

Sustainable development strategies for the water supply and wastewater sectors

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ABSTRACT: This paper describes the main aspects and outputs of a major project, which was completed recently, and was aimed at producing the necessary tools to support a sustainable and integrated development for the water supply and wastewater sectors in Portugal, within the present context of political prominence, the availability of important financial resources and opening to the private sector.

The major outputs and innovating contributions described in this paper, which address a wide range of users—including regulators, water utilities, consultants, contractors, manufactures, research and development organisations and universities—can be seen as guidance tools for a sustainable process of technology transfer and procedures for the alteration of behaviours. This project was developed within the philosophy and principles of the Portuguese Quality System, in which the final goal is to create conditions for the qualification and certification of all those interested in this process.

The authors believe that the set of tools resulting from this project could significantly contribute to the quality which must be associated with such a large number of water supply and wastewater systems during the next few years, in order to ensure that we are working for excellence towards the achievement of those essential services.

GENERAL SCOPE: THE IMPORTANCE OF AN INTEGRATED APPROACH ON WATER SUPPLY AND WASTEWATER

At the *Rio de Janeiro Conference*, held in 1992, it was recognised that we are in an era of global factors, such as global environment issues, global epidemics, global environmental hazards, bilateral and multilateral co-operation, being therefore vital to ensure a *sustainable development*, a concept which emerged world-wide, meaning that all aspects involved in the development process are to be considered in a consistent way in order to optimise the expected results with the available resources.

In the specific area of drinking water supply and sanitation, the activities recommended by *Agenda 21 Document* to be implemented by all states, according to their capacity and available resources, include the general rules concerning integrated management, emphasising some aspects such as: treatment and safe reuse of urban and industrial wastewater; application of the principle that decisions are to be taken at the lowest appropriate level, with public consultation; human resources development at all levels including special programmes for women; public awareness, information and participation.

The *integrated approach* of the water cycle as regards the correct knowledge, evaluation of their interconnections and mutual impacts in order to safeguard public health and protect the environment is a key issue. On the other hand, an *integrated management* of water supply and wastewater needs nowadays,

apart from technical objectives and available technology, clear and coherent institutional framework, applicable financial policies and tariff structures, updated regulations and standards, continuing human resources development at all levels and public information, dissemination and participation.

The project described in this paper aimed at producing tools for supporting sustainable and integrated development water supply and wastewater strategies in Portugal with regard to for the next years was carried out having in mind this contextual approach. After an overview of both national and European scenarios, the main means of improving and changing behaviour in water management are presented, as well as the challenges that resulted from this study as a consequence. The project is then described, with a particular focus on organisation, the main issues, the outputs and innovative contributions to agents of the water and environment industry. Finally, some considerations are made with regard to the application of this methodology and experience world-wide.

THE EUROPEAN AND NATIONAL SCENARIO: A DYNAMIC CONTEXT

Within the current European scenario, with particular reference to the European Union, special mention must be made to the differences that still exist between countries, with regard to their development in general, and water supply and wastewater management in particular. That situation trends to change quicker, on the basis of a converging orientated policy, supported by specific funds, namely the so-called Cohesion Fund.

This implies that several countries within the European Union must quickly increase these services. This scenario is reinforced with the recent political changes in Central and Eastern Europe, where environmental issues have become a priority.

In Portugal, the water supply and wastewater sector has, for some time, been characterised by a lack of general quality. This can be seen in major delays and shortages in terms of cover, low levels of customer service, the poor quality of materials and equipment used in the systems, lack of organisation in the sector, partial lack of an institutional framework and a number of shortages from the entities involved.

The political, social and economic importance of this sector imposes a national strategy for its more harmonious and quicker development by taking the best advantage of the favourable situation. This results from important funds made available by the European Union that are specially reserved for environment infrastructures.

From the objectives established, it was estimated that about €2.9 billion are needed, at current prices, for covering new works and of rehabilitation of the existing systems so as to reach an acceptable level of service. By adding to this amount the overall investment already done on the existing assets, it can be concluded that the country will then possess an infrastructure for water supply, sewerage and wastewater treatment that will have a value of more than €6.5 billion.

