INCO-CT-2006-517673

Specific Measures in Support of International Cooperation (INCO)- Mediterranean Partner Countries (MPC)

INECO

Institutional and Economic Instruments for Sustainable Water Management in the Mediterranean Region

Coordination Action

DELIVERABLE NO 10

ALTERNATIVE INSTITUTIONAL AND ECONOMIC INSTRUMENTS TOWARDS A MORE EQUITABLE AND EFFICIENT WATER ALLOCATION AND MANAGEMENT

Due date of deliverable	30/06/2007		
Actual submission date	28/10/2008		
Start date of project	1st July 2006	Duration	36 months
Organisation name of lead contractor for this deliverable	IEFE– Istituto di Economia e Politica dell' Energia e dell' Ambiente, Universita Commerciale Luigi Bocconi		
Author(s)	Prof. Antonio Massarutto (IEFE) Ms. Vania Paccagnan (IEFE)		
Revision	Final version		

Project co-funded by the European Commission within the Sixth Framework Programme (2002-2006)		
Dissemination Level		
PU	Public	X
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

Preface

"Alternative Institutional and Economic Instruments towards a more equitable and efficient water allocation and management" is the 10th Deliverable of the INECO Project (Institutional and Economic Instruments for Sustainable Water Management in the Mediterranean Region, Contract No: INCO-CT-2006-517673). The Deliverable summarizes part of the work undertaken within the framework of Work Package 7 of the INECO project, for the identification of instruments that can improve water allocation and management operations in the Case Studies developed by the project.

This analysis pertains to the 2nd Phase of the INECO Project. The 1st phase was devoted to the definition of "significant" water management problems in Cyprus, Egypt, Tunisia, Lebanon, Syria, Algeria, and Morocco. On the basis of these problems, subsequent steps involved:

- A detailed situation analysis of the issues at hand;
- Institutional mapping and stakeholder analysis to identify actors, decision-makers and users that affect or are affected by the problem examined;
- Engagement in a participatory approach with stakeholders to discuss the problem and share opinions and experience on how it can be addressed in a desired water resources management situation.

The 2nd Phase of INECO is building on the outcomes of this process, to suggest, adapt and evaluate institutional and economic instruments that can help in problem mitigation. The Phase involves the:

a) Suggestion of options/instruments which can be considered applicable for each case study;

b) Evaluation of instruments by local stakeholders;

c) Synthesis of outcomes in the form of guidelines and policy recommendations.

This report, compiled by Partner 4 of the INECO Project (Istituto di Economia e Politica dell' Energia e dell' Ambiente) presents a synthesis of findings from point (a) above. Furthermore, the Annex of this document, compiled by Partner 1 (National Technical University of Athens) is a Discussion Document on Alternative Instruments, which provides a detailed listing of options suggested for each Case Study.

Contents

1. INTRODUCTION 7

2. THE CHALLENGES IN WATER RESOURCE MANAGEMENT FOR SOUTHERN MEDITERRANEAN COUNTRIES 8

3. THE APPLICATION OF ECONOMIC AND INSTITUTIONAL INSTRUMENTS IN THE INECO CASE STUDIES 9

3.1 Command and Control approach – Regulatory systems and enforcement 9

3.2 Environmental taxes 10

3.3 Water pricing, Subsidies and Full Cost Recovery (FCR) 11

3.4 Tradable water systems 13

3.5 Liability systems 13

3.6 Voluntary agreements 13

3.7 Information campaigns 14

3.8 Public participation and community empowerment 15

4. ASSESSMENT OF THE EFFECTIVENESS OF INSTRUMENTS IN ATTAINING SEVERAL FUNCTIONS 15

5. POLICY RECOMMENDATIONS 16

1. Introduction

This report is intended as a synthesis of the findings of WP7 of the INECO project. The objectives of this WP, titled "Analysis of economic and institutional instruments with emphasis on effectiveness and equity" were to:

- Describe the socio-economic and financial environment regarding the provision of water services;
- Evaluate the effects of existing economic instruments in the residential, agricultural, industrial, tourism and recreational sectors;
- Assess the financial sustainability of water resources systems;
- Identify, analyse and discuss alternative institutional arrangements and economic measures

In particular, in WP7 an extensive analysis of the current framework in which the economic instruments are applied has been carried out. In order to facilitate the discussion of the WP7 analysis with the stakeholders, this report has been structured with two aims in mind: firstly, to summarize the outcomes of questionnaires for the evaluation of alternative options from Lebanon, Syria, Algeria, Tunisia, Cyprus, Egypt and Morocco; secondly, to facilitate the discussion amongst stakeholders on alternative institutional arrangements.

In this note, we will not review the economic and institutional instruments, but we will only recall their functions. For a detailed overview on suggested economic instruments in the countries quoted above, the interested reader could refer to chapter three of the document "Discussion Document on the Identification of alternative options", which is annexed to this Deliverable.

This report is structured as follows:

Section 2 attempts to clarify the main challenges in water resource management that Southern Mediterranean Countries will have to face in XIX century. Then we will review the current experience on the application of economic and institutional instruments in the INECO Case Studies. In particular, with reference to first category of instruments, we will refer to different categories of water charges, to water tariffs, to transferable rights to use or pollute water, liability regimes and voluntary agreements. With reference to the second category, we recall how property rights are defined and governance mechanisms in the water domain.

This is considered as a critical first step in the analysis, since it makes possible to define the starting point of any institutional reform. In particular, we will assess whether the current application of economic instruments makes it possible to attain relevant functions, i.e.

- Allocative, i.e. use market instruments to signal the Willingness-To-Pay (WTP) to use water resources so as to distribute them in the most beneficial way to society;
- Incentive, i.e. creating incentives for behavioural change, so as to promote self-regulation, and at creating incentives for the adoption of more environmental friendly practices;
- Financial viability and attractiveness for human/financial capital, i.e. raising revenue to find the financial resources necessary to run water services and ensure that services provided respond to demands both current and future.
- Cost sharing, i.e. makes each water user contributing to the financial and environmental costs he/she induces.

Subsequently, in the second part of this report, we will provide some policy insights, based on the European and international experience on the application of these instruments.

2. The challenges in water resource management for Southern Mediterranean Countries

In the XIX century, water scarcity will be the most critical issue in Southern Mediterranean Countries. In fact, this already constitutes a serious policy issue in recent years, but it is expected that water stress will be exacerbated by the foreseen increases in water demands and the effects of climate change at local level. For instance, in Tunisia it is expected that industrial and tourism demands will duplicate by 2030. The current stress factors are different in each country and, as a consequence, will require different policy responses. Moreover, the expected increase in temperatures and drop of precipitation levels is bound to have significant impact on water availability.

Presently, the agricultural sector is still the dominant water user in the region; this situation is expected to continue at least in the medium term, as food security remains a key policy goal in most of the countries examined. In this perspective, the preservation of existing and possibly the development of new irrigation schemes are likely to be one of the main objectives that will shape policies in the near future.

