. In fact, it was a "framework-law", in which regional bodies were not only expected to draw up the all the regulations, but also to plan the construction of infrastructures to combat pollution and at the same time provide for their funding. The implementation of the Regional Plan for water reclamation required the proper infrastructures, endowed with personnel specialised in a sector in which the public administration had very few experts.

However, reasons of a political and economical nature[4], together with the inadequate implementation of control systems, have not enabled the rational planning envisaged by the Merli law to achieve the aims of safeguarding the environment and the quality of the waters in a fully satisfactory manner. In the subsequent period the legislator adopted other provisions in the field of water management and planning. But they were still measures based on sectoral principles and so they failed to provide solutions to problems arising from the need to link quantitative aspects in the use of water resources to qualitative aspects.

3.3 We can begin to draw an important conclusion from the above analysis. Government intervention in the management of water resources has aimed to provide more controls over the use of water necessary to satisfy socio-economic needs in the public interest, and this has constituted a great change in the territorial impact of government projects. In particular, we have seen the gradual introduction of water projects which have been both regional and national, instead of projects based on an essentially local plan. However, although it marks an important turning point in Italian planning policy, the introduction of projects on a national and regional scale does not mark a substantial difference in the conceptual approach adopted in previous periods and it would be rather superficial to limit our evaluation of water management only to this aspect. From the point of view of water resource management and of plant technology what needs to be emphasised is the huge change in criteria over the use of available water resources, which in Italy, as in other countries, are limited in quantity in relation to expected future needs: water seems to be irregularly distributed both geographically and seasonally; which makes it suitable only for partial use, bearing in mind the present need for continuity in its use.

From this different perspective, it seems useful to point out that before the Second World War it was customary, both in Italy and all over Europe, to build a simple type of water system based on one use-one purpose

[4] Creaco-Rizzo (1985) have formulated a political-economic model showing that the difficulties in the implementation of the Merli law can find theoretical and empirical justification in the principles of public-decision theory.

and located in such a way as to use only a part of a single waterway which would be advantageous from an economic and technological viewpoint. Even earlier, during the First World War, it was fairly common to find multiple use or multiple purpose systems to accommodate various types of use. After the multi-purpose approach, plants designed according to the principle of combined use appeared, involving multiple resources which functioned together and offered services for one or more uses. Therefore, between the two World Wars, especially in Northern Italy and in Sardinia, a conceptual and practical approach to the management of systems and water resources was evolving which broadened the criteria for using available resources. From a theoretical point of view, the shift towards a multi-purpose approach or a combined-use approach appears to have determined a broader use of a systems analysis in water allocation.

In Italy, however, systems analysis was generally ignored, and often used merely by chance and without considering the theoretical principles of optimisation methodology itself. In the post World War II period, plans were drawn up using systems analysis during the 1960s. But it was in the National Water Conference that systems analysis was viewed as an essential tool for overcoming the shortcomings of the traditional methods of water allocation which, even though adequate from an engineering point of view, proved to be insufficient for the systematic application of economic principles to decision-making processes. In the conclusions reached by the Conference, the basic concepts of the application of systems analysis to water planning were succinctly expressed with reference to Italy, with the aim of introducing a water plan, at both a national level and at a number of regional levels, in order to identify the best use of water, in the short, medium and long term.

3.4 Nowadays various public administrators who are responsible for water management and planning seem to have more frequent recourse to systems analysis. They have learned from the experience of an organisation which has had an important role in the socio-economic development of one of the most depressed areas of Italy: the *Cassa per il Mezzogiorno* (the Fund for the Improvement of Southern Italy), hereafter referred to as the Fund. The idea of setting up the Fund was

officially announced by the Premier, De Gasperi, in his speech at the sixth opening of Parliament[5]. Amongst the "absolutely new" characteristics of his government, De Gasperi (1950) announced a "a special multi-year programme of public works and interventions for depressed areas and, therefore, especially for the southern part of the country"[6], the importance of which was also recognised by the members of the Leftist opposition[7].