In summary, we can say that, both at European and national levels, the water supply and wastewater sectors have a quite dynamic context, where extensive investments will occur and important benefits are expected.

THE WILLINGNESS TO CHANGE: GROWING WITH QUALITY

There are three main reasons why the current situation in Portugal is clearly more promising than in the past. The first is that today this sector is clearly accepted, from a political point of view, as an essential factor in the social and economic development of the country, with public opinion becoming progressively more informed. The second is that the last few years have been characterised by an exceptionally high investment in this sector, largely resulting from the input of European structural funds. This factor alone makes it reasonable to expect that during the next decade the average coverage values verified in the European Union will be reached. The third reason is the instigation of legislation that has allowed private companies into some areas that, up to now, were exclusively the responsibility of public administration as regards water supply and wastewater.

They are also three factors that can be thought of as politically motivating forces for the process of alteration that launched the intervention of private companies in this sector. First, there is the extreme dispersion of water supply and wastewater systems, which is of unmanageably inconvenient proportions in several regions of the country. These areas of the

country require integrated systems, that should be operated and maintained with a high degree of professionalism and configured at an adequate technical and economic scale. They should gather several municipalities in joint solutions, so as to cover a territory that cannot be confined to administrative borders. Second, it is necessary to invest heavily in the quality of the services through a high professionalism that promotes criteria which will emphasize the quality of services rendered to the population, by ensuring the technical and financial sustainability of those systems. In the current scenario, it is therefore thought that a management of the type used in private companies and the stimulus to participation of private companies and investors in this area of activity is highly convenient and adequate. Lastly, it is imperative to organise our market and stimulate the water companies so as to ensure that, in a highly competitive and aggressive European scenario such as exists at the present time, Portuguese strategic interests and specific development will be preserved.

It is therefore important to make full use of this situation, so that, in the short term, one can guarantee sustainable development by organising this market and promoting quality into the sector.

Every effort to promote the qualification, diversification and organisation of the market in all these sectors is essential, all the more so since the water industry operates under a natural monopoly, and the behaviour of the market cannot, on its own, ensure the primacy of quality. A better integration of activities in this sector and the indispensable regulations would always be necessary to create in the Portuguese market the conditions similar to those of the more developed countries, thus ensuring the quality of the service and the primacy of the public interest. These will become even more important in a context of opening water services to the private sector, so as to introduce transparency and contractual stability into the relations between local authorities and private companies.

In this context, it was thought that the availability of a set of tools to support further sustainable development would help to produce a true guarantee of quality. This approach is considered indispensable in the planning, construction and management of such a large number of water supply and wastewater systems in Portugal over the next few years. In this way, one can avoid making large investments without guaranteeing benefit from them.

THE PROJECT: GENERAL PRESENTATION

In this context, the General Directorate of the Environment of the Ministry of Environment and Natural Resources decided to implement a major project, with the technical support of the Laboratório Nacional de Engenharia Civil. This project, under the heading of 'Tools to Support Sustainable Development Strategies in Water Supply and Wastewater', aimed at producing the necessary tools to support sustainable and integrated development strategies in the present context of political

prominence, availability of important finance resources and opening the water network to the private sector.

In this regard, mention must be made of the following: (i) its ambitious goals, due to the extensive range of problems that needed to be tackled; (ii) the convenience of its implementation, since an important phase of alteration and modernisation of the sector is presently underway; and (iii) the alteration of behaviours that it will hopefully bring about in the several organisations involved in the process, which are increasingly aware that a general improvement in water quality will occur.

The development of the project was divided into four phases, as follows.

In the *first phase*, the aim of the project was to make an overall characterisation of the situation in the sector.

In a *second phase*, the aim of the project was to make an overall diagnosis of the situation in the sector. In this diagnosis the following aspects, which are considered as being the most relevant from the point of view of an overall analysis of the sector, were covered: institutional framework; legislation, technical regulations and standardisation; economic and financial issues; statistical information; regional planning; planning and design; co-ordination, control and supervision (project management); construction and rehabilitation; supply of materials and equipment; operation (system management); human resources; and research and development. For each aspect, a diagnosis of the situation was carried out to identify the most relevant problems currently placed for further corrective measures.