Nevertheless, high pressures are exerted on water resources from other water use sectors, as a result of diversification of policies for economic development, such as:

- Tourism, especially in coastal areas (e.g. in Cyprus and Tunisia) or in historical cities (e.g. Damascus and El Cairo). The tourist water demand is causing local impact on water resources; pressures are exerted mostly during the summer and coincide with the peak irrigation season, thus inducing conflicts regarding inter-sectoral water allocation, and infrastructure development to manage peak water demands.
- Industrial uses raise concerns in Egypt, where there plans to relocate polluting and water demanding industries away from urban settlements, in the middle of the desert. The increase in industrial water demand is an issue in Syria as well, where in the Barada river basin it is estimated that by 2025 the percentage of water industry with respect to domestic demand will raise from 25% (in 1985) to 40%. Water provision to these industrial premises could potentially be in competition with other water uses.
- New urbanisations will entail a sharp increase in (high quality) water demand for domestic users. In particular, in Egypt it is estimated that by 2017 almost 9 million people will be moving to the new sixteen cities, currently under development.
- In some cases an increase in the water demand for energy purposes is foreseen. In Morocco, for instance, it is expected that the deficit in production of hydroelectric power will be of 60% in the Oum er Rbia basin.

These high pressures on water resources will be exacerbated by the consequences they will entail on the qualitative features of the resource. Regarding domestic use, these impacts could derive from an insufficient level of treatment of waste water discharges. Untreated waste waters could have adverse effects both on surface and ground waters, thus contributing to the water stress already faced in particular areas. Agriculture uses, instead, cause diffuse pollution (derived from nitrate and ammonia loads) that in some cases could compromise the quality of water intended for

domestic use. They also entail an increase in the level of salinity and eutrophication of water bodies. This can in turn require the development of advanced processes for producing safe water for domestic use, thus inducing a significant increase in the corresponding water supply costs.

In addition to the management of increasing water demand and adverse quality effects, a major challenge arises from the maintenance of water infrastructure (especially large reservoirs), which, in the past has been the dominant policy for supplying water to local communities. An insufficient level of maintenance is currently witnessed by the high level of leakages in water distribution networks (both in the domestic and in the agricultural sector).

Coping with water scarcity in these areas seems to be crucial for environmental and social reasons. The inadequate irrigation of some areas is still causing soil erosion and a reduction in soil fertility and productivity. Moreover, the insufficient availability of water resources causes equity and health concerns. In order to cope with increasing demand, varying precipitation levels exacerbated by droughts and inadequate infrastructure, water supply provision has already been rationalized in some areas. However, the need to use water, not only for domestic uses, could entail illegal behaviours, like the break of water pipes. Such illegal conducts do not only have a social dimension, but also an environmental one. For example, in the Barada River Basin, Syria, episodes have been reported of farmers breaking wastewater pipes to use water for irrigation purposes; this has already caused soil pollution and contamination of agriculture products.

Both internationally, but also at the national and local level it is now recognized that in the majority of cases, the solution does not lie in the further increase in water supply (due to technical, environmental and financial constraints) but in the increase of the efficiency in water use. In this context, the next Section of this report discusses issues relevant to the current implementation of economic instruments, thus paving the ground for the suggestions on alternatives developed in the Annex of this document.

3. The application of economic and institutional instruments in the INECO Case Studies

3.1 Command and Control approach – Regulatory systems and enforcement

With regard to the command-and-control (C&C) instruments, each Case Study is characterized by a different degree of standards for water use/wastewater discharge, and different levels of enforcement.

Discharge standards in **Cyprus** are fully enforced in compliance with the pertinent EU legislation.

In **Tunisia**, the whole regulatory system is adequately defined. An abstraction inventory has been developed and monitoring responsibilities are clearly defined. Discharges are monitored by the National Agency for Environmental Protection, which is also responsible for inflicting penalties and sanctions in cases of environmental violation. There is an inventory of discharge points in each Governorate, which includes discharges for discharge from oil mills, discharge from industrial units and discharges from waste water treatment plants. Conformity to discharge standards is checked through dedicated laboratories.

The inventory of discharge points in the **Seybouse River Basin, Algeria** has not been completed yet; authorities (ABHCSM) estimate that a database will be available in about 3 years time. Discharge monitoring, due to lack of technical and financial resources is not undertaken

everywhere. Furthermore, discharge standards are in the process of being defined by the Ministry of Environment. All industries, however, need to obtain a discharge permit, which is issued by a local Commission.

The legislative system of **Syria** defines all aspects regarding standard setting and enforcement. However, it is not clear whether these are actually enforced. In the Barada River Basin, and in an effort to facilitate compliance to standards, the Government has given a grace period to industries to conform to the relevant legislation. After the expiration of this period, it is expected that all aspects of the law will be fully enforced.

In **Lebanon**, standard setting is complete but there are problems with regard to enforcement. The discharge inventory is incomplete; penalties and sanctions for standards' violations are often not applied.

In the **Egypt** case, competences are well defined. Moreover, the National Water Resource Centre (NWRC) has developed extensive monitoring networks for groundwater, Nile water and drainage water. The level of enforcement in some cases is not satisfactory, since only licensed discharges are regularly monitored and the majority of facilities are unlicensed.

No information on this point is available for the **Morocco** case study.

3.2 Environmental taxes

Regarding environmental charges and taxes, we consider effluent charges (i.e. taxes on the direct pollution entailed by human activity) and taxation on fertilizers and agricultural inputs (i.e. taxes on the input used in economic activities which will have adverse environmental effects).

It is recognised that, despite the fact that effluent charges are foreseen by national environmental laws in many cases, there are actually enforcement problems, due to the institutional factors, such as insufficient information available, unclear distribution of control competences, monitoring system inefficiencies, etc. This is the case in Syria, Egypt, and Lebanon.

In the Egypt case, the environmental laws are in some case overlapping; this creates confusion on the correct allocation of competences and responsibilities. It is acknowledged that in order to enforce these regulations large investments are required, and public funds are not available for this purposes.

In Lebanon, the Ministry of Environment is responsible for setting effluent charge systems. The Ministry can entrust the task to other private organisations, but the system has not yet been applied.

In Syria, fertilizer tax accounts for 3%, pesticide tax is 5%, and 1% for grains. However, the effectiveness of these economic instruments is undermined by the fact that in certain cases the producers can transfer these taxes to produce buyers and the final consumer.

In Cyprus, however, the possibility to introduce this instrument has been studied in respect to a tax on mineral nitrogen fertilizers according to the nitrogen content of the fertilizer. The effect of such a measure will be the reduction of nitrogen pollution of the soil in a cost-effective way. It has been calculated that a tax of 130% of the mineral fertilizer price will prompt a reduction in fertilizer use from 105 to 57 kg N/ha. A tax on pesticides has been studied in respect to introduce a tax on pesticides according to the dosage instructions, the toxicity and the persistence of the active ingredient. The effect will be the rationalisation of pesticide use and application. It has been estimated that a price increase by 50% would lead to a 25-50% reduction in pesticide application.

No information on environmental taxes is available for Tunisia and Morocco. In Algeria, and although effluent charges are foreseen by legislation they are extremely low, and take the form of a lump sum paid by industries. Generated revenue is not earmarked for environmental purposes but allocated to State Budget.

3.3 Water pricing, Subsidies and Full Cost Recovery (FCR)

In all the countries considered, the FCR principle is not applied, since water tariffs cover only part of the costs incurred in the provision of water services.

