Abstract. *The current level of pollution in basin of the Danube River threatens the health of both human and aquatic ecosystems as well as the biodiversity and bioproduction. This determined the countries that are riverine to the Danube to cooperate on regional and international levels to adopt adequate measures that are able to stop the degradation of water and improve its status. The key issue in solving the problems mentioned above is to develop integrated water management policies. The objective of the present work is to highlight the principles that define the modern concept of water management promoted by the Water Framework Directive (WFD) and to provide some input concerning their implementation along the basin of the Danube River. Taking into account the fact that the most significant WFD principles are: regional cooperation, public participation to the development and implementation the plan of measures to combat pollution and reduced the costs for services, in the Danube River basin, the water management has three levels of coordination: international, national and sub-basin level. In the approach considered, the measures adopted for preventing/reducing pollution are directed towards the main polluters: agglomerations, industry and agriculture and aims mainly to improving the wastewater treatment by introduction of the Best Available Techniques (BAT) in industry and of Best Agricultural Practice (BAP) in agriculture. The application of these measures has important advantages especially related to reducing the risk of pollution and improving the water status, as well as to provide real benefits to human health and aquatic ecosystems.*

Keywords: Danube River, pollution, hazardous substances, regional cooperation, water management.

A MODERN APPROACH OF WATER MANAGEMENT IN THE DANUBE RIVER BASIN

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Management & Marketing
Challenges for the Knowledge Society
(2012) Vol. 7, No. 4, pp. 777-792

1. Introduction

The international community recognizes that a sustainable development of the society is not possible without environmental protection, and the water quality protection represents an important part of it.

The conservation and improvement of the water quality are in the present important requirements and lead to the necessity of a more sustainable water use for the protection of the health and the needs of the future generations.

Following the idea that pollution do not affect only the present generation, but also the future generations, the Danube countries have signed as main objective of the Convention on Cooperation for Protection and Sustainable Use of Danube River (1994) the sustainable and equitable water management including conservation, improvement and rational use of surface and ground water.

In the same direction, the European Union by the Water Framework Directive (2000) asked to all water users to promote sustainable water use based on long-term protection of available water resources.

It is worldwide recognized that the key issue for sustainability in preventing the water pollution consists in the water management.

At this point, it should be also highlighted that similar studies concerning the implementing of a management system or a sustainable development are already available in the public domain. Nevertheless, as regards some other such studies were performed and some examples in this direction would be the works of Păunescu et al. (2008) and Tâlvescu and Dima (2008) that are related to the sustainable development, Todd (2009) dealing with the sustainable environmental management.

The objective of the present paper is to present the role of the regional cooperation for the water management in the Danube River basin and to highlight the importance of the implementation of a modern and integrative approach, for water management promoted by the WFD to prevent/reduce pollution and improve the water quality in the Danube River basin (DRB).

2. The regional cooperation

Although after 1990 the DRB pollution decreased perceptible and a continuous improvement of the water status can be noticed, the water pollution remains at a level that threatens both human health and the health of the river's aquatic systems.

In an effort to protect the water quality and to stop its degradation, the Danube countries have organized and participated to a number of European and international conferences that have adopted principles of action, rules and programs for water quality protection. Increased regional cooperation and water management is previewed to implement effective measures for its sustainable use. At the same time they have adopted legal mechanisms and structures that facilitate the implementation of the integrated water management and regional cooperation.

Thus, in 1985 it was signed in Bucharest, the Declaration of the Danube Countries to Cooperate on Questions Concerning the Water Management of the Danube, through which all the states neighboring the Danube agreed to cooperate for a common management of the water resources (Amato, 2005). This statement was established as a new framework for regional cooperation (ICPDR, 2004a).

Six years later, in September 1991, the representative of these countries met in Sofia, Bulgaria where the Environmental Program for the Danube River Basin (known as the Danube Environmental Program) was signed. This is focused on the protection and restoration of the river by supporting monitoring, data collection and assessment, and emergency response systems.

The development of the Strategic Action Plan has been a major task of the Environmental Program for DRB, which started in 1992. The Action Plan makes a significant contribution to the effort to improve environmental management in the Danube Basin (Task force for the Program, 1994).

