

Participatory Irrigation Management: the case of Consorzio di Bonifica of Capitanata ⁽³⁾

by

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1. FEW NOTES ON THE LEGAL FOUNDATIONS OF THE RECLAMATION CONSORTIA IN ITALY

At the beginning of the '30s, the areas of the Capitanata (Foggia – northern Apulia) were in so hydraulically bad conditions that any form of agricultural and economic development was hindered. The presence of marshy and unhealthy areas favoured the development of Anopheles and malaria was a barrier to human and rural land settlements. In such a scenario, despite the execution of the first drainage and hydraulic regulation works, large agricultural areas for pasture were still present and soil tillage for sown crops was too sporadic.

Such unbalances, the requests for redemption of land, human and social growth of the population, gave rise to the laws on hydraulic management and subsequently on comprehensive reclamation. Comprehensive reclamation was aimed at “recovering the lands still covered with marshes and swamps for production purposes”. The legislation on hydraulic management works in force at that time was then integrated with the rules that envisaged a “Reclamation Master Plan” based on which the reclaimed land had to be equipped with roads, waterworks, power lines, rural constructions. In 1933, a comprehensive law was issued – the R.D. 215/33 – that modified and integrated all the previous laws on reclamation and implemented the provisions of the law 3314/28.

In his far-sighting view, the major author of the law (Arrigo Serpieri, 1933) thought that comprehensive reclamation, as a whole, had to be implemented by involving the land owners in the process of modernization of agricultural production.

The law defined the works of concern of the State, that had to pay for the corresponding costs of execution and, at the same time, the works of concern of the private individuals. Since the private farmers would have not voluntarily accepted to participate in this transformation, the State obliged them to make the improvement works; if they refused to execute the planned works, the State was authorized to go on with works on its own and to charge the corresponding costs to them.

In order to facilitate that transformation process, Associations of private farmers (Consortia) with public purposes were established. The State was still entitled to execute the reclamation works of its concern; it assigned the works in concession to the Consortia, and it also imposed the compulsory participation of the landowners falling within the area of the scheme.

Consequently, the Reclamation Consortia, from the legal viewpoint are defined “private bodies of public law”.

The private farmer was, and still is, considered the main author of the transformation process, although subjected to the directives and the (partially) public financial support.

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The works of concern of the State were and are still financed through the allocations stated in the Ordinary Law, that depend on the Ministry of Agriculture of Public Works, or through special laws issued *ad hoc* for special lands.

From 1928 to 1934, in the province of Foggia, 9 basin Consortia were established in the following order:

20 September 1928	<i>Consorzio di Bonifica delle Valli del Cervaro e del Candelaro;</i>
8 July 1928	<i>Consorzio di Bonifica di Laguna di Lesina e Adiacenze;</i>
8 July 1929	<i>Consorzio di Bonifica di Torre Fantine;</i>
29 July 1929	<i>Consorzio di Bonifica del Lago di Varano;</i>
15 January 1931	<i>Consorzio della Bonifica including the watershed of Rio Salso;</i>
27 April 1931	<i>Consorzio di Bonifica e Trasformazione Irrigua del Tavoliere Centrale;</i>
17 March 1932	<i>Consorzio di Bonifica e Trasformazione Fondiaria dell'Alto Tavoliere;</i>
16 March 1933	<i>Consorzio di Bonifica di San Severo e Torremaggiore;</i>
5 January 1934	<i>Consorzio di Bonifica di Cerignola.</i>

In 1933 all these basin Consortia gathered into a unique Consortium that was called “*Consorzio Generale per la Bonifica e la Trasformazione Fondiaria della Capitanata*”.

Later on, by the P.D. of 10 May 1965, the Consortium was named as it is today “*Consorzio per la Bonifica of Capitanata*” and its boundaries were better defined; it covered an area of more than 441 000 hectares. These boundaries were confirmed in the By-law approved by the territorially competent Apulian Region government, in 1981 following on the Regional Law 54/80 that dictates the rules in the matter of determination of the schemes and the establishment of reclamation consortia.

2. THE CONSORTIUM FOR THE RECLAMATION OF CAPITANATA AND IRRIGATION

As previously described, the initial needs were definitely aimed at recovering the agricultural lands through hydraulic regulation works with the side- but not less important objective of draining the unhealthy areas to eradicate malaria and creating liveable life conditions in the countryside.

The high costs for water conveyance, lifting and distribution, as well as the changing market conditions of the irrigated products at that time (in the ‘30s and ‘40s), caused that the initial approach to land transformation, as reported in the “*Reclamation Master Plans*” was markedly oriented to dry farming, so much so that the term irrigation didn’t appear in the name of the Consortium.

Only twenty years later (at the beginning of the ‘50s), the decisive role irrigation would have played in the subsequent cropping and economic transformation of the land became evident with all the consequences on the agricultural economic development of Capitanata and the community as a whole. This was further boosted through the setting up of the “*Cassa per il Mezzogiorno*” (Southern Italy Development Fund) and the drawing up of a programme of interventions for the implementation of well defined water schemes aimed at introducing irrigation over a surface of 200000 hectares subdivided into three sub-schemes.

The programme, far from being completed, foresees the execution of a number of reservoirs to intercept and store water (the province of Foggia has no large waterways) far from the site of use, of conveyance works in the areas equipped for irrigation and the corresponding distribution systems.

The irrigable surface is equal to 142 000 hectares of the AA (Agricultural Area) and is organized into two distinct and separate irrigation schemes: in the north of the province, the Fortore scheme that uses the waters of the Fortore river stored in the artificial reservoir of Occhito (live capacity of the reservoir 240 million cubic meters) for 103 000 hectares of equipped area; in the south, the Sinistra Ofanto scheme uses the waters of the Ofanto river to irrigate an area of 39 000

hectares. The Carapelle irrigation scheme is still to be implemented, due to the lack of adequate funding, although the executive project of the storage, conveyance and distribution works has been completed since long (Figure 1).