In **Egypt**, there are no fees for withdrawals from groundwater. When compared with other North African countries, water tariffs paid by households and industry are relatively low. In agriculture, farmers are directly responsible (through direct labour) for pipe and canal maintenance. Failure to do so entails a request for paying the expenses incurred. Overall, it is estimated that subsidies on capital investment amount at 60 to 75% of the total expenditure. Water is thus heavily subsidised, since water tariffs cover only 20% of the total provision costs. It is estimated that if the FCR principle is applied, the impact on individual bills will be significant, as a 300% increase with respect to current tariff level is envisaged.

In **Lebanon**, the system is heavily subsidized for all water users. In order to apply FCR principle, current water tariffs would increase 4 to 5 times.

In **Syria**, current water tariffs for domestic uses cover 90% of operating costs in cities and 40% in rural areas. By the end of 2010 it is envisaged that the recovery of cost should be 95% of the operational cost. Farmers have to pay a fixed charge of 3500 SP/hectare/year, irrespective of the type of crop. This charge covered covers only a part of the cost for the irrigation water distribution network, in addition to the costs for network operation and maintenance. Additionally, in practice charges are often not applied, as in the past farmers used to abstract water from the river or from their own wells without paying anything. Legally licensed industrial premises should pay 30 S.P. for each m^3, and 40% of their total bill for wastewater treatment. However, in the Barada River Basin, there are many illegal industrial workshops, most of which are using water from the distribution network and pay only the minimum tariff. Furthermore, tariffs are uniform throughout the country, and are not related to the actual production costs of each utility.

For **Algeria**, no information on the level of cost recovery is available. However, it is known that water sector is currently heavily subsidised. No abstraction charges are applied and water tariffs are defined according to the consumption and type of use.

The **Morocco** water sector also benefits from important subsidies. For drinking water provision, the recovery of costs is effected through:

- A water supply (or royalties) charge, calculated according to water consumption.
- A contribution to the 1st implementation (PPE - Participation au Premier Etablissement) , aimed at recovering the corresponding investment costs;
- A fixed charge to cover connection costs;
- A fixed charge for the recovery of surveys and assessments;
- A pollution charge, for which the pertinent legislation is under approval.

Water supply charges in urban areas vary among regions and comprise two parts: a fixed charge, and a volumetric charge, which depends on the volume of water consumed. Water tariffs are differentiated according to the type of use (residential or industrial). Residential water tariffs follow

the IBT scheme where the first block is priced at a rate lower than cost. The 2nd consumption block is priced at a rate equal to the unit cost, whereas rates for the 3rd and 4th blocks are priced at rates much higher than the total water supply cost. Charges for sewage collection and treatment also comprise a fixed and a variable charge, differentiated according to the type of use. It should be noted that water billing is performed on a monthly basis, both for municipal water utilities and private operators. In spite of the above, water tariffs cannot ensure alone an adequate recovery of costs, due to the limited ability-to-pay of the users. This is particularly true in the small villages and cities, where costs are higher. In this case, the contribution of local authorities, through subsidies and grants is required. Furthermore, it should be noted that the delays noted at the investment level contribute significantly to the overall financial balance.

In irrigation water provision, cost recovery is effected through the setting of a simple volumetric rate (not differentiated according to the overall consumption), which varies according to the region. With regard to groundwater, two water charges are applied: the first concerns water delivered by the ORMVAs at the entrance of the farmer's field whereas the second concerns water pumped by farmers using their own equipment. In the latter case, a much lower charge is paid. For surface water, the tariff varies among basins. It should be noted that generally cost recovery is low and does not exceed 30%.

In **Tunisia**, up to 1970 water was granted to farmers free of charge with the aim to encourage agricultural activities and increase the value of agricultural land. The current governmental policy with regard to irrigation water pricing primarily aims at the recovery of operation and maintenance costs, whereas cost related to the renewal of equipment and important repairs in infrastructure are mostly undertaken by the government. The aim of this policy is to try to secure a minimum level of financial sustainability of water service providers, while at the same time provide better services to farmers. In 1996 the recovery of operation and maintenance costs reached a global equilibrium at the national level, due to the regular increase of 15% in irrigation water tariffs since 1991. However the recovery of operation maintenance and renewal costs did not exceed 60%. Furthermore the collection of fees from consumers is at times inadequate resulting to the lack of financial resources for the GDAs (Agricultural Development Groups). It is expected that future pricing policies for irrigation water will lead to the intensification of agricultural activities in the irrigated perimeters and orient farmers towards the application of water conservation measures. In the domestic sector, before 1986 water pricing was uniform for all users. After the establishment of SONEDE, a distinction was made between households, tourism and industry. This approach prevailed up to 1974 when an IBT pricing system distinguishing between consumption blocks and user types was established. However, the provision of potable water is still subsidised at around 30%. The water bill also includes a charge for sewage collection and treatment. The first (social) block (which corresponds to a minimum water consumption) is limited to 20 m³. The second block corresponds to a quarterly consumption between 20 and 40 m³ whereas the third block is between 40 and 70 m³. The 4th block is between 70 and 150 m³. In cases that the consumption exceeds 150m³ and in regions where SONEDE is not subsidized by the State, the price per cubic meter is 6 times higher than the one of the first block. Overall, it can be stated that the current pricing system provides incentives for water conservation and recovers the management, operation and maintenance costs for the networks operated by SONEDE.

3.4 Tradable water systems

Tradable water systems have not been introduced in any of the considered Case Studies. It is recognised that current institutional settings de facto impede the introduction of formalised forms of water trading, both of water quantity and of water quality credits. However, some forms of informal water markets could be introduced by involving farmers associations.

Moreover, currently in Tunisia some forms of water trading could be introduced since trading between regions is allowed. This option however, could raise concerns regarding the impact on water resource balance at local level.

3.5 Liability systems

Liability systems (such as environmental performance bonds) are not currently applied in the considered case studies. It is however acknowledged that the degree of institutional innovation (i.e. liability definition and enforcement) necessary to put them in place could constitute a serious obstacle towards their introduction in the studied water management systems. The only country that has introduced them is Egypt, following the law 4/1994. However, it is noted that in this case firms can subscribe them for free, this way transferring their liability to tax payers and thus diminishing any incentive to implement precautionary measures to avoid major pollution or contamination.

3.6 Voluntary agreements

Voluntary agreements are quite common in all Mediterranean Case Studies.

In Tunisia, for instance, voluntary agreements regarding the implementation of efficient irrigation techniques are experimented through contracts between the Regional Department of Agriculture Development (CRDA) and Agriculture Development Groups (GDAs). They both have a supporting function: the GDAs assist farmers to prepare their technical files necessary to change irrigation methods. The CRDA studies the technical files and after approval submits them to the bank to grand the corresponding subsidy. The CRDA also offers expansion services to users and user groups.

In Algeria, the Ministry of Environment has introduced voluntary agreements called "*contrats de performance environmentale*". For the moment, in the Seybouse Region, five industries (out of 86) have signed the contract. The industrial sectors involved are steel, fertilizers, milk and fats.

In Cyprus, the National Agricultural Payments Organisation is promoting a voluntary agreement scheme for the prevention of nutrient pollution in areas designated as vulnerable. The main provisions of the scheme include:

- Farmers will reduce application of fertilizers up to a maximum of 17 kg N/dec/year;
- A subsidy scheme is available for the farmers who will participate, to compensate for the reduction of the production, as follows:
    - 1st year: 30 € / dec;
    - 2nd year: 24 €/dec
    - 3rd year: 18 €/dec
    - 4th year: 12 €/dec
    - 5th year: 6 €/dec

Furthermore the provisions of the Code of Good Agricultural Practice are applied through the island, i.e. control of fertilizer use, use of improved irrigation systems and preparation of irrigation

schedules, relocation (wherever is possible) of animal husbandry units, slurry collection, mechanical separation and land application of piggery waste, on-going farmer training programmes, etc.