The Fund, set up in 1950 to promote southern economic development on a long-term basis, envisaged a complex mixed programme comprising public works (mainly human and material infrastructures) and incentives for public and private enterprise in the agricultural, industrial and service sectors. Projects were to be carried out in virtually every corner of the South's huge territory. The irrigation and water system projects were particularly important. The economic evaluation of irrigation projects was, on the whole, calculated to obtain loans from the International Reconstruction and Development Bank. The benefits of such projects included an increase in the gross value of agricultural production, in *per capita* income, and in the State's tax revenues, while aggregate national economic profitability was normally valued at the market price at the time of demand for a particular item.

Clearly, the above summary does not include all the economic

[5] On the historical origins of the Fund and its political motivations, see Cafiero (1975) and Barucci (1978). The subject of the parliamentary debate caused by discussion of the De Gasperi proposal is found in Bini (1976). On the same point, see also Pescatore (1982).

[6] The beginning of the Southern Italian Question dates back to more than a century before the unity of Italy (Villari, 1978). But it was only from 1950 onwards that, once the philosophy of temporary measures which aimed to deal with emergencies was abandoned, the State began to deal with the southern problem with a broader view and with measures based on reasoning that was very different from the previous tradition, dealing with the needs of the South as a whole, as a region which needed to become part of Italy's economic system. It may be said, therefore, that in 1950 people were completely aware of the dual nature of the Italian economy, and of the fact that more than one third of the country had a backward economy, while the regions located closer to those areas from which European economic development had spread in the nineteenth century continued to progress (Di Nardi, 1960).

[7] In this context the words of Giorgio Amendola (1950) take on meaning when he said that "for the first time the South has been put in a place of honour in the Government's declarations".

analyses carried out by the Fund, and aims only to draw attention to the Fund's efforts to help provide better methods of resource allocation. The Fund was, in fact, the first organisation to make expert use of systems analysis. However, it cannot be denied that in terms of project implementation, the Fund had little impact on narrowing the gap between North and South, which was the main objective of Italian planning. Admittedly, the Fund was not able to overcome the problems of Italian coalition politics, piecemeal patronage and strongly bureaucratic administration[8].

There is a wide range of historical and economic literature on the Fund's failure to fulfil its main objective (Saraceno, 1986). It is not the aim of this paper to review this literature. For our purpose, it is rather more important to point out that the Fund's special intervention substantiated the project planning process which improved as government authorities improved their capacity to identify, prepare, evaluate and undertake particular projects. This was another positive aspect of the Fund's activity since it contributed to Italy's accepting more widely a process that views projects as the building blocks of a general plan in which the various bodies responsible for funding enjoy a considerable amount of autonomy in investment decisions, within the framework of systems analysis.

4. Water planning and sustainable development

4.1 The most recent phase in Italian legislation on water resource management and planning involves a major revision of the development process. This re-thinking emphasises sustainability as a guiding principle so that economic development may take into account environmental and social factors when policies and strategies are being laid down. The concepts and observations underlying sustainability are not really new

[8] As Hayward (1975, p. 16) states, "interministerial co-ordination was put into the hands of a Cabinet committee but ministers failed individually to give financial effect to the politics agreed on collectively. In any case, the average delay between the decision to spend and the release of funds is claimed to be 900 days, laborious traditional public expenditure procedures resulting in unspent funds being used for other purposes".

and go back to the mid-1970s. In fact, as a development criterion, sustainability was formally introduced in 1976 by Bariloche (Chichilnisky, 1977). More recently, sustainability and sustainable development were given further impetus and were popularised by the Brundtland Report according to which the aim of economic development was to increase pro-capita levels of wealth and to reduce poverty and inequality, at the same time protecting and renewing the resource base of national economies and the world economy. The Brundtland Report stimulated debate both on the environmental consequences of industrialisation and on the effects of present actions for coming generations. Moreover, the report renewed interest in the physical and ecological constraints to economic growth. As a result, sustainability and sustainable development began to appear in a range of contexts and to figure as an explicit goal in many domestic and international policy-making institutions. For instance, at a supranational level, the European Community in its Fifth Environmental Action Programme (European Economic Commission, 1992) described the challenge of the 1990s in terms of the need for a far-sighted, cohesive and effective approach to achieve sustainable development.