The basic problem of the area of Capitanata is the poor availability of water as compared with the demand at the intersectorial level. The causes are to be found in:

- ☞ the incomplete execution of the supply works;
- ☞ the continuous reduction in unit discharge to allocate the available resources for municipal and drinking uses;
- ☞ the variation in the cropping systems with respect to the design schedule (more specialized crops being grown and non-compliance with the percentage of irrigated surface per crop assumed at the design stage).

2.1 Example of the Sinistra Ofanto irrigation scheme

In this section, a brief description of the Sinistra Ofanto irrigation scheme is reported as an example. Some considerations are illustrated in order to stress the importance of the management rules on the farmers' behavior and the farmers' reaction when the management rules are modified.

The Sinistra Ofanto irrigation scheme is located in the province of Foggia (Italy) and it is run by the Consortium of Capitanata.

The scheme (Fig. 2), covering a surface of about 39000 ha of which 22500 ha in the lower area, is approximately triangular-shaped, bounded at south by the Ofanto river and at south-east by the town of Cerignola. The system is divided into seven irrigation districts (numbered from 4 to 10) which are, in turn, subdivided into sectors with surface ranging from 20 ha to 300 ha.

The irrigation districts are served by storage and daily compensation reservoirs supplied by a conveyance conduit which originates from the Capacciotti dam (Fig. 2). The pressurized irrigation network in each district originates from those reservoirs and is designed for on demand delivery scheduling.

The district distribution conduits consist of underground steel pipes. These conduits supply the ramified sector distribution systems. A control unit is installed at the head of each sector and consists of a gate, a Venturi meter with recorder and a flow regulator. The sector distribution networks serve the farm outlets, mostly designed for a minimum pressure head of 20 m and a discharge of 10 l s^{-1} .

Soils are generally sandy-loam and silty-loam.

The actual cropping patterns for districts 4 and 10 are reported in Table 1. Crop patterns are not very different among the irrigation districts but they are very different from those foreseen at the design stage (Table 1). In particular, there was a strong decrease in the area occupied by olives, with a substantial increase of the area with table grape, which has much higher water requirements. Consequently, the irrigation demand has increased and supply is no longer sufficient to match demand under the conditions assumed at the design stage.

The analysis of all recorded discharges have shown that water is withdrawn every day, including holidays and the night-time, because many farmers are equipped with automated trickle irrigation systems.

During peak periods, sometimes, a restriction of deliveries is imposed. This consists in a rotation among the irrigation sectors of this district, closing the water supply every three days, alternatively, to 50% of the sectors while maintaining free access to the water to the other 50%. This delivery schedule is called "restricted frequency demand".

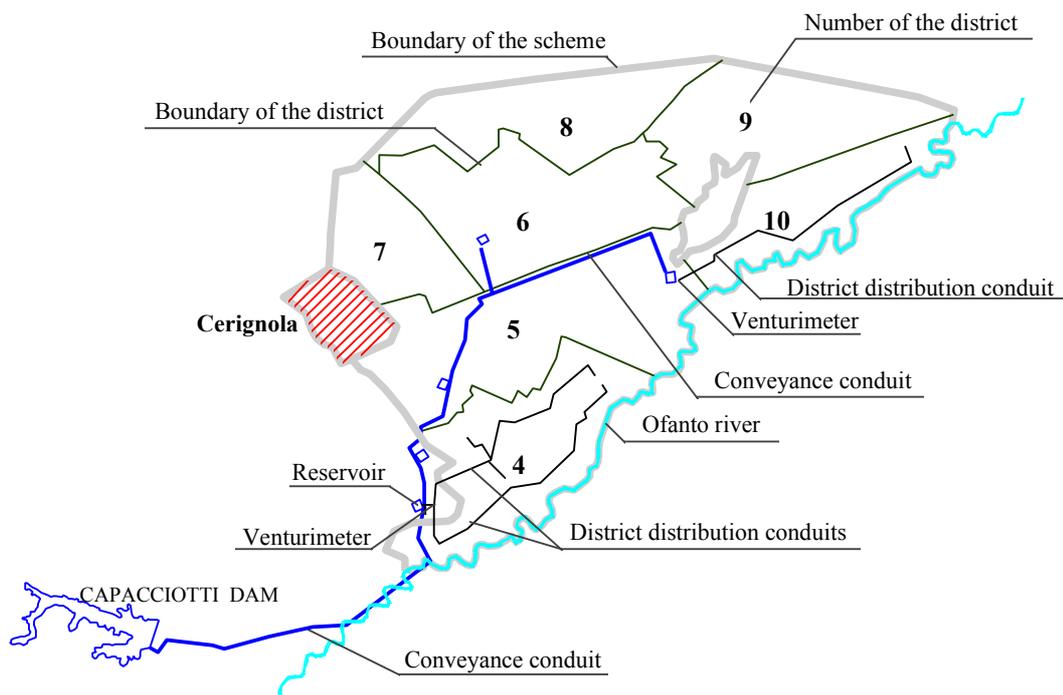


Figure 2 - The "Sinistra Ofanto" irrigation scheme (lower area)

Table 1- Designed and actual cropping patterns in the irrigation districts 4 and 10

CROPPING PATTERN	DISTRICT 4				DISTRICT 10			
	DESIGNED (1975)		ACTUAL (1991-96)		DESIGNED (1975)		ACTUAL (1991-96)	
	IRRIGATED AREA		IRRIGATED AREA		IRRIGATED AREA		IRRIGATED AREA	
	(ha)	%	(ha)	%	(ha)	%	(ha)	%
Vineyards	444.0	21.9	1325.9	63.4	282.0	21.9	909.7	69.7
Olive trees	1149.0	56.6	424.9	20.3	730.0	56.6	133.3	10.2
Orchards	21.0	1.0	76.2	3.6	13.0	1.0	111.7	8.6
Horticulture	-----	-----	265.5	12.7	-----	-----	150.7	11.5
Field crops	416.0	20.5	-----	-----	265.0	20.5	-----	-----
TOTAL	2030.0	100.0	2092.5	100.0	1290.0	100.0	1305.4	100.0

In the Figure 3, the demand hydrographs recorded at the upstream end of a typical network are reported. From these graphs, it may be observed that during the on-demand operation farmers tend to irrigate when they need and according to their habit. On the contrary, when restricted frequency demand is applied all farmers tend to irrigate simultaneously, during daytime and nighttime, by using the maximum discharge permitted by the network.