No voluntary agreements have been reported for the cases of Syria, Egypt and Lebanon, although farmers seem willing to participate, provided an incentive to shift from current irrigation techniques to water savings ones are provided. The situation is similar for the industrial sector.

3.7 Information campaigns

All the considered case studies have experienced information campaigns, although with different degrees of pervasiveness and effectiveness.

The cases where the most organised information campaigns have been put in place are Egypt, Tunisia, Cyprus and Syria.

In Egypt, information campaigns regarding best management practices in agriculture have been put in place, resulting in a huge amount of saved water irrigation. On the other hand, information campaigns targeting the general public have been introduced, with publications on newspaper and TV programmes broadcasting.

In Tunisia, information campaigns regarding efficient irrigation systems have been put in place since two decades. Such policy measure had an impact on the area irrigated with efficient systems which reached actually 85 % of the total irrigated area and it is expected to be 100% by the end of 2009. Moreover, environmental information regarding water resource management is available for the general public through the web.

In Cyprus, a number of water savings campaigns have been put in place, like:

- Public awareness campaigns through advertisements, spots and articles in the media;
- Weekly television and radio programmes for the farmers;
- School visits (during 2005, officers of the WDD provided lectures to 26 public elementary schools);
- School drawing and essay competitions;
- Distribution of information material on water management issues;
- Daily uploaded web-site offering information on water issues, including water saving measures, reservoir storage, statistical data for the use of water, etc.;
- Training provided by the Department of Agriculture for the farmers on irrigation water scheduling and frequency patterns.

In Syria, several campaigns have been launched with the objectives of increasing public awareness regarding water stress and water resource protection. In particular, awareness campaigns for farmers were centred on the following themes: modern irrigation methods, dangers of using polluted water, nitrates effects, excessive application of fertilizers and pesticides, etc.

Information campaigns targeting farmers have also been introduced since a decade in Algeria. Other countries, such as Lebanon and Morocco have a more limited experience on this point.

Overall, it should be noted that the overall effectiveness of information campaigning is difficult to assess, due to the lack of systematic control of outcomes or due to the fact that information campaigns are often combined with other instruments (i.e. subsidies). For instance, in Cyprus, as a result of demonstration campaigns accompanied by long term low interest rates, the flood irrigated

area has decreased from 13,400 ha in 1974 to 2,000 ha in 1995, whilst in the same period micro-irrigated areas have increased from 2,700 ha to 35,600 ha.

3.8 Public participation and community empowerment

Structured forms of public involvement are present only in Cyprus, in order to define the program of measures in accordance with the WFD. A number of stakeholder groups have been selected and their involvement is envisaged. At this stage, public participation has been scheduled to be performed in response to at the three phases of the implementation of the River Basin Management Plan, i.e.:

- Phase A: Time and Work Schedule of the River Basin Management Plan (February 2007);
- Phase B: Intermediate report on Significant Water management Issues (February 2008);
- Phase C: Draft River Basin Management Plan (December 2008).

Public consultation campaigns and other forms of stakeholder engagement are in very early stages in all the other countries considered.

4. Assessment of the effectiveness of instruments in attaining several functions

From the information given above we can assess the effectiveness of economic and institutional instruments, so as to give some policy recommendations (next paragraph).

From the allocative point of view, it has to be noted that Mediterranean countries allocate their water resources on the basis of institutional arrangements, since the application of economic instrument is absent. Allocation is based on historical water rights and socio-political priorities, and it does not take into account the economic benefit that the use of water resources offers to the society as a whole. Under these conditions, it is likely that current water allocation policies (both inter-sectoral and intra-sectoral) are not optimal from a socio-economic point of view. There is therefore room for improvement, for two reasons mostly:

- It is not known whether water resources (excluding demand for domestic uses) is currently allocated to the most valuable uses;
- Even if resources were allocated according to economic principles (i.e. on the basis of its marginal contribution), it is still possible to attain improvements by increasing the water intensity of different water uses.

Institutional instruments alone could not be sufficient to attain these policy objectives and the introduction of economic instruments could increase the amount of information available to policy makers by involving water users in water allocation processes, as already experienced in Spain. However, this policy option would require institutional innovation, and is not immediately applicable.

A more feasible policy option is to improve the current water use patterns, by promoting water reuse and by decreasing the amount of water used per unit of produce. Water policy innovation, in other words, should focus on improving the incentive function.

On this point, it has to be said that current water tariffs are very low to address any incentive function. However, would it be required to attain this objective, raising the level of water tariffs could simply penalise all the users, especially the poorest ones. In order to increase the incentives of saving water, whilst guaranteeing at the same time poorest household, it is necessary to act on

water tariff structure, by introducing increasing block tariffs with high rates for the highest block and by differentiating the fixed amount on the basis of the type of water uses and, in case of domestic uses, on the basis of household income. It can be expected that an increase in water tariffs could have an effect on water uses showing higher water elasticity, typically productive functions (see below). However, letting pay more the uses that show higher willingness to pay could contribute to attain several policy objectives at the same time, i.e. (i) improve the financial viability of the system; (ii) share the costs among users.

Considering the financial viability of the system, the level of cost recovery could be improved, as current water tariffs cover a small proportion of total provision costs. As we have underlined above, in some cases revenues cover only 20% of total costs. It is unlikely, however, that the total costs of water systems could be covered only by water tariff revenues. Nonetheless, there is room for improvement, especially for what concern the percentage of unpaid bills that in some cases reaches 40% of the total number of households. If the strict application of FCR principle could raise some concerns in the case of domestic users, in other cases, like the industry and tourism one, this principle could be applied without social consequences, provided that it is possible to accurately monitor the consumption of these uses.

Regarding cost sharing, apart from cross subsidies, an indirect way of dividing water provision costs among users is to share the exploitation of water resources. In other words, it can be possible to reuse water, besides consumption and production processes, among users. For instance, it could became necessary to reuse cooling water in other uses, like agriculture ones. Moreover, the treated discharges could be used for agricultural purposes. All these options would make possible to use the same resources twice (even if with different qualitative patterns) and to split the provision costs among the different users.

5. Policy recommendations

From the analysis carried out above, some policy recommendations can be derived.

First of all, in all the case studies considered, there is a need to complete water infrastructure and raise the corresponding necessary financial resources. Despite the fact that in all the countries considered the full cost recovery principle is not completely applied, the simple increase of the water tariffs could not be sufficient to assure the financial viability of the system, for two reasons. First, it is acknowledged that the strict application of this principle will entail a sharp increase in water tariffs, and this could raise social concerns. Secondly, it has to be valued whether this measure will be sufficient to raise all the financial resources necessary to complete water infrastructures and ensure their reliable operation.

In fact, in Europe some countries, like Portugal and Spain, have developed/completed their water infrastructure with the support of the EU Cohesion Fund. For instance, Portugal was able to almost complete its sewage service coverage (15% in 1990 to 90% in 2006) by using these structural funds. For the Mediterranean countries, similar sources of funding could be found. They could be originated by bilateral or international support initiatives.