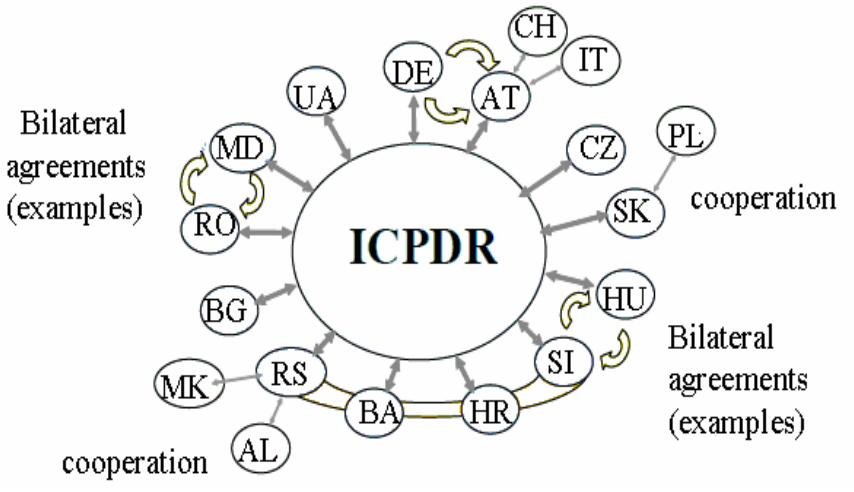
Also, the above Convention leaded to the harmonization of water quality monitoring produced by the International Commission for the Protection of the Danube River (ICPDR, 2004a). This Commission is the instrument which facilitates, coordinates and provides the communication between the Danube countries. In the ICPDR are included 13 countries neighboring the Danube basin and having each more than 2000 km2 along the river. These countries cooperate also with the countries having less than 2000 km^2 in the basin (Figure 1).

In general three levels of coordination in the Danube River basin can be defined: Danube basin level, bilateral (multilateral) level and national level (ICPDR, 2005a; ICPDR, 2008a; ICPDR, 2008b).

Where DRB boundaries extend beyond the borders of the countries cooperating under the DRPC (Danube River Protection convention) (for example in Italy or Poland) the neighboring countries have the responsibility to find a form of coordination with the other countries. (ICPDR, 2005a).

In 29 of June 1994, was signed in Sofia by 11 of the countries neighboring the Danube and the EU the Convention on Cooperation for the Protection and Sustainable Use of the Danube River (DRPC). This Convention constitutes the legal and politic framework for cooperation and water management in the Danube basin. The Convention is aimed at achieving sustainable and equitable water management. The Contracting Parties have agreed to cooperate on fundamental water management issues by taking: `all appropriate legal, administrative and technical measures to at least maintain and improve the quality of the Danube River and its environment' (ICPDR, 2004b; ICPDR, 2004a; ICPDR, 2005b; ICPDR, 2008).

Since 1996 a regular monitoring of the water quality has been performed under the ICPDR after the Trans-National Monitoring Network (TNMN) in the Danube River Basin was formally launched. The main objective of the TNMN is to provide a structured and well-balanced overall view of the pollution status as well as of the long-term development of water quality and pollution loads (Amato, 2005; ICPDR, 2005b).



Source: ICPDR, 2005a, p.7

Figure 1. **Coordination mechanisms for the Danube River basin**

To facilitate the implementation DRPC, the Danube states agreed that with its entry into force the ICPDR is established. The ICPDR is thus the framework for basin-wide cooperation.

After adopting of the Water Framework Directive (WFD), at its 3rd Ordinary Meeting on November 2000 in Sofia, the ICPDR made resolution that Contracting Parties (Danube countries and CE) ensure to make all efforts to arrive at a coordinated international River Basin Management Plan for the DRB in line with the requirements of the WFD. The implementation of the WFD throughout the Danube basin is considered the highest priority from ICPDR.

Some Danube countries are parties to other international agreements.

In July 1992, in Rio de Janeiro at the UN Conference on Environment and Development the Convention on biological diversity was signed by 72 countries and the EU. Eight of the Danube states are signatories. Its objectives are the conservation of biological diversity and the sustainable use of natural resources (Task force for the Program, 1994).

In April 1993, Environment Ministers of the UN Economic Commission for Europe (ECE) and the Environment Commissioner of the European Union were endorsed Environmental Action Program for Central and Eastern Europe. This represents a broad consensus on environment and development.

It has to be highlighted at this point that the regional cooperation plays an important role in coordinating the efforts of the Danube countries to adopt and implement the most adequate measures for preventing and reducing the water pollution.

3. Water quality management in the DRB

3.1. Integrated water management

Civilization has many uses for high-quality water, and many ways of degrading water quality. The main water uses in DRB are domestic drinking water supply, industry and irrigation. The water resources and the environmental quality are under great pressure from human activities. The most important problems affecting the health of the aquatic ecosystems and water users are: organic pollution, nutrient pollution, hazardous substances pollution, alteration due to the hydro morphological pressure, microbial pollution.