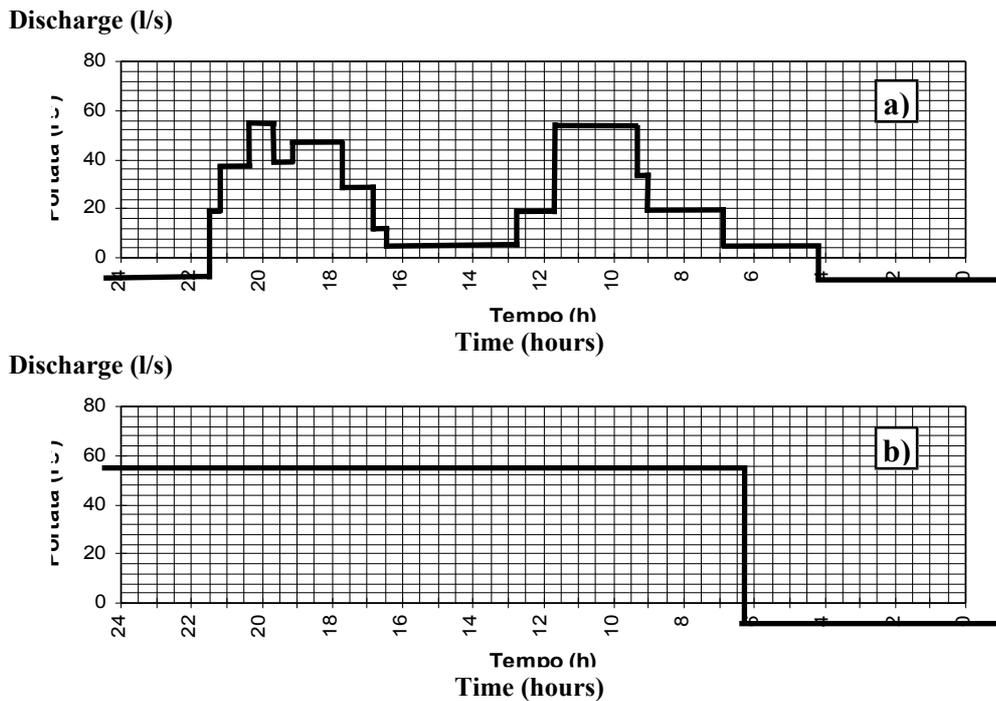


Figure 3 - Typical demand hydrographs at the upstream end of a sector. a) On-demand operation; b) Arranged demand operation.

This behavior often leads farmers to over irrigate their fields because of uncertainty in water availability. Thus, operation under restricted demand does not necessarily induce water saving but rather an increase in water demand.

Furthermore, because farmers are the ones who take risks in their business, they should have water with as much flexibility as possible in order to manage it well and to minimize their risks. For this reason, on-demand delivery schedules should be preferred instead of other types of operations.

3. ADMINISTRATION STAFF OF THE CONSORTIUM

The Consortium is administered by the farmers, i.e. those who own the land within the reclamation consortium.

Farmers are generally members of trade-union associations that represent the common economic and social interests of farmers with respect to the community (fig. 4).

The three associations grouping almost all the farmers are:

- 🏡 Unione Agricoltori (Farmers' Union): mainly formed by the producers who manage medium-large size farms;
- 🏡 Federazione Coltivatori Diretti (Owner-occupiers' Federation): mainly formed by producers who manage medium-small size farms;
- 🏡 Confederazione Agricoltori (Farmers' Confederation): mainly formed by the farmers who manage small farms;

The Consortium has its own By-law, approved by the Apulia Region government in 1981, that regulates the administrative procedures of the Consortium.

As previously reported, all the firms (owners) who own plots within the reclamation consortium are compulsorily inscribed in the registers of the Board and are called to contribute, each for his benefit, to the running costs of the Consortium.