4.2 In Italy, as in other European countries, the adoption of sustainability as a development model is a direct outcome of the way in which the European Community, and at present the European Union, has changed its environmental policy from an "incidental policy" to a legally and institutionally independent policy sector (Creaco, 2001). In Italy, the introduction of sustainability as an environmental policy was also fostered by other obligations undertaken in supranational contexts. It was within this framework that the Galli law was approved. This was preceded by another important legislative measure, aimed at rationalising water management and planning, identifying the catchment basin as the best location to consider the complex aspects of water conservation and use. This law introduced a radical reform with the primary aim of ensuring that water management and planning activities would be carried out according to principles of water sustainability.

Obviously, this outcome could not be reached without having some

impact on the legal aspects of water and especially on the use of resources with the aim of protecting them. In this regard, the reform introduced the basic principle according to which all water, both surface and underground water, is public, thereby establishing that all water use needs to be licensed.

The reform was based on the concept of a water equilibrium, i.e. adapting available resources to the needs of different uses: for the first time, the principles of environmental protection and economic efficiency were brought under a single law containing a coherent land-planning project. Besides the radical changes regarding the principles and aims of water management from the legal point of view, there was also a change concerning the authorities responsible for the implementation of projects. On the basis of modifications introduced by the Galli law, water management and planning were to be entrusted to the central government, the regions and local authorities according to the following scheme:

- The central government would promulgate framework legislation and adopt EU Directives;
- The regions would be responsible for water resource management and planning, pollution control and all administrative issues;
- The local authorities would be responsible for the organisation and management of water services, increasingly under inter-municipal organisations, imposed by law.

After the introduction of these regulations, important analyses and investigations were carried out, with the aim of examining their financial, institutional, economic and social impact. The findings on the whole showed that the legislative and institutional framework of water policy in Italy was in alignment with the rest of Europe. However, the distance between theory and the proper implementation of law is still great enough for us to conclude that the Italian water issue has not yet been completely solved. Many dark areas still remain in the whole planning mechanism, probably because certain important aspects of the Galli law were more the outcome of political compromise than a response to the need for an efficient implementation of policies based on water sustainability.

5. Water sustainability and evaluation methodologies

5.1 Since the late 1980s, when the Brundtland Report attracted worldwide attention, people have become increasingly aware of the great need to put the sustainability concept into practice. Various approaches have been proposed but they all share a common denominator: the need to adopt the concept of sustainable development, but also to change the "project cycle", i.e. the process in which an intervention is identified, prepared, evaluated, completed, managed and lastly monitored.

In the traditional approach to water management and planning, and to natural resources in general, in each phase of the project cycle the main responsibility of those who were supposed to evaluate and carry out the project was that of examining the various options and choosing them, paying attention to the plant and to technical considerations, i.e. by favouring the purely engineering aspect of the whole decision-making process. This approach to planning had a clear technological bias, with a tendency to always choose the most recent and advanced technology available. Probably, such a way of operating was based, on the one hand, on the desire of engineers to defend their professional impartiality and, on the other, on the need to transfer responsibility for deciding on other important aspects to the political and institutional sphere.

The shortcomings of this approach, which can be seen in other important aspects of the project, have led to the acceptance of an allocation principle based on evaluating the social costs and benefits of public projects. This principle views public projects not only as material products to be evaluated mainly according to their technical features, but as the outcome of economic policy, the costs of which can be evaluated on the basis of the objectives to be fulfilled. At the operational level, this way of considering the project cycle has led to the adoption of cost-benefit analysis within the public decision-making process, as an evaluation method for determining and implementing the project. In fact, cost-benefit analysis encompasses all the stages of the project cycle, from preparation to decision,and from implementation to monitoring, which results in a process of subsequent controls, the information from the previous phases being used in each phase to improve the efficiency of

the entire project. The whole process is carried out by considering the projects' basic aspects simultaneously and systematically.