Ensuring in present and future of the water needs for the population and economy, both quantity and quality can be achieved by management of water resources based on the integrated management. Integrated water management means covering allocations, water use and water discharge permits on the basis of integrated and comprehensive plans developed by means a broad-based participatory planning process. It focuses on the river basin.

Integrated water management is based on a series of integrative principles: access to clean and enough water for people, rational management of water in order to optimize social and economic development with protection of natural ecosystems, unified management of water quantity-quality, involving all stakeholders (public and private); realistic costs of services (Vlad, 2008). Integrated management stays on basis for sustainable management of water resources to ensure satisfaction of current objectives of the society without compromising the future targets, while protecting the environment (Vlad, 2008). It is recognized that River basin management is the key for sustainability in water and land use management (Zessner et al., 2005). Three main policy goals characterize the water management: efficiency, equity and sustainability, as parts of sustainable development. Sustainable and equitable water management consists of conservation, improvement, and rational use of surface and groundwater.

Strategy and integrated water management policy contains some new elements:

- developing management plans in river basins;
- prevention of the condition of water bodies;
- define and achieve “good status” of water until 2015;
- establishment of monitoring networks and programs comply with the new concept of integrated water monitoring;
- progressive reduction of water pollution with priority substances/ dangerous;
- pollution prevention and control;
- rehabilitation of water resources.

Integrated water management is based, according to WFD, river basin management plan, which according to the knowledge status of water bodies, sets the objectives and proposes measures to achieve them (Vlad, 2008).

The new approach of water management differs from traditional management by the following:

- introduces the river basin management for all European river systems;
- introduces sets uniform standards in water policy throughout the UE;
- stipulates defined timeframe for the achievement of the good status of surface water and groundwater;
- includes public participation in the development of rivers basin management plans;
- introduces economic analysis of water use (ICPDR, 2004a; ICPDR 2005c).

In Romania, the implementation of integrated water management policy is in compliance with EU water policy. All EC directives including the Water Framework Directive have been transposed into the national legislation. Integrated water management aiming at achieving of good water status for all waters by 2015 and to promote sustainable water use based on long - term protection of available resources. Fundamental document of the water policy in Romania is the Water Management Strategy. This strategy outlines the main directions and has as main objective integrated management of the water resources (ICPDR, 2004a).

3.2. Water management in DRB

Preventing water damage, progressive reduction of pollution, achieving of a good status of water and sustainable and equitable use of the water are major objectives of water quality management in the Danube River basin. These objectives are strictly linked to obligations of the countries under the Convention Cooperation for the Protection and Sustainable use of the Danube River (DRPC), which have committed to make all efforts to implementation of the WFD.

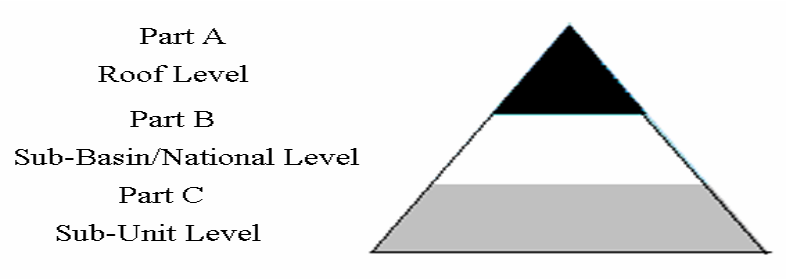
The management of the Danube River is based on the cooperation of all riverine countries in preventing and reducing water pollution in the river basin by adopting proactive measures, by each country, to protect the water quality and the riparian ecosystems (Task force for the Program, 1994).

The Danube River basin is complex due its size and varied forms of relief, and due the large number of countries on its territory, with appreciable socio-economic differences. As an example the upstream countries are more economically developed and prosperous than downstream, which affects also some aspects of the water management (ICPDR, 2008a).

Because of this complexity the basin-wide water management is based on three levels of coordination (Figure 2) (ICPDR, 2008b; ICPDR, 2004c; ICPDR, 2005a):

- the international basin-wide level - the Roof level (Part A);
- the national level (managed through competent authorities) and/or the internationally coordinated sub-basin level for selected sub-basins (Tisza, Sava, Prut and Danube Delta) (Part B);

− the sub-unit level, defined as management units in the national territory (Part C).



Source: ICPDR, 2009a, p.3

Figure 2. **The levels of coordination water management**

The level of detail of management plans increases from the international to the sub-unit level.

The international basin-wide level of management (Part A) includes relevant basin issues with trans boundary effects. This is strongly based on findings and actions at the national/sub basin level.