The raise of water tariffs, however, could remain a valid policy option to decrease the dependence from international donors, especially in situations where water demand is pushed by uses having a high willingness to pay, like the tourism and industry ones. In these cases, the first step is to introduce different water tariffs level for different uses, thus distinguishing domestic ones from the others and then applying to the latter a highest per unit rate.

The increase in water tariffs for high value uses could also have incentive and allocative functions. First, regarding incentive functions, the increase in water tariffs could promote the adoption of water saving behaviour. For instance, economic literature has highlighted that industrial water uses are quite elastic to water tariff increases and tend to introduce recycle system in productive processes (especially for water reused for cooling purposes). On what concerns domestic use, it is acknowledged that water demand is more rigid and water tariff increase could only translate on higher water bills, without having any effects on the consumption levels. The increase in water tariffs could have a positive incentive effects only in cases where consumption patterns are characterised by high portion of non essential consumption (e.g. water used in gardens or swimming pools). For instance, in Hungary the increase in water tariffs experienced during the 1990s entailed a decrease of water consumption of 18%. In the countries considered, however, it is unlikely that such an important consumption decrease will occurred, since per capita consumption is low compared to the levels characterising East Europe countries in the 1990s.

Regarding the use of water in the agricultural sector, whilst water price increases would ameliorate the financial viability of irrigation water systems (nowadays, as highlighted above, agriculture pays a small proportion of the water costs it entails), it is unclear how this will influence water demand for irrigation purposes. For instance, the increase of water tariffs could make this input too costly for low value crops and thus cause a shift to more valued cultures. It will not cause an increase in efficiency in water uses in all cases where water is not priced on the basis of effective consumption but on the basis of the cultivated area. In order to ameliorate water irrigation patterns, by introducing less water using techniques, the pricing of water according to consumption is a first step that should be accompanied by other actions, aiming at convincing farmers to change their irrigation modes, like information campaigns and support initiatives. Most of all, in order to avoid adverse impacts on agricultural production, all these actions should also be accompanied by financial support to installing new water saving irrigation systems.

Second, considering allocative functions, it has to be noted that the current allocation of water resources is the result of administrative decisions or custom traditions. An option to modify current allocation of water resource would simply to modify the historical allocation decisions. However, this policy option could not be the most suitable one, due to problems. First, any authoritative modification of historically acquired rights could raise social opposition. Second, it could be the case that the policy maker has not sufficient information about the current level of water use (due for instance to illegal connection). For this reason, decisions could not be the optimal ones from a social point of view. The information base could be improved by involving water users, without needing radical institutional innovation. For instance, in Spain bilateral negotiations among water users occur and make possible the improvement of the allocation of existing water resources.

Finally, coming to cost sharing issues, cross subsidies among different types of users should be reversed in favour of poor households and avoiding subsidising productive sectors (like agriculture and industry), unless this is justified by social and equity considerations. An option could be to use the high valued uses' WTP in favour of poorer households. For instance, in Spain the desalination plants built to meet tourist demand, are also used to provide water to residents. In fact, by considering the economies of scale that characterises these assets, the marginal cost of connecting an additional household to an existing plant is almost zero. The same could be said for industrial uses. In Italy, some waste water treatment plants built for industrial uses are then also used by domestic users, by connecting these plants with the public sewerage services.

In addition to all the above mentioned recommendations, a preliminary step before introducing any water reform is to act on institutional aspects. As highlighted above, it is evident that many economic instruments are already in place, and only need to be effectively put in place. Nowadays, there is a serious problem of enforcement, especially on what concerns illegal connections, unpaid bills and non-conformity to discharge standards. Of course, improving the enforcement of water management instruments will be possible only by spending additional financial resources, so as to increase the information available, build databases on environmental information and put in place all the centres necessary to monitor the quality of water sources and discharges.

The institutional improvements are not related only to the enforcement level, but could also be referred to a better coordination between administrative bodies. In certain cases, an overlapping of regulatory functions has been reported. Resolving this point is a necessary condition to put in place an effective monitoring system.

INECO

INCO-CT-2006-517673

Specific Measures in Support of International Cooperation (INCO)- Mediterranean Partner Countries (MPC)

INECO

Institutional and Economic Instruments for Sustainable Water Management in the Mediterranean Region

Coordination Action

DELIVERABLE NO 10 - ANNEX

DISCUSSION DOCUMENT ON THE IDENTIFICATION OF ALTERNATIVE INSTITUTIONAL AND ECONOMIC INSTRUMENTS IN THE INECO CASE STUDIES

Due date of deliverable	30/06/2008		
Actual submission date	28/10/2008		
Start date of project	1st July 2006	Duration	36 months
Organisation name of lead contractor for this deliverable	NTUA– National Technical University of Athens		
Author(s)	Ms. Eleni Manoli (NTUA) Dr. Eleni Kampragou (NTUA) Prof. Dionysis Assimacopoulos (NTUA)		
Revision	Final version		

Project co-funded by the European Commission within the Sixth Framework Programme (2002-2006)		
Dissemination Level		
PU	Public	X
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

Contents

1 Introduction - Background 5
2 The framework for the analysis of economic and institutional instruments 7
2.1 The INECO Case Studies' Scope 7
2.2 Identification of options 8
2.3 Evaluation of options and proposals 8
3 Economic and institutional instruments for water resources management 10
3.1 Overview 10
3.2 Economic instruments for water management 11
3.3 Institutional instruments and arrangements 15
3.3.1 Command-and-control instruments 16
3.3.2 Decentralization and community-driven management 16
3.3.3 Private sector involvement 22
4 Identification of alternative options for the Egypt Case Study (Bahr Basandeila Canal) 24
4.1 Phase 1 outcomes: Identification of problems and objectives 24
4.2 Preliminary identification of alternative options 25
5 Identification of alternative options for the Syria Case Study (Barada River Basin) 28
5.1 Phase 1 outcomes: Identification of problems and objectives 28
5.2 Preliminary identification of alternative options 29
6 Identification of alternatives for the Lebanon Case Study (Damour River Basin) .. 34
6.1 Phase 1 outcomes: Identification of problems and objectives 34
6.2 Preliminary identification of alternative options 35
7 Identification of alternative options for the Cyprus Case Study 40
7.1 Phase 1 outcomes: Identification of problems and objectives 40
7.2 Perceptions of local stakeholders for the management of groundwater in Pegeia 41
7.3 Preliminary identification of alternative options 42
8 Identification of alternative options for the Tunisia Case Study 44
8.1 Phase 1 outcomes: Identification of problems and objectives 44
8.2 Preliminary identification of alternative options 45
9 Identification of alternative options for the Algeria Case Study (Seybouse River Basin) 49
9.1 Phase 1 outcomes: Identification of problems and objectives 49
9.2 Preliminary identification of alternative options 50
10 Identification of alternative options for the Morocco Case Study (Oum Er Rbia River Basin) 53
10.1 Phase 1 outcomes: Identification of problems and objectives 53
10.2 Preliminary identification of alternative options 54
11 References & Bibliography 56
Appendix I: Description of economic instruments 58
I.1 Market instruments 58
I.2 Fee-based measures 59
I.3 Other fiscal instruments (taxes on inputs and outputs) 61
I.4 Financial instruments 61
I.5 Liability systems and assurance regimes 62

I.6 Voluntary agreements 63

1 Introduction - Background

This document discusses alternative institutional and economic instruments which are applicable to the INECO Case Studies' context as analysed and identified during the 1st Phase of the project (Figure 1). It summarizes the analyses from the first year of the project, and links them to the international experience on institutional and economic instruments for addressing the water management issues that are the focus of INECO.