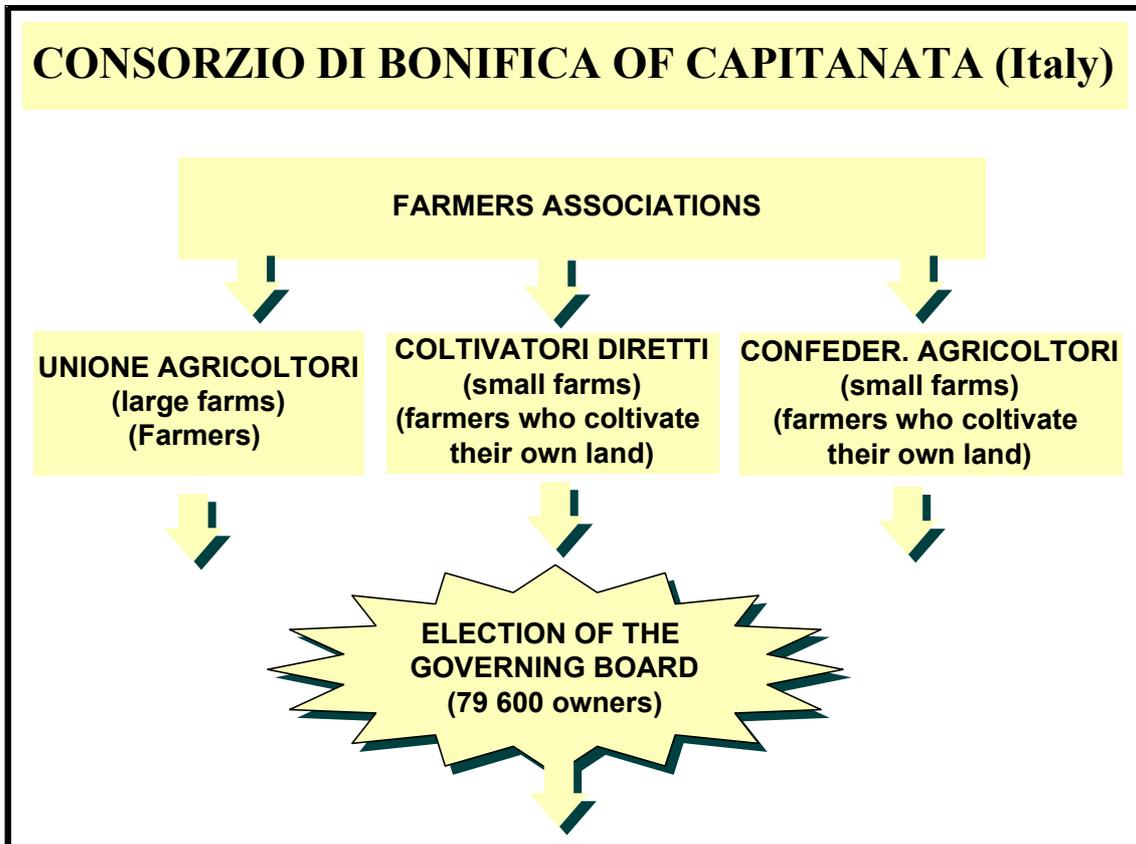


Figure 4 - Flow chart of the criteria for electing the Governing Board of the Consorzio of Capitanata

The associated firms are 79 600 and they constitute the basic electors called “Associates’ Assembly”.

The other organs of the Consortium are:

- 🏠 Council of Delegates (consisting of 90 elective members and 18 members by right);
- 🏠 Administrative Deputation (consisting of 12 members);
- 🏠 President + 2 Vice-Presidents;
- 🏠 Board of Auditors.

The Associates’ Assembly elects 90 elective members of the Council of delegates.

For this purpose, the Associates’ Assembly is subdivided into 5 rate-payment sections. The definition of the limits of rate-payment of each section is made by the Administration Deputation and approved by the Regional government.

Each section is attributed a number of percentage seats equal to the ratio between the sum of rates imposed on the associates belonging to each section and the total of the consortium ratepayers, up to a maximum limit of half the delegates to be elected.

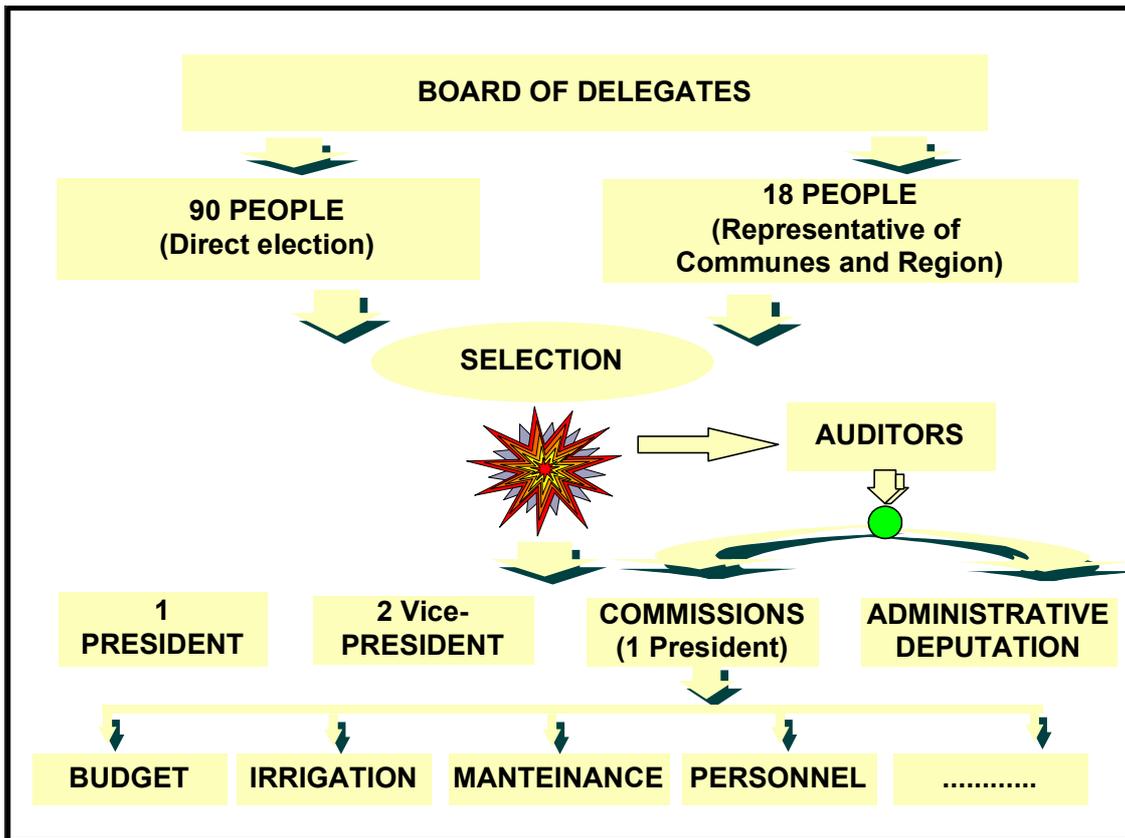


Figure 5 - Flow chart of the administrative staff of the Consorzio of Capitanata

So, it is not the surface owned by a firm that determines the membership to one of the 5 sections but the amount of rates paid.