The national level also manages the existing problems at the sub-basin level. For the river Danube basin, that covers the territory of more countries, WFD calls for the creation of international districts and for coordination of work in these districts (ICPDR, 2009a).

The Danube countries have adopted an integrated water management with the main purpose of achieving a good status of the river water. The regional strategies are intended to support the national decision-making on water management and on the restoration and values and describe the main objectives for DRB, as well as the steps towards the environmental objectives that must be achieved.

The main objectives of water quality management are:

− prevent the deterioration of the water status;

− protect, improve and restore all the water bodies in order to achieve a good ecological and chemical status by 2015 Progressive reduction of pollution with dangerous substances.

For the achievement of the basin-wide objectives to improve the ecological and chemical status of the water bodies a continuous feedback mechanism is necessary from the international to the national level and vice-versa (ICPDR, 2009a).

An important contribution in raising the efforts of the Danube countries to adopt and implement measures to prevent and reduce trans boundary impacts and to monitor water quality can be the regional cooperation (Task force for the Program, 1994). For this reason it becomes necessary the identification of the trans boundary problems and their structuring so that through a joint effort these problems to be solved.

The problems on water condition in the Danube basin are diverse and vary from country to country. The measures for the protection of the waters are defined and carried out according to their own priorities and financial means. Their environmental priorities are guided by the aim of maintaining and improving the quality of water for their drinking water supply, recreation, fisheries etc.

The management of the water quality evaluates, based on monitoring data, the risk of water pollution in the river basin and on this basis establishes the water quality objectives. To achieve these objectives are identified prevention and mitigation measures of water pollution, and after their evaluation, they are included in programs of measures and implemented. The implementation of the selected measures is based on the implementation plan. This process needs to be monitored and evaluated continuously. It helps the decision makers to understand better the effectiveness of the measures implemented (Figure 3).

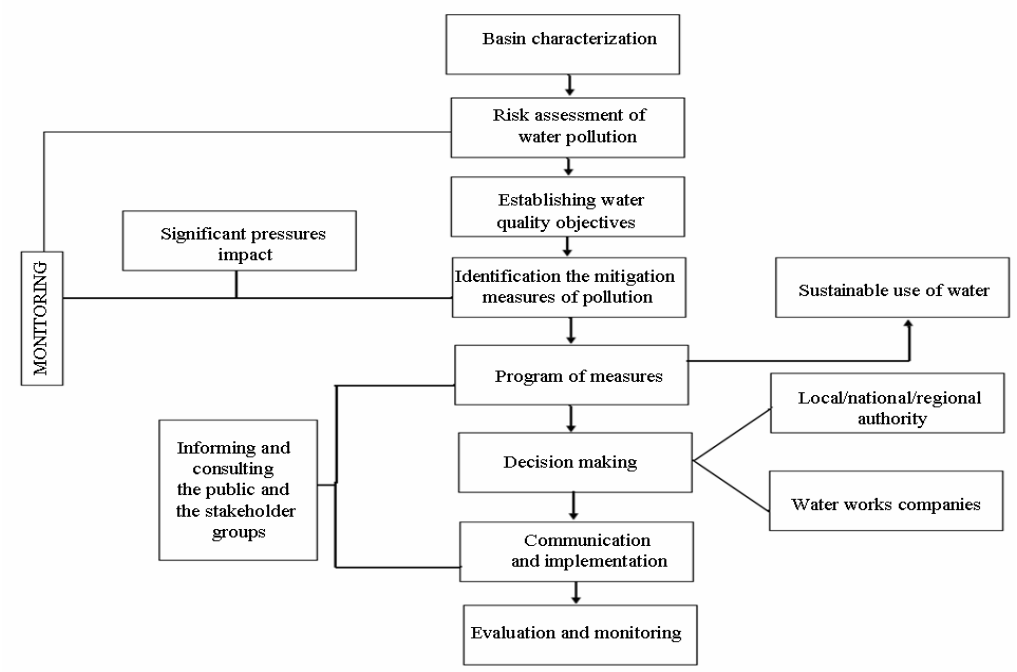


Figure 3. **Water quality management**

Deciding on the most effective measures to prevent and reduce the water pollution, their communication by polluters to implement, and information, consultation and public participation in the development and introduction the programs of measures are defining elements of the management concept able to ensure sustainable use of water in the Danube River basin.

Active involvement of stakeholders (NGOs, civil society, users, operators) by providing opportunities to participate and influence decisions on water management is

required by the WFD member states and is written between ICPDR (International Commission for the Protection of the Danube River) principles (ICPDR, 2009a; ICPDR, 2009b).