In the *third phase*, a summary identification was made and a corresponding preliminary analysis of tools of an institutional, financial, regulatory, technical and socio-ecological nature was carried out. The existence of these tools was considered desirable or necessary for a sustainable development of the water supply and wastewater in Portugal. For this study, a reference chart was developed which showed the tools and interventions that needed to be carried out. These amounted to 37 measures, which were very wide-ranging but complementary.

Once the characterisation, diagnosis and identification of the measures was carried out, it was clearly stated that a set of structural initiatives had to be developed corresponding to the measures identified. Without this, the optimization of investments will not be possible due to the risk of inadequacy of the solutions adopted and the lack of guarantee of their durability. The convenience of integrating this project in the philosophy and in the principles of the Portuguese Quality System, to the extent that the final objective was to create conditions for qualification and certification of all those interested in this process was also recognised. Therefore, the aim of the *fourth phase* of the project was to develop more thorough studies, relating each of these measures by producing the necessary tools. This last phase included 16 independent but complementary studies. The most relevant aspects of this phase—such as organisation, approach methods, results and innovating con-

tributions—for the several agents involved in the sector are presented below.

DEVELOPMENT OF TOOLS: LAYOUT AND ORGANISATION OF THE PROJECT

In view of the size, difficulty and the short-term of implementation of the project and also the interdependency between all its studies, a careful organisation of this project was carried out from the beginning so as to increase its effectiveness. The project was thus divided into 16 independent but complementary studies and adequately articulated, which are as follows: the water supply and wastewater in Portugal; institutional framework; financial tools and tariff structures; internal organisation of utilities; specifications for the water and environmental market; management contracting; technical regulations; technical standards; construction and operation costs; certification of products and facilities; laboratory network; framework for the assessment of levels of service; statistical information systems; human resources training; information and public awareness; research and development.

The group of studies mentioned above was carried out by a team of about 55 experts, both national and foreign. It was multidisciplinary by nature (civil, chemical, sanitary and environment engineers, architects, biologists, economists, sociologists and legal experts) and pluri-institutional (R&D institutions, university, consultants and administration).

The project was co-ordinated by the two authors, who were also, jointly or individually, responsible for some of the studies. Each of the studies referred to above had a person in charge, helped by a specific team. An Accompanying Committee was created for on line evaluation of the project, and a Consultative Committee, with invited experts, generally supported the co-ordination and the sectorial studies.

Each of the 16 studies was published as part of a special edition under the general title *Management of Water Supply and Wastewater Systems*, to be widely distributed (1000 copies) by the Portuguese technical community, namely administration, water utilities, consultants, contractors, manufacturers and suppliers.

To reinforce this technology transfer process, several actions were taken during the development of the project with the objective of not only promoting it but also encouraging some feedback resulting from its initial application to daily practice. Some of those actions were: publishing a periodic newsletter, to be mailed to all the relevant agents of the sector; presenting papers and articles describing the project in technical seminars; participating in technical exhibitions with specific stands describing the project; organising one-day restricted 'brainstorming' meetings with the more representative agents of the water and environmental industry; organising 3-day open seminars across the country to present and explain in detail the tools resulting from the project and promoting its application to real world situations.

MAIN ISSUES, OUTPUTS AND INNOVATIVE CONTRIBUTIONS

The main issues, outputs and innovative contributions from each of those 16 studies are briefly referred to below.