The other 18 members are appointed by right by the Regional Government upon indication and as representative of the other territorial boards (Municipalities, Provinces, Mountain Communities).

The administrative office lasts 5 years.

The Council of Delegates elects the President among the elective members and, among all its components – elective or by right, the other components of the Administrative Deputation, complying with the proportion between elective members and members by right.

Again, the Council of Delegates elects, among the components of the Administrative Deputation, the two Vice-Presidents and it appoints the Board of Auditors and the components of the Advisory Committees.

The latter are charged to co-ordinate and further investigate the works on the matters of their concern and to refer, at the advisory stage, to the Deputation of the Council. (Figure 5).

At present there are 11 committees:

- 🏠 Personnel;
- 🏠 Budget;
- 🏠 Assets;
- 🏠 Maintenance;
- 🏠 Fortore irrigation;
- 🏠 Ofanto Irrigation;
- 🏠 Expropriation;
- 🏠 Works in course of execution;
- 🏠 C.E.D. (Data Processing Unit);

- 🏠 Relations with other Boards;
- 🏠 New Classification Plan.

Each administration organ of the Board performs the tasks established and regulated by the By-law of the Consortium.

The By-law of the Consortium defines all the functions and the tasks attributed to the Consortia by the State and regional laws, or however required to pursue its institutional goals.

4. TECHNICAL STAFF OF THE CONSORZIO OF CAPITANATA

Irrigation, though being one of the major activities of the Consortium, is not the only one. The Consortium also works in the field of:

- 🏠 Soil Defence;
- 🏠 Maintenance of natural and artificial water courses;
- 🏠 Administration of domanial areas;
- 🏠 Extension service
- 🏠 Others.

Consequently, the technical staff is adequate to the operational needs of the Board and it is organized as illustrated in Figure 6.

From the figure, it is evident that the Directorate General supervises three sub-Directorates:

- 🏠 Agricultural Service
- 🏠 Engineering Service
- Administration

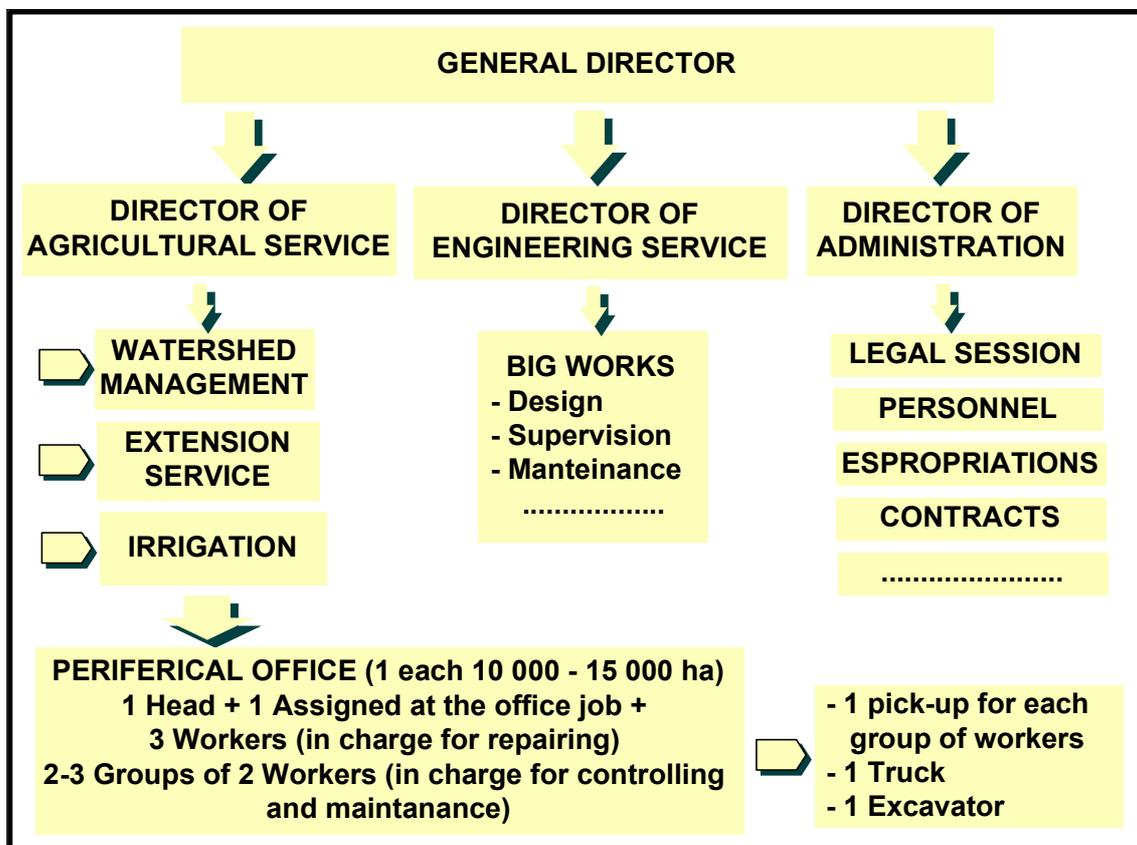


Figure 6 - Flow chart of the technical staff of the Consorzio of Capitanata

Each Directorate, in its turn, is organized into operational sectors in relation to the activities performed. It results that some sectors are only marginally or not at all concerned with the management of waters and irrigation.

As far as irrigation is concerned, the competence on reservoirs and on big conveyance works is attributed to the Directorate of the Engineering Service, whereas the Agricultural service is in charge of water distribution to farms and the relations with users.

For organizational purposes, the irrigation schemes are subdivided into sub-schemes both for the big conveyance works and the distribution plants.

The type of interventions normally executed on the reservoirs and the big conveyance works (both during maintenance and operation), due to their low frequency and to the characteristics of the machines and the equipment needed for the execution of repairs, doesn't justify (economically speaking) maintaining a technical staff dedicated to such work. Therefore, the Engineering service mainly operates on the irrigation network through contracts; only few interventions are made through direct administration.