The responsibility for development and implement of the national environmental action programs falls primarily to the public authorities at the central, regional and local levels, and water works companies. Industry, agriculture, non-governmental organizations and the public will also have important roles to play (Task force for the Program, 1994).

4. Prevention and mitigation measures of water pollution

The programs of measures are part of the management plan. They are focused on proactive measures and follow the objectives of the water quality achievement, respectively of good ecological status/good ecological potential of water achievement and good chemical status/good chemical potential. These programs are built upon the results of the pressure analysis and the water status assessment (ICPDR, 2009a).

The analysis of the pressures and of theirs impact aim primarily to identify where and at what extent the human activities are a real risk for the water conditions. This analysis has a central role in developing the plan of action. The significant pressures identified represent the basis for the list of some possible measures. From the analysis of various scenarios as well as from economic analysis the best measures are selected in order to be included in the plan of measures.

Among the identified measures, after the pressures analysis and evaluation of the water status, those measures that support the development and implementation of international and national environmental policies, laws and regulations are taken. These include the introduction of harmonized ambient and emission water quality objectives or standards, planning procedures and economic measures.

They also should allow the creation of complementarities and synergies between various mandatory legal measures with financial instruments, voluntary agreements and national programs. Developing relevant measures to address basin-wide problems can only be achieved through an accurate understanding of the region (ICPDR, 2010).

The measures that have to be taken should consider multiple uses of water protection, including the needs of aquatic ecosystems. They must lead to reduction/elimination of the existing significant pressures for the Danube River water and the improvement of its status.

The program of measures for the protection the quality of water at the basin-wide level is oriented towards the agreed vision and management objective. It is based on the measures at the national level.

The programs of measures have in mind the main sectors that pollute the Danube, namely the urban centers for improvement of the wastewater by upgrading existing infrastructure and its extension to reduce the amount of pollutants discharged into water.

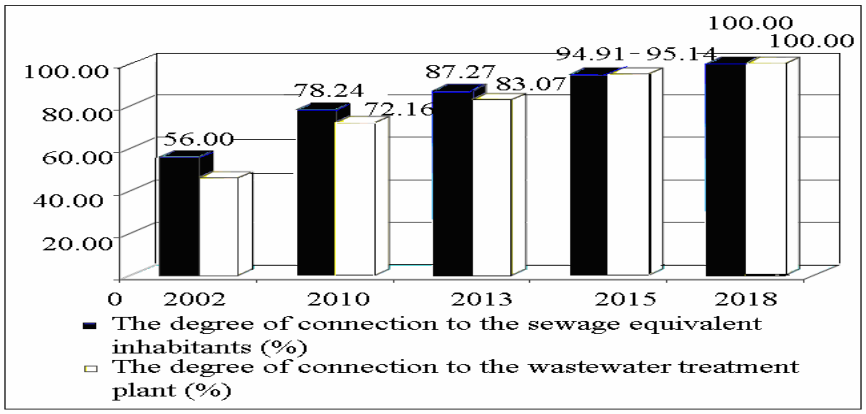
The Danube pollution by urban wastewater is caused by the absence in many urban areas of the Danube River basin of collection systems and implicitly of the wastewater treatment or of the existence of the collection systems without wastewater treatment or inappropriate treatment plants. Urban Waste Water Treatment Directive (UWWTD-Council Directive 91/271/EEC, amended by Commission Directive 98/15/CE, requires Member States of EU to collect and treat urban wastewater discharged from agglomerations over certain size (above 2,000 P.E-population equivalent.)

In response to the UWWTD, in many of the upper Danube countries tertiary upgrades (nutrient removal) have been made. At the same time, sewerage/coverage and baseline wastewater treatment (primary and secondary biological) are increasing in the middle and lower Danube country.

Romania obtained a transition period for UWWTD (Urban Waste Water Treatment Directive) implementation of more than 12 years after joining the EU because the agglomerations with over 2,000 P.E. which have sewer with or without treatment plants or non-collection systems and/or wastewater treatment plants with equipment and proper operation.

In 2007 there were 2,289 agglomerations with over 2,000 P.E. which have not treatment plants and from the total of 316 existing treatment plants, only 14 stations were conform to the legislative requirements. In the following year other 20 wastewater treatment plants will be completed (Ministry of Environment and Forests, National Administration „Romanian Waters", 2008).