Phase 1, titled "Situation, Problem and Stakeholder Analysis" ends with the finalization of the WP 5 Workshops. Together with the finalization of the WP 5 workshops, the main outcomes of Phase 1 were:

1. The selection of one significant water management issue (Focal Problem) for each region;
2. The identification, through Stakeholder Analysis, of the key persons/institutes (Stakeholders) that have an interest and should be involved in the next phases of the project;
3. The analysis and mapping of the problem causes and effects;
4. The definition of main (key) objectives that should be addressed in order to achieve the mitigation of the focal problem.

Outcomes 3 and 4 were consolidated through meetings and workshops with local stakeholders. Phase 2, "Formulation of alternatives and evaluation of proposals" elaborates on alternative instruments that could contribute to the achievement of the objectives determined in Phase 1. Alternative instruments are formulated into proposals for the implementation of the suggested options, also including required changes and reforms, and additional supporting instruments. These proposals will be evaluated by stakeholders. Finally, in Phase 3 the entire process outcomes will be generalized and used for the formulation of adaptable guidelines.

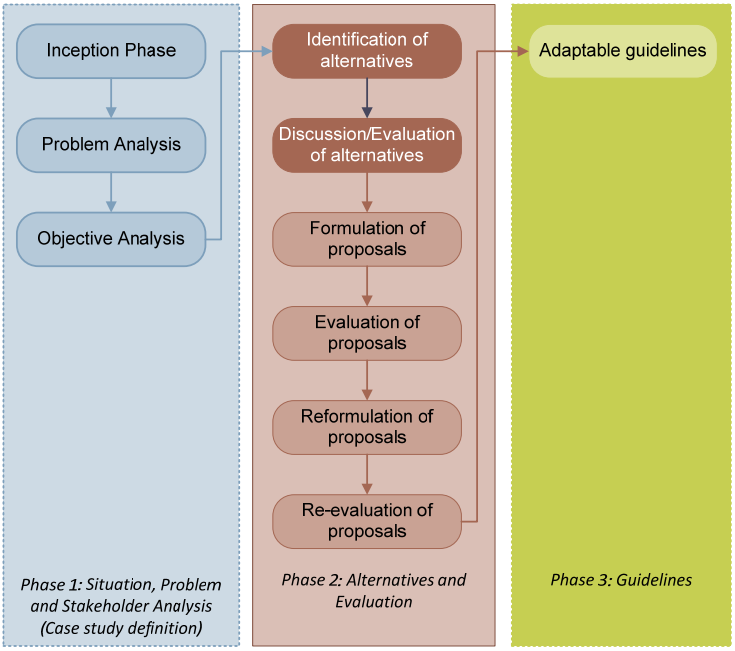

Figure 1: The INECO project phases

The document is structured in the following way:

- Section 2 discusses the INECO approach for the identification and evaluation of alternative institutional and economic instruments applicable to the Case Studies.
- Section 3 presents a brief overview of institutional and economic instruments for water management, based on literature review.
- Sections 4 to 10 outline the background context (problem tree and objective tree analysis) and present a list of options considered applicable for each Case Study.

Finally, the Appendix provides a more detailed description of economic instruments for water management.

2 The framework for the analysis of economic and institutional instruments

2.1 The INECO Case Studies' Scope

Economic and institutional instruments studied in the project are linked to the focal water management problems of the INECO Case Studies. Focal problems can be grouped in two major categories: those associated with water quantity and those associated with water quality. The Lebanon case forms a distinct example that touches upon both issues (global water stress due to the inefficient allocation of limited water supply, but also due to pollution, i.e. quality deterioration of available supply).

In brief, the selected focal water management problems (1 per country) are:

- **Egypt:** *Water quality deterioration* in the region of the *Bahr Basandeila Canal of the Dakahlia Governorate,* where waste disposal, heavy use of pesticides, inadequate domestic wastewater treatment, and uncontrolled discharge of industrial effluents have transformed the open waterway to a repository and conveyor of liquid waste. The major water pollution issue, which is common in the entire Nile water distribution network, poses great risks for human health, agricultural production, and the river and coastal ecosystems.
- **Syria:** *Water pollution in the Barada River Basin (Greater Damascus Area),* due to the discharge of high loads of industrial and domestic waste and wastewater, which exceed the river's self purification capacity, and the decrease of river flow, resulting from rainfall decrease and use of the Feige Spring for drinking water supply. Water pollution has caused the collapse of the Barada river ecosystem, which also sustains the large forest of "Ghouta", a cultural heritage area and environmental hotspot in the region.
- **Lebanon:** *Increasing water stress* for meeting domestic, agricultural and industrial water demands *in the Damour River Basin*, further exacerbated by upstream pollution, groundwater interbasin transfer, and lack of financial and technical capacity to address infrastructure requirements and enforce legislation on water resource protection.
- **Cyprus:** *Aquifer depletion and sea intrusion in the Pegeia region*, which results from overpumping in order to meet domestic and tourist needs in the region.
- **Tunisia:** *Aquifer depletion and sea intrusion*, mostly due to uncontrolled abstractions for irrigation purposes and the inadequacy of the presently applied alternatives and disincentives to groundwater overexploitation; water reuse is barely practiced, due to the low quality of treated water, soil types and cropping patterns, and most importantly due to farmer unwillingness to pay for treated wastewater. The problem is further exacerbated by the lack of technical capacity in the agricultural sector, the limited application of water saving methods in irrigation and the current water-intensive cropping patterns.
- **Algeria:** *Pollution of the Seybouse River*, which receives large volumes of untreated industrial and domestic effluents posing both direct and indirect risk on human health, agricultural production and the river ecosystem.
- **Morocco:** *Increasing water stress in the Oum Er Rbia River Basin*, resulting from increasing demand and inefficient water use in the agricultural sector, where high losses in irrigation distribution networks combined with the currently adopted irrigation practices (non-efficient

irrigation methods and water intensive, non-economically sustainable cropping patterns) contribute to significant water waste.

2.2 Identification of options

The current stage of the project focuses on identifying options suitable for the mitigation of the focal water management problems and their causes.

Different options are designed for different purposes and are addressed to different levels of governance (water service provision, river basin management, national water policy). For example, in most countries domestic water pricing is performed at the water service provision level and not at the regional or national level. Furthermore, controlling allocation of water among different users is an objective linked to river basin or aquifer management and does not form part of the goals set by a water utility or water service provider.

In this regard, each identified option can contribute to the achievement of one or more of the objectives set for problem mitigation. This relationship is identified by specifying for each option the objective(s) to which it contributes. Furthermore, some options require additional (supporting) measures for their implementation, which are specified and can form part of the proposal that will be formulated in the subsequent phases of the project.

2.3 Evaluation of options and proposals

The key question when evaluating measures is their feasibility and applicability. Feasibility depends on the timeframe for the implementation of an option and on the resources required (financial, human, technical etc.). Applicability depends on the already established institutional and socio-economic environment (perceptions, policies, laws, regulations etc).