The technicians of the directorate plan the works to be executed and schedule, also for the operation periods, the interventions to be made based on the number of breakages occurred and the problems arisen in the previous years; they then prepare the technical drawings, the specifications and the corresponding tenders for contract for the assignment of works to specialized firms.

The Directorate of the Agricultural Service is responsible for water and the relations with the users. Within the Directorate of the Agricultural Service, an "irrigation" sector has been set up that exclusively deals with it and also:

- ☞ prepares the irrigation scheduling and requests the discharge to be taken for the delivery to each irrigation sector;
- ☞ points out to the Directorate of the Engineering Service any inconvenience of the big conveyance works and the lifting plants;
- ☞ draws up the documentation for the attribution of consumption rates to each user and informs the Land Register Section for the fee collection.

The control on the land and the good operation of the network and the equipment, the frequent interventions for repair both on pipes and on water meters or gates, require a wise operational organization, also because, considering the nature and frequency of interventions, each type of operation performed on the plants is made by direct administration, i.e. using the means and the personnel of the Board and the material specifically purchased at the beginning of the irrigation season.

Also, the relations with the users, as for water demand, communication of any failures, request for information, complaints, suggestions, require the constant presence of technical staff in the peripheral offices.

The specific irrigation offices depend directly on the irrigation sector of the Directorate of the Agricultural Service and they are located on the territory in such a way to be easily reached by users.

In the "Fortore" irrigation scheme, 9 irrigation centres have been set up with the corresponding peripheral offices; whereas in the "Sinistra Ofanto" scheme, 6 irrigation centres have been set up. The command area of each centre depends on the characteristics of the land and of the systems. Each irrigation office has a technician (surveyor or agricultural school graduate) who co-ordinates the group of technical assistants including:

- ☞ an employee;
- ☞ a foreman;
- ☞ a team of three workers for repairs;
- ☞ a team of two or three assistants for intervention and control operations.

Each team has the equipment and the machines required to perform the activities related to their tasks (Fig. 6).

5. TARIFF RULES

As previously said, the Consortia are, by law, private boards of public law and they are non-profit.

The associated members have to contribute only to the expenses borne for the management of the activities performed. So, it is not a tax they pay to the Consortium but a contribution.

Such contributions are proportioned to the direct benefit each user receives from the activity performed by the Consortium.

It was said that the Consortium also performs other activities in addition to irrigation for which it bears some costs.

Therefore, the first contribution borne by the firm is that for reclamation and it is calculated with respect to the surface (subdivided into five rate-payment classes in relation to the benefits each zone receives)¹.

Table 2 - Rate-payment classes

Homogeneous zones	Payment rate (£/ha)
Irrigated zone with reclamation works	62 560
Upper Sinistra Ofanto zone	56 310
Zone to be irrigated in the near future	51 620
Zone with designed irrigation systems not executed yet	46 920
Plain zones with reclamation works	31 280
Hilly zones	15 640

If the estate falls within the irrigation scheme (remember that only 142 000 hectares out of 441000 are irrigable) the firm has to pay also an irrigation water rate that consists of two parts (Fig. 7):

- ☞ a fixed rate;
- ☞ a variable rate.

The first is proportioned directly to the surface served and the fee is related to the hectare, whereas the second depends on the volume of water taken from the hydrant (all the hydrants are equipped with water meters).

The fixed rate (£/ha 30 000) has to be paid even if the owner decides not to irrigate, since in any case the Consortium performs every year maintenance operations to keep the plants in a good operational state; moreover, although the user doesn't grow irrigated crops, he gets a benefit in terms of the re-evaluation of the estate submitted to irrigation. The benefit has necessarily to be associated with a fee. Also, by paying a fixed rate the farmer is stimulated to convert his farm to irrigation and to invest.

The variable rate depends on the volume of water used. The yearly water duty is 2 000 m³/ha. In order to prevent water wastes, due to bad use by farmers, rising tariffs are fixed for water surpluses as a true deterrent:

¹ £ = Italian Lira; 2000 £ ≈ 1 euro

- up to 2 000 m³/ha 170 £/m³ ≈ 0.09 €
- from 2 000 to 2 500 m³/ha 210 £/m³ ≈ 0.11 €
- from 2 500 to 3 000 m³/ha 300 £/m³ ≈ 0.15 €
- more than 3 000 m³/ha 400 £/m³ ≈ 0.20 €