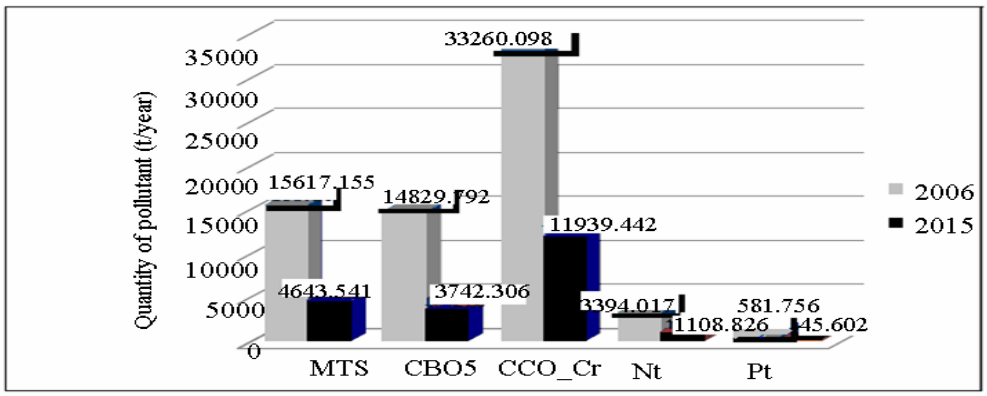
In Figure 4 the degrees of connection to sewage and wastewater treatment plants to be achieved by 2018 in the Danube Delta and Dobrogea Basin Area are illustrated.



Source*:* Ministry of Environment and Forests, National Administration „Romanian Waters", 2010.

*Figure 4***. Degrees of connection to sewers and sewage treatment needed to be made to the compliance period (2018) in the Danube Delta and Dobrogea Basin**

The evaluation of the effect of the measures for modernization and expansion of sewage and wastewater treatment plants in agglomerations from Dobrogea and the Danube Delta shows a significant decrease of the amount of pollutants discharged into the Danube River and its effluents in the recent years (Figure 5).



Source: Ministry of Environment and Forests, National Administration „Romanian Waters", 2010, p.474

Figure 5. **Evolution of the pollutant loading by implementing of basic measures to mitigate the effects of the significant point pressures – agglomerations effluents from the Danube Delta and Dobrogea Area**

The magnitude of reduction depends on political decisions and the economic support for investments in wastewater treatment. The main directions for the industry to reduce pollution are:

− pollution prevention, which is the first modern approach towards the proactive management;

− pollution control focused on controlling and treats pollutants emission (Petraru and Gavrilescu, 2010).

Reduction of the discharges from industry is possible by modernization and improvement of efficiency and operation existing facilities, introduction of clean technologies and the best technologies in the field (BAT) by imposing pollution limits from industrial sources and implementing new technologies involving less pollution.

ICPDR has identified the industrial sectors Chemical Industry, Food Industry, Chemical Pulping Industry and Papermaking Industry being amongst the main industrial polluters in the Danube River Basin. The industrial discharges of these industries shall comply with the 'best available techniques' (BAT) (ICPDR, 2004a).

A fast and efficient measure to reduce nutrient emissions in to surface waters is considered the introduction of P-free detergents. This measure could have in the short term a significant influence on decreasing nutrient loads in the Danube.

Reduction of emissions from agriculture by introducing of Best Agricultural Practice (BAP) and the national ecologic policies in order to reduce the values of the nutrients and hazardous substances.

Wetlands and floodplains connected to rivers act as nutrient filters and have positive effects on the reduction of nitrogen and phosphorous quantities in water. A study conducted in 1999 concludes that a total of nearly 300,000 ha of potential wetland area restoration represent an approximate reduction of ca. 30,000 tons N and 3,000 tons P/year (ICPDR, 2004a; ICPDR, 2004b).

612, 745 ha of wetlands/floodplains identified to have reconnection potential. Agreement 62, 300 ha to be re-connected and/of the hydrological regime to be improved by 2015.

The pressures on wetland due the expansion of agricultural uses, river engineering works, drainage and irrigation are to be considered as significant and need to be addressed by measures. It is considered that, connected wetlands/floodplains play a significant role on water status (ICPDR, 2009a).

To the success of the actions contributes the encourage of the investments that lead to reduce the amount of waste, introduction of organic products, risk control from accidents and taking preventive measures for reduction of pollution from inland navigation.

A high priority have the development of the systems of monitoring, including laboratory, data collection and assessment and emergency response systems, harmonization of monitoring and of the methods of development of the information systems.

Economic and fiscal policies and measures should be introduced to encourage water conservation and the better waste management as well as the adoption of the regulations authorizing the discharge of the waste water into water courses and emissions limits for point sources based on BAT.

A fundamental role to prevent the damage and improve the water quality it is environmental management in urban centers and industrial enterprises. It will be strengthened in order to control the pollution and waste reduction.

Selecting and prioritizing of the measures to prevent/reduction the water pollution to be included in the program of measures is based on evaluating each of these, both its contribution to improvement status of water and implementation cost (Figure 6) (Gasparotti, 2010).