- Volume 1 (Water supply and wastewater in Portugal) presents a general overview of water supply and wastewater in Portugal, describes the overall structure of the project, summarises the following 15 volumes and describes the respective interconnections between studies. It can be regarded as an introduction and a users guide to the other volumes.
- Volume 2 (The institutional framework) presents a detailed description of the institutional framework for water supply and wastewater in the country, summarises all the relevant legislation and identifies the responsibilities, duties and rights of the different agents; as regards users, it can be seen as a guided tour to the legislative framework.
- Volume 3 (Financial tools and tariff structures) describes and characterises all the relevant financial programmes that could be used by municipalities to promote water supply and wastewater systems and suggests a tariff system and respective methodology to ensure economic balance and social equity.
- Volume 4 (Internal organisation of the utilities) proposes a rational organisation for water supply and wastewater services, namely municipal services, on levels of human resources, technical, administrative and finance, according to the corresponding size and characteristics of the municipalities and the complexity of their systems. It can be regarded as an internal optimisation process for the utilities that exist at present.
- Volume 5 (Specifications for the water and environmental market) defines the minimum qualifications needed for access to the activities of consultancy, design, project management, supervision and construction of water supply and wastewater systems. Furthermore, it proposes the criteria for the selection of those agents by the municipalities and regulates the insurance issues for those activities.
- Volume 6 (Management contracting) describes four different types of management contracting and presents the standard terms of bidding that is associated for those contracts between municipalities and private companies. The goal is to protect the municipalities and to guarantee in the contract a minimum level of service for the users, covering a gap resulting from the recent opening of this activity to the private sector.
- Volume 7 (Technical regulations) presents a detailed description of the technical regulations for the water supply and wastewater sector, on European, national, regional and local levels, and suggests methodologies and technologies for their fulfilment; as regards users, it can be seen as a guided tour to the technical regulations.
- Volume 8 (Technical standards) presents a detailed description of the existing technical standardisation for the water supply and wastewater sector, on a European and national basis, mentions a database that is easily available to users and suggests methodologies and technologies for their fulfilment. As regards users, it can be seen as a guided tour to the technical standardisation.
- Volume 9 (Construction and operation costs) presents the cost factors and the typical costs per inhabitant for investment and operation of the various components of the water supply and wastewater systems, suggests a cost updating criteria and an asset cost evaluation criteria and defines the minimum size of the systems that will ensure economic feasibility.
- Volume 10 (Certification of products and facilities) proposes a testing and certification methodology for single products as well as for water supply and wastewater systems and the corresponding municipal organisations.
- Volume 11 (Laboratory network) defines requirements for analytical laboratories of different levels and sizes, namely the definition of the parameters to be determined, the equipment and human resources required, the investment costs and the quality assurance system.
- Volume 12 (Framework for assessment of levels of service) defines a set of indicators for evaluation of the global and sectorial performance of the water supply and wastewater systems, in order to be able to quantify the different relevant aspects. This was the basis for a broader study developed for the IWSA on performance indicators.
- Volume 13 (Statistical information systems) proposes a new national system for data on water supply and wastewater, with periodical gathering, validation, filing and processing of information, at national and municipal levels.
- Volume 14 (Human resources training) describes the staff training needs of the sector and proposes a large national programme of training and recycling courses in water supply and wastewater at various levels, with corresponding professional profiles and curricula.
- Volume 15 (Information and public awareness) proposes methodologies concerning relations between the municipalities and the public, namely guiding municipalities to provide relevant information for the public and increasing the public participation in the process.
- Volume 16 (Research and development) defines the needs and priorities of research and development in water supply and wastewater, based on the developing stages of the country.

In summary, a wide range of different tools were developed as a significant contribution to the quality that must be associated with the activities and agents related to water supply and wastewater systems.

All the agents within this sector will benefit from this project, and relations between them will become more clearly defined, namely: regulators, represented by the Central Administration; utilities responsible for the management of those systems,

represented by the more than three hundred Local Administration (municipalities), and by the regional water companies; consultants (designers, project managers and supervisors); construction contractors; manufacturers and suppliers; operating contractors; research and development organisations; universities; training organisations; end-users, either individuals or collective (users associations).

THE INTERNATIONAL DIMENSION OF THE PROJECT

The authors believe that the set of tools resulting from this project could significantly contribute to supporting an important and difficult period of growth of this sector in Portugal.

However, it is also obvious that this methodology can be used by and applied to other countries, especially where this sector is under reorganisation and/or development. This is our

main reason for promoting this project at an international level, as an example of a valuable contribution for the success of a national policy.

Examples of the first situation are the East and Central European Countries—where the new political context reinforces the need for a large reorganisation of this sector—in addition to some Western European countries.

A large number of South American, Asian and African countries are good examples of the second situation, where water supply and wastewater has, in general, a poor level of service and greater investment is needed.

In both situations, this type of approach, which of course needs to be tailored according to the local context, can be useful for supporting both the reorganisation and the development of the sector and can avoid the making of large investments without guaranteed benefits.