In addition to assessing alternative options, an objective of the project is to arrive at a set of recommendations on what reforms/arrangements need to be promoted in order to achieve progress towards sustainable water management. Thus, the overall outcome of this process can be defined as **an overall policy proposal for each Case Study, describing not only possible economic and institutional options, but also the enabling environment for their successful implementation.**

In this perspective, Table 1 describes a set of generic criteria for option and proposal evaluation. The list was drawn taking into account the “headline” overriding criteria for IWRM (Environmental Sustainability, Economic Efficiency, and Social Equity), and the list of criteria proposed by OECD for the evaluation of alternative instruments.

Overall, four categories of evaluation criteria are formed:

- Effectiveness criteria, which aim at evaluating contribution to the achievement of the objectives set, but also in enhancing collaboration, public participation and community empowerment.
- Social considerations’ criteria, which describe effects in terms of social inclusion, affordability, equitable access and social sustainability.
- Economic efficiency, where criteria correspond to the overall economic impact that an option or proposal can have in regional economy and development strategies.
- Ease of implementation: Criteria pertaining to this category aim at describing the effort required for implementation, taking into account the current political environment, legislation and administrative structures.

Each option or proposal is evaluated by local stakeholders in terms of its contribution to the specified criteria using qualitative marks ("significant contribution", "medium contribution", "small contribution", "and no contribution"). The aggregated evaluation scorecard delineates which options can be considered mostly applicable for each Case Study.

Table 1: Criteria for the evaluation of alternative institutional and economic instruments (options) and proposals within the framework of INECO

Category	Criteria
A. Effectiveness	**A1.** Contribution to the achievement of the key objective **A2.** Mobilization of local community **A3.** Promotion of technological/institutional innovation
B. Social considerations	**B1.** Affordability for sensitive user groups (poor, women etc.) **B2.** Promotion of inclusion of all user groups **B3.** Cultural/ethical acceptance **B4.** Alleviation of conflict among user groups
C. Economic efficiency	**C1.** Financial cost of implementation **C2.** Negative economic impact on important sectors (agriculture, industry, tourism) **C3.** Impact on regional economic development strategies
D. Ease of implementation	**D1.** Need for institutional and legislative reforms **D2.** Required effort for integrating with existing policies for other sectors (e.g. agriculture, industry) **D3.** Administrative barriers to implementation

3 Economic and institutional instruments for water resources management

3.1 Overview

Policy instruments refer to legal, institutional, economic, social change and other management mechanisms that are in place or proposed in order to improve the efficiency of water management operations.

Economic instruments encompass a rather diverse toolkit of policies whose main characteristic is that they provide market signals by affecting/modifying relative prices in order to influence the behavior of consumers, polluters and other economic agents and provide incentives to them for internalizing the externalities that they may be producing (Robinson and Ryan, 2002). A tentative classification of economic instruments for water management, which are further detailed in the Annex, is outlined in Figure 2.

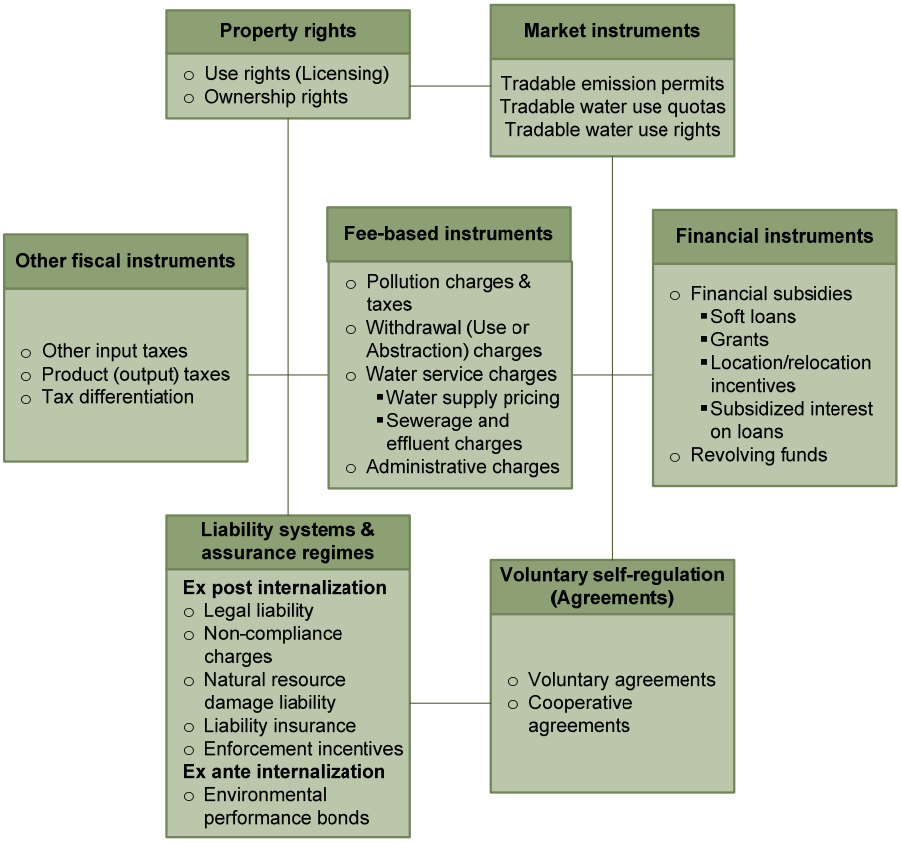

Figure 2: Overview of economic instruments for water management (adapted from Panayotou, 1994)

It should be noted that different instruments have advantages over others in different applications and circumstances, and severe limitations in others. According to the functions (objectives) they fulfill, economic instruments can be classified as follows (Kraemer et al., 2003):

- Instruments that mostly aim at creating incentives for behavioural change (incentive function). This category involves instruments that aim at self-regulation, and at creating incentives for the adoption of more environmental friendly practices. A typical example is incentive taxes,

which are levied with the intention of changing environmentally damaging behavior and without the primary intention to raise revenues. These instruments are successful in their purpose if rates are sufficiently high to stimulate the users to invest in pollution abatement and/or conservation.

- Instruments that mostly aim at raising revenue (fiscal and financial function). In the case of environmental charges and taxes, a distinction is made on whether the revenue is earmarked, and invested in resource protection, or simply added to the general government budget. If the purpose of a tax is merely to gain money for the national budget, the economic instrument can be categorized as a fiscal environmental tax. However, it is recognized that these instruments offer as well incentives for behavioural change.

Furthermore, Kraemer et al. (2003) point out that economic instruments can also have additional results ("soft functions"), such as capacity building and improvements in implementation, such as (a) the provision of an additional source of finance for building personnel capacity; (b) the creation of a need for continuous updating of information on water abstraction, consumption and pollution, and thus provision of an opportunity to strengthen the information and knowledge base; (c) the introduction of many elements of control and enforcement usually associated with revenue raising.

Institutional instruments and arrangements refer to overall enabling environment to support water management operations; the instruments and arrangements pertaining to this definition involve, among others, options for:

- Enhanced public participation;
- Decentralization and community involvement
- Formulation of water management bodies based on hydrological boundaries;
- Setting of standards, water-related legislation and regulations and their enforcement;
- Frameworks for private sector involvement
- Access to and disclosure of information;
- Monitoring processes, coordination and collaboration protocols, etc.