To estimate the effectiveness of the measures regarding the reduction of pollution scenarios and mathematical models were developed. The most widely used models are MONERIS, W_a Q (water quality), Midterm Scenario for forecasting water quality in terms of nutrient content, QUAL 2K model (Vision Scenario for forecasting water in terms of organic pollution and other pollutants (ICPDR, 2009a, ICPDR, 2009b). For the economical assessment of the measures to reduce water pollution cost-effectiveness analysis (CEA) is used. This analysis shows how much is achieved the maximum possible degree of ecological efficiency with lower costs. CEA can be a decision support the national level for selecting the most cost-effective combinations of measures for inclusion in the program of measures. The measures which have the most cost-effective will be selected.

To prioritize the measures and estimate the benefits apply the cost-benefit analysis.

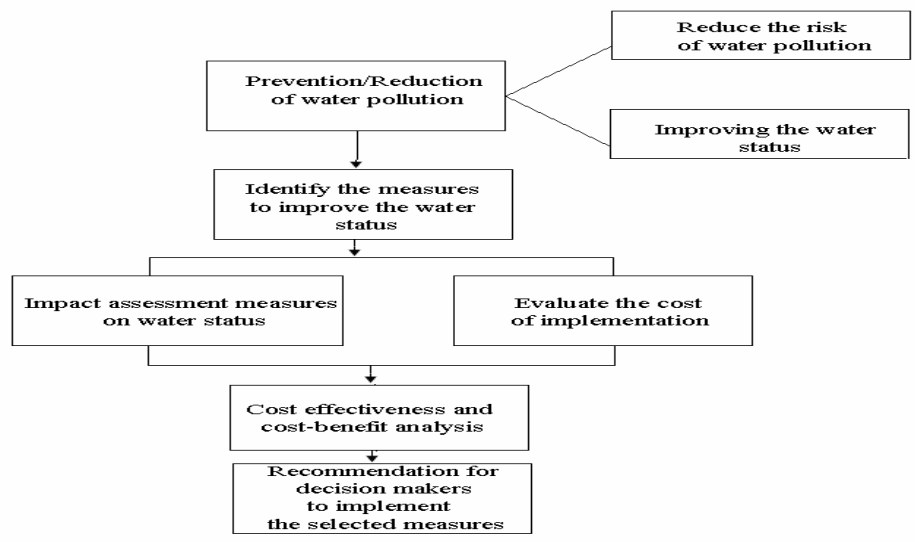


Figure 6. **Evaluation of the measures to prevent/reduce the water pollution**

The economic analysis is considered as the best used method to determine how scarce resources should be allocated. An accurate estimate of the costs associated with the implementation of pollution prevention measures is very important for the decision-making and strategic planning process.

Measures identified as best in terms of water status and cost will be introduced in the final measures program and implemented.

The benefits of pollution prevention are multiple (Figure 7).

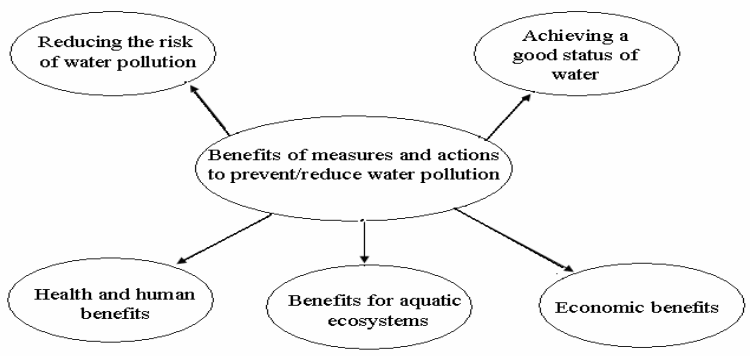


Figure 7. **The benefits of pollution prevention**

As resulted in the Figure 7, the benefits of pollution prevention are:

- reducing the risk of water pollution; improvement the water status;
- health and human life benefits; benefits for aquatic ecosystems;
- economic benefits.

5. Conclusions

The current level of pollution in the Danube River Basin (DRB) has determined the riparian countries to cooperate in order to improve the water status.

In some regional conferences, they have adopted a series of principles of action, measures and projects to prevent/reduce pollution, regional cooperation and water management.

Riparian countries committed to implement the WFD throughout the Danube basin, have adopted a new modern and integrative approach, of the water management promoted by WFD whose principles are based on cooperation, public participation and realistic costs of services.