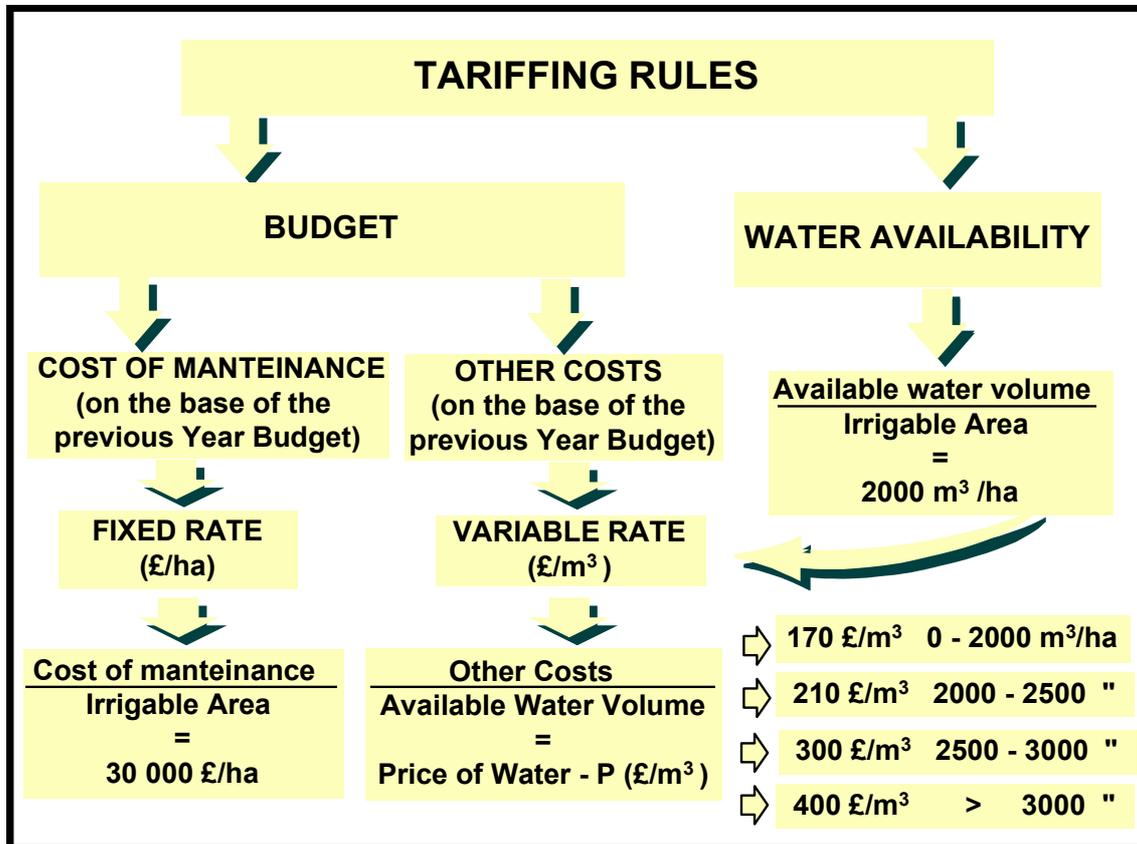


Figure 7 - Flow chart of the tariffing rules

As an example of the importance to have this type of tariffing rules, some considerations on the case of the Sinistra Ofanto irrigation scheme are reported below.

Important differences between water volumes effectively supplied to the crops and volumes calculated by using the theoretical formulations have been observed in this scheme (Tab. 3).

Table 3 - Effect of the price of water on the farmer's behavior (water consumption expressed in m³/ha) in the Sinistra Ofanto irrigation scheme

CROP	1991 (m ³ /ha)	1992 (m ³ /ha)	1993 (m ³ /ha)	1994 (m ³ /ha)	1995 (m ³ /ha)	1996 (m ³ /ha)
Vineyards (measured)	2064	2151	2287	2480	1458	2315
Vineyards (calculated)	4848	3967	5185	4650	3153	5637
Olive trees (measured)	1606	1734	1486	1909	893	1431
Olive trees (calculated)	3062	2439	3301	3118	1736	3772
Tomato (measured)	4586	4060	4486	4964	4654	4699
Tomato (calculated)	5425	4347	5849	4719	5078	6387

Table 3 shows that, from 1991 to 1996, the water volume supplied to vineyards varies around 2000 m³/ha (corresponding to the available duty). The same situation was observed for olive trees where the measured supplied volume was lower than 2000 m³/ha. It may be due to the tariffing rules applied by the Consorzio of Capitanata that induced farmers to optimize the use of water. In fact, for the volume of 2000 m³/ha farmers pay the lowest rate (170 £/m³).

As for tomato, farmers supplied about the double of the duty. In this case, in order to reduce the water volume that should be paid at a higher rate, farmers cultivated only half of the farm with tomato. In this way they could supply 4000 m³/ha by paying only 170 £/m³. On the other half they cultivated wheat without irrigation.

In the past, the Regional government participated in the management costs through special contributions allocated each year to the Consortium. But it is more than 10 years that, despite the presence of a regional law that states the allocation of contributions in favour of the reclamation consortia for the management expenses (maintenance and operation) for irrigation-related activities, due to the lack of funds, the Consortium has not received any sum of money. On one hand, the State has borne and still bears the costs for the execution of the works, whereas the private farmers only pay for the management of the system.

As for the definition of how much to pay, prior to the beginning of the irrigation season, the yearly budgets are made to establish the costs the Board will bear in the course of the irrigation season.

Each operational sector that deals with irrigation draws up its own budget, subdividing the expenses between maintenance and operation; later on, all the budgets are aggregated into a unique general budget referring to irrigation. In order to take into account the costs of the personnel (and others) not fully dedicated to the irrigation (administration, Land Register, Data Processing Unit, etc.) the grand total is increased by 25%.

Since the Board is non-profit, the receipts should theoretically coincide with the expenses. However, the receipts resulting from the fixed rate can be more or less exactly quantified in that the served surface and the farms among which the water has to be shared are well known, whereas the volume of water to be used is uncertain since it depends both on the availability of the resource stored in the reservoirs (at the time of drawing up the budgets the storage stage is still incomplete) and on the investments and the climatic pattern.

Of course, though accurate estimates may be, there are factors that cannot be controlled and that can change the expected fees collected and the management costs. Therefore, at the end of the irrigation season, based on the management balance, the fixed and the operation fees are determined and registered in the tax-roll for collection.

Any compensation in favour of the users is credited with them upon the collection of the fixed fee for the next year.

5.1 Fee collection procedures

The collection of the fees paid by the users is made through the yearly tax-roll emission, made executive in conformity with the law.

On this matter, for the variable rate, the irrigation sector transmits to the Land Register and Tax office – that in turn works in close co-operation with the Data Processing Unit – the data relative to the consumption of each user. The said sector up-dates the consortium land register, in relation to the type of taxation adopted and converts the volumes taken into fees to be paid, by applying the planned tariffs in relation to the unit discharges.

The technical time required for the emission of the tax-rolls causes that the water used in the course of an irrigation season be paid at the beginning of the next irrigation season.