5.2 The reference to cost-benefit analysis as a method for determining and managing public projects promptly raises the question of the usefulness of applying conventional economics when dealing with issues linked to sustainable development. This issue is theoretically based on recognising the existence of alternative approaches for deciding on public projects. In fact, cost-benefit analysis is the oldest and most traditional method for assessing a project's desirability; since the 1960s, other methods have emerged while new environmental ideologies gradually became more established. A different method for project evaluation was in fact introduced: its main feature was the absence of monetary evaluation in a project's benefits and costs. This new technique was introduced in the United States in 1970 by the National Environmental Protection Act (NEPA). This act aimed to reform the ways agencies conducted business so that environmental values would be considered along with utilitarian criteria, with the ultimate aim of taking into account the unintended effects and consequences of planned projects and operations. Specific objectives were listed, which, generally speaking, formed the core of sustainability. The Act required an Environmental Impact Statement, with its English acronym "EIS", for "every major federal action significantly affecting the quality of the environment".

Following the introduction of NEPA and its evaluation method which requires a systematic interdisciplinary approach that ensures the integrated use of natural and social sciences and environmental design arts in planning and in decision-making processes, there has been a significant change both in engineering practice and in environmental ethics. As far as politics are concerned, growing awareness that the goal of managing the environment for everyone's benefit has often been neglected and overshadowed by the pursuit of narrower and more immediate economic goals, has made decision-makers more sensitive to the potential environmental consequences of their actions. As an outcome, the "EIS" is now a commonplace legal term and an evaluation procedure in many other countries and in supranational situations.

An important offspring of the EIS was the 85/337 European Community Directive (EUROPEAN COUNCIL, 1985) on the assessment of the effects on the environment of certain public and private projects, requiring that "member states shall adopt all measures necessary to ensure that, before consent is given, projects likely to have significant effects on the environment by virtue *inter alia* of their nature, size or location are made subject to an assessment with regard to their effects" (article 2). In Italy, the Directive was transposed by means of a law that since 1986 has considered firstly the projects of national importance and then regional projects.

5.3 In the context of policy-making, the theories underlying evaluation methods using conventional cost-benefit analysis and other evaluation methods in which environmental impact is the only important aspect for project selection have been greatly criticised when they ought to provide adequate guidelines for sustainable development. In particular, their inadequacy has been highlighted by the fact that they are based on a one-dimensional, well-defined performance indicator, whilst the concept of sustainability encompasses wide-ranging visions of development which include, not just increases in real *per capita* incomes and environmental impact, but also other factors regarding social welfare. The validity of this argument has led to a need for more appropriate analytical tools for strategic evaluation in relation to sustainable development, assessing plans and projects by different criteria. Today, there are many publications which present an alternative multi-criteria approach to sustainability, where environmental impact and economic efficiency are only two of the whole range of relevant criteria. Since eco-systems are generally used in several ways simultaneously by a number of different users, "these criteria can be different in nature: private economic (employment, income distribution, access to facilities), environmental (pollution, deterioration of natural areas), energy (use of energy, technological innovation, risk), physical planning (congestion, population density, accessibility, etc.), and so forth" (Munda et al., 1994, p. 162). The crucial issue to attain sustainability is thus to devise some kind of project and plan value on the basis of an explicit or implicit set of measures for the various criteria.

This will enable many conflicting views at a local, regional, national and supranational level to reach some form of logical compromise about environmental and resource management and policies that aim at ecologically sustainable development.