Water management based on the risk assessment of water pollution, sets the objectives for water quality and on this basis identify measures to prevent and reduce pollution. After evaluating these measures, in terms of performance on the water status and the cost of implementation, they are included in the measures plan and implemented.

The adopted measures are considering the major polluters: agglomerations, industry and agriculture.

Pollution prevention benefits are: reducing the risk of pollution and improvement the water status, benefits to human health and aquatic systems.

The present work presented briefly the current status and the main perspectives concerning the joint measures that have to be carried out by the countries along the Danube River for preventing and reducing the water pollution. There are of course several other measures and strategies that have to be designed in the near future according to the dynamics of the economic development along the Danube River and also to the expected enhancement of the navigation in the Seventh Pan European transportation corridor that represents an important logistic chain in the European inland transportation.

References

Amato, C. (2005), "The Danube River", available at: http://www.bluedanubeholidays.com

Gasparotti, C. (2010), "Risk assessment of marine oil spills", *Environmental Engineering and Management Journal,* Vol. 9, No. 4, pp. 527-534

ICPDR, EU Dablas Task Force, (2004a), "Evaluation of Policies, Regulation, and Investment Projects Implemented in the Danube River Basin Countries in Line with EU Directives and Regulations", *DABLAS II Project Report*, Vol. 1, available at: http://www.icpdr.org/ DANUBIS, pp. 1-139

ICPDR (2004b), *Policy and legal reforms and implementation of investment projects related to the ICPDR Joint Action Program 2001-2005,* available at: http://www.icpdr.org, pp. 1-115.

ICPDR (2004c), *Danube River Basin-Part A-Roof report*, available at: http://www.icpdr.org/ DANUBIS, pp. 1-17

ICPDR (2005a), *Development of the Danube River Basin District Management Plan- Strategy for coordination in a large international river basin*, available at: http://www.icpdr.org, pp. 1-26

ICPDR (2005b), "The Danube River basin district*", WFD Roof Report 2004*, pp. 1-192

ICPDR (2005c), *Active for the Danube River Basin. 1994-2004. Ten years of cooperation in the Danube River Basin*, International Commission for the Protection of the Danube River.

ICPDR (2008a), *Outline of the Danube River Basin District Management Plan Part A-Basin-wide Overview,* International Commission for the Protection of the Danube River. ICPDR (2008b), *Extract from the Management Plan of the Danube Basin, Part A- General aspects of the International Danube Basin*, International Commission for the Protection of the Danube River

ICPDR (2009a), *Danube River Basin District Management Plan (Basin-wide Overview),* International Commission for the Protection of the Danube River

ICPDR (2009b), Management Plan of the Danube Basin, 2009-2015*,* International Commission for the Protection of the Danube River

ICPDR (2010), "Shared waters joint responsibilities*"*, *ICPDR Annual Report*, pp. 1-16 Ministry of Environment and Forests, National Administration „Romanian Waters" (2008), *National Project Management Plan. Summary of management plans at basin/catchment areas*, (In Romanian) available at: http://www.mmediu.ro/beta/, pp.1-116

Ministry of Environment and Forests, National Administration „Romanian Waters" (2010), *Danube River Management Plan, Danube Delta, Dobrogea Basin Area and coastal area* (In Romanian) available at: http://www.rowater.ro, pp. 1-594

Păunescu, C., Purcărea, I. and Pantea, C. (2008), **"**Managing quality in organizations through performance measurement", *Management & Marketing*, Vol. 6, No. 1, pp. 105-116

Petraru, M. and Gavrilescu, M. (2010), "Pollution prevention, a key to economic and environmental sustainability*", Environmental Engineering and Management Journal*, Vol. 9, No. 4, pp. 597-614

Task force for the Environmental Program for the Danube Basin (1994), *"*Strategic Action Plan for the Danube River Basin (1995 – 2005)", *Interim Secretariat for the Convention,* VIC, Vienna, Austria*,* pp. 1-144

Tâlvescu D. and Dima, A.M. (2008), "Strategies for regional sustainable development in south-west Oltenia", *Management & Marketing,* Vol. 3, No. 3, pp. 39-68

Todd, R.P. (2009), "Corporate social responsibility and global standardization: sustainable environmental management in the chemical industry", *Management & Marketing,* Vol. 4, No.1, pp. 3-16

Vlad, M. (2008), *Managementul apelor uzate in industrie*, Editura Fundației Universitare "Dunărea de Jos", Galați

Zessner, M., Kroiss, H. and Lampert, Ch. (2005), "The relation between Nutrient Management in the Danube Basin and Eutrophication Problems in Receiving Black Sea Coastal Waters", available at: http://www.iwaponline.com/wio/2005/03/wio200503011.htm

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