6. THE ROLE OF THE EXTENSION SERVICE

The experience acquired in irrigation management has contributed to transform the extension service approach. Since the early '80s, the need was felt to have an extension activity more specifically oriented to irrigation, also in compliance with art. 15 of the Regional Law 54/80 that transferred the competence of the extension activity in irrigation to the reclamation consortia.

Following on the said Regional Law, the technicians have started to enrich their competence in the field of irrigation by further investigating the crop water requirements.

The first results materialized in the preparation of irrigation technical files for the major crops grown. They were illustrated in the course of meetings organized at the municipalities, the trade union offices and the extension service offices of the Consortium.

Later on, the extension service has carried out activities aimed at improving the use of the water resource through the simple and systematic dissemination of the information drawn from the best literature on irrigation, with special reference to more accurate estimates of crop water requirements by the collection of agro-meteorological data of the stations densely located on the territory.

The agro-meteorological data, gathered in a data bank, are processed at the head office of the Consortium through adequate pieces of software prepared by the Data Processing Unit of the Board upon indication of the technicians of the extension service.

The final output materializes in the preparation of weekly bulletins that are adequately disseminated through the participation of associations, co-operatives, entrepreneurs and other technical offices.

A quality jump in the dissemination of information was possible through telecoms, first by the national project AGRIVIDEOTEL and later through a dedicated INTERNET site (address: <http://www.consortio.fg.it>, e-mail: coboca@isnet.it) that supports an interactive programme called IRRINET where, by indicating the area of the scheme where the farm is located and the corresponding data on the crop to be irrigated and the hydraulic characteristics of the system used, you can obtain the volume to be supplied and, in the case of localized irrigation systems, the irrigation time, on the basis of the agro-meteorological data taken from the station closest to the farm.

Numerous experimental trials have been made on the techniques and the methods of water distribution to the crop. In a short period of time, these experiences have contributed to move from the old surface methods introduced at the early operation stages of the public systems, to the new sprinkling and, subsequently, drip irrigation methods.

At present, more than 70% of the irrigated crops are drip irrigated, with unquestionable positive effects on the application efficiency, a better water saving and improved crop yields (quality and quantity).

Extension activity has concerned not only irrigation but also the experimentation of new species and new cultivars to be introduced in the cropping patterns, mechanization and marketing of products.

As far as irrigated crops are concerned, satisfactory results have been obtained by growing tomato for industry in the newly irrigated areas and, in the '80s, oil crops (sunflower, safflower).

Also worthy mentioning are the trials and the results in almond-growing and industrial crops like sugar-beet; the latter has played and still plays a major role in the cropping patterns of the Fortore scheme.

Numerous experiences have been developed in the vegetable sector where, in the course of the years, sprouting broccoli growing (for which Capitanata has become one of the most important production basin of the Mediterranean), fennel, pea and spinach have gained increasing importance. In these last years, important experiences, successfully transferred to agriculture, have been made on asparagus and artichoke.

Finally, on the sandy lands close to the sea in the areas of Zapponeta and Margherita di Savoia, with the construction of the new public irrigation systems, crops typically grown on sand have been

practices: onion, carrot and early potato. The early experiences were then followed by a market response generated not only by the demand of the domestic market but of the foreign one as well.

As far as mechanization is concerned, it is worthy mentioning the early experiences of mechanical harvesting of tomato associated with the cultivation of new varieties adapted to the new cropping technique.

7. CONCLUSIONS

Based on all the above, we can state that to limit the risks associated to the non-compliance of the users with the assigned water duty, the Consortium adopts the following measures:

- ✎ Technical assistance aimed at the correct and wise use of available resources and the assigned water duty. The user is supported by the extension service of the Consortium as for the irrigation volumes and intervals to be adopted;
- ✎ Dissemination through the sticking up of the agro-meteorological and irrigation bulletins at the peripheral irrigation offices through a dedicated INTERNET site supporting an interactive programme (IRRINET) that can supply the users with the volume to be applied to the crop and the time of irrigation depending on the agro-meteorological data taken from the station closest to the farm;
- ✎ Disincentive to excessive withdrawals by users through regular controls performed by the technical staff of the Consortium on the network and on the volume recorded at the water meter of each user. Unfortunately, there is no coercive means to limit withdrawal, so that the Consortium can simply pursue an information policy aimed at educating users to limit the irrigated surfaces according to the real availability of water in the reservoirs.
- ✎ Tariffing rules that may serve as deterrent against the excessive use of water;
- ✎ On-demand delivery schedule to enable farmers to optimize the use of the available resource;

Moreover, we can state that a Governing Board (Administrative Deputation) elected among the associated members, rather than people not involved in agriculture, is certainly very efficient, since administrators are users as well and, consequently, they are directly involved in the prompt resolution of any problem related to the management of the systems, considering that any inefficiency and delay in decision-taking have a real time impact on the operation of the farms they manage. As from the above, the organization cannot absolutely be exploited for purposes other than the institutional ones.

The objective of the administrative choices is then to reach the high efficiency parameters in order to maximize, in economic and labour terms, the results of irrigation, through optimizing water distribution both at the farm (through a wise management of collective systems) and crop level (through the orientations and suggestions of the extension service).

The State, that financed the public works and maintains their property, assigns the management task to the Consortia and exerts a control power through the members by right of the council of delegates and the governing board.

The role of politicians is of crucial importance to obtain funding for new works; it is just worthy mentioning that, at present, the Consortium has already prepared many projects to be executed and is awaiting for the funding to execute important storage (Piano dei Limiti dam, the dam on Triolo river, Palazzo d'Ascoli dam, the dam on Rio Salso, and the weir on Marana Cerasa), conveyance and distribution works, as well as the hydraulic management and soil defence works.

Whereas, as for the direct management of the structures, the role of the politician who intervenes in the decisions of the Council, either by lack of knowledge of the real problems, or due to political interests that not necessarily coincide with those of the users, may negatively affect the efficacy of the choices and the strategies to be pursued.

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