The process of broadening perspectives to deal adequately with the problem of planning natural resources in general, and of water resources in particular, is illustrated in *Table 2*. Differences in the type of project under consideration and differences in evaluation techniques and in the professional skills required to translate theoretical theories into practical projects all reflect this broadening of perspective. Certain objections may be put forward concerning this process and the introduction of categorisation, in this specific case with regard to decisions about timing and the specification of professional skills (Rossi, 1996).

As regards this last aspect, most objections which could be raised lose their force once it is acknowledged that the multi-purpose nature of natural resources requires an inter-disciplinary approach in which

TABLE 2. Evaluation approach in water resources planning and management

Date	Project solution	Evaluation methodology	Professionals
Before 1929 crisis	Technical solution	Cost-benefit analysis (administrative procedure)	Engineers
After 1929 crisis	Technical and economical solution	Cost-benefit analysis (statement of special benefits as a means of making local interests pay part of the cost)	Engineers and economists
After World War II	Technical and economical solution	Cost-benefit analysis (costs and benefits evaluation in the language of welfare economics)	Engineers and economists
Since the 1970s	Technical, economical solution	Cost-benefit and environmental analysis and Environmental Impact Assessment	Multi-discipline team
After the 1990s	Technical, economical, environmental and social solution	Multi-criteria analysis (evaluation of projects and plans according to a broad set of criteria, which can be of very different types)	Multi-discipline team

economists, engineers, town planners, industrial chemists, physicists and other professional categories offer their skills to the evaluation team in a joint effort to acquire a broader knowledge of the complex interactions within economies and natural environments and between economies and natural environments.

6. Concluding remarks

In Italy, as in most industrialised countries, the growing economic and social importance of water resources has triggered a legislative process with a view to supplanting the individualistic and private nature of their use. This process reached its final stage in 1994 with the Galli law, which introduced the basic principle of public ownership of all water, both surface water and underground water. Within this process, planning methods have been progressively implemented since the 1950s, with the ultimate aim of ensuring both systematic land conservation and the rational use of water resources. In Italy, both global and sectoral planning have become very complex because of a wide-ranging and heterogeneous set of problems. On the whole, two aspects have played a crucial role: on the one hand, the bodies involved have often been a nebulous mixture of the old and the new; on the other, the objectives underlying political choices have largely produced confused guidelines due to governments' inability to introduce an integrated and coherent medium-term economic policy. This has inevitably led to the failure to establish a satisfactory relationship between public and private planning respecting their individual areas of discretionary decision-making power.

Because of the increasing impact of economic activity on the environment, recent planning and management strategy has aimed at rationalising resource allocation, both in general and within the water sector in particular in order to find alternative ways of integrating environmental protection with economic development and social equality. For decision-makers, both in the public and the private sectors, therefore, the 1990s have been a period for exploring new research in this non-traditional field of inquiry.

The Italian approach towards different methods of water management

and planning has existed for almost ten years. From the theoretical point of view, the superiority of integrated systems of water management over sectorial interventions has become increasingly recognised. Moreover, recent legislation introducing integrated systems of water management has been an essential step towards water sustainability. In this respect, the Decree Law 152/1999 overcame the shortcomings of the Merli law, by reinforcing the measures for saving water and for environmental quality control, particularly by means of identifying areas susceptible to processes of eutrophication and of areas vulnerable to both nitrates and phytosanitary products, as well as areas subject to desertification.

However, although considerable progress has been made, the Italian approach towards sustainability is still in a state of flux with many dark spots and still not much light. Despite the initial enthusiasm, we have come to realise that the path to water sustainability is more difficult than was envisaged when the strategy was first adopted. Our survey of ways of thinking about the Italian path to new methods of water management and planning has barely touched on the most important issues and has examined only some of the wide range of subjects essential for reconciling the economic, social and ecological aspects of the water issue. A start has been made in revealing gaps and failures in existing policies and operations but much more needs to be done. Viewed from this perspective, our paper has a certain theoretical and practical value. By highlighting the link between abstract models and principles on the one hand and concrete problems on the other, the paper makes a contribution to the search for innovative, workable and sustainable solutions to the environmental problems we face today.

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