Furthermore, institutional arrangements are sets of working rules that are used to determine who is eligible to make decisions in some arena, and what actions are allowed or constrained. Further, the rules describe what procedures must be followed, what information must or must not be provided and what payoffs will be assigned to affected individuals.

3.2 Economic instruments for water management

Classification of economic instruments can be performed according to various schemes and can be based on their function(s), their position along the water cycle (e.g. abstraction, discharge, and use), the authority that can undertake their implementation etc.

Economic instruments described in this document are classified into six broad categories:

- **Property rights**, which can be either ownership or use rights and aim at controlling the utilization of the resource,
- **Market instruments**, which refer to transferable rights to use or pollute water, and aim at creating efficient markets in which rights can be traded and where, as a result, social cost is minimized.
- **Fee-based measures**, which refer to:

- The application of an economic rate to activities that induce damage to water resources through taxes, environmental charges, fees etc. and/or
- The application of a charge (or user fee) for recovering the (total) costs for the water services provided.

- **Other fiscal instruments**, including taxes on inputs and outputs and tax differentiation for specific practices.
- **Financial instruments,** including subsidies (grants, soft loans to users and polluters) and financing mechanisms, such as revolving funds.
- **Liability and assurance regimes**, which aim at internalizing and recovering the cost of potential damage. Environmental performance bonds can provide incentives to avoid or restore environmental damage.
- **Voluntary agreements, which are contracts established between** the public administration and the user (or a user group) in which the user agrees to achieve a certain environmental objective and receives a subsidy or other forms of help to change its technology or practices. In cooperative agreements the role of the public administration is undertaken by another user (or user group) who has interest in the achievement of the environmental objective.

Table 2 provides an overview (description, advantages and disadvantages) of the most commonly applied economic instruments for water management.

Table 2: Brief description, advantages and disadvantages of economic instruments commonly applied for water management

Category	Instrument	Description	Advantages	Disadvantages
Water Pricing	Flat pricing	Constant amount paid, regardless of quantity used	Easy to implement, no metering required, ensures cost recovery if rates are appropriate	No incentive for water conservation
	Uniform rate per unit volume of water consumed	Constant rates for consumption of water regardless of the quantity	Easy to implement	Effect on conservation is more limited than IBR as increasing consumption is not penalized.
	Increasing block rate (IBR)	Higher rates for consumption of greater quantities of water	Promotes conservation effectively Greater consumption is penalized to avoid excesses by users.	May impact low income households
	Decreasing block rate (DBR)	Lower rates for consumption of greater quantities of water	Simple to implement. Attractive to large users – offers incentives to join the Public Water Supply System and abandon self-supply (groundwater)	Perverse incentive that rewards increasing use
Taxes	Taxes on inputs Taxes on outputs	Charges usually of money imposed by authority	Use of existing legislation and administrative structures Can lead to efficient conservation if rate is sufficient to change behaviour Way to obtain use data	Politically and socially undesirable. Perception of revenue raising and not conservation oriented. May impact on the relative competitiveness of industry/agriculture

Category	Instrument	Description	Advantages	Disadvantages
Subsidies	Grants, Indirect payments, Regulations, Rebates etc.	Government interventions through direct or indirect payments, price regulations and protective measures to support actions that favour a set purpose	Best suited for dealing with non-point source pollution. Well suited to the residential sector, especially when combined with awareness programs.	Should not be necessary as the system moves towards full cost recovery. In the residential sector, efficiency programmes can be seen as a way to buy capacity for growth that is often not welcome by the consumers.
Environmental charges and taxes	Pollution charges (or taxes)	Payments based on the measurement or estimation of the quantity and quality of a pollutant discharged into the environment.	Can be very effective at improving water quality when charges reflect the type and impact of pollution released into the environment and the sensitivity of the receiving environment Very useful for large point-source emitters such as industries who have control over their output.	Low charges do not promote pollution reductions. Not effective when charges do not reflect the type and impact of pollution released into the environment and the sensitivity of the receiving environment. Not very effective for non-point source pollution. Can require a significant monitoring system and information collection is necessary to ensure the charges are being applied correctly
	Abstraction (withdrawal) charge	Rate for removing water from the environment for irrigation or for treatment to produce drinking water or for industrial use	Effective in obtaining water distributors (such as municipalities) to promote conservation among their users. Easy to monitor for large users such as industry and municipalities	Low charges have a minimal impact on conservation Can require a significant monitoring system and information collection is necessary to ensure the charges are being applied correctly, especially in the case of groundwater abstractions
Market instruments	Tradable water abstraction permits Tradable emission permits	Set a target and allows trading between entities to achieve the target. Some reduce more than the target, some lees, but overall the target is achieved.	Offers a pollutant or water consumption reduction incentive. Can be very flexible and applied to specific pollutants. Permits will flow towards the highest value water use (efficient allocation). Can be an effective conservation approach when restrictions on trading are introduced for pollution control or resource conservation	Not well suited to the residential sector. Less effective for non-point source pollution (agriculture). Without restrictions, tradable emission permits can cause pollution hot spots if no provisions are made. Permanent trades may be constrained by concerns about future security of the entitlement due to evolutions in water

Category	Instrument	Description	Advantages	Disadvantages
				policy. Can have high transaction costs
Liability systems	Penalties, fines, different forms of sanction in case of environmental violation	Enforcement of legal action in the case of non-compliance with existing environmental regulations	Pollution control is achieved through the decentralized decisions of polluters to act in their own interest (incentive towards self-regulation) Environmental liability laws constitute a significant step towards the application of the polluter-pays principle. Compliance costs are also reflected in prices of end-products and therefore contribute to the principle of ecologically honest prices.	Damage is assessed and damage costs are recovered ex post Not applicable in cases of diffuse pollution, where it is impossible to identify and link individual polluter(s) activities to the negative environmental impact Not recommended for developing countries with poorly developed legal systems, or with cultures that very rarely use courts to resolve disputes or award damages
Voluntary agreements	Voluntary Agreements Cooperative Agreements	A contract between the public administration and the user (or a user group) in which the user agrees to achieve a certain environmental objective and receives a subsidy or other forms of help to change its technology or practices. In cooperative agreements the role of the public administration is undertaken by another user (or user group) who has interest in the pursuit of the environmental objective.	Promotes self-regulation and allows for flexible and adjusted adaptation to technological options. Establishes a win-win situation among all parties concerned Offers incentives for continuous improvement Is readily acceptable both by society and by polluters/users	Needs monitoring from regulatory authorities Requires wide awareness and training of users on appropriate practices Can be costly to implement in case of agricultural users Competitive problems can be caused when several users/polluters are committed collectively, as a user's individual performance becomes dependant of its competitor's performance.

As mentioned above, economic instruments serve different purposes (functions) and therefore different instruments are suitable for different purposes. Furthermore, different instruments apply to different levels of governance (water system functions). Table 3 links the aforementioned instruments to functions, water management issues and objectives set by the relevant authorities.

Table 3: Linking economic instruments to water management issues, possible objectives and functional levels for water management (adapted from Sawyer et al., 2005)

Function (Authority)	Issue(s)	Possible objectives	Instruments
Water service provision (water utility)	• Water use exceeding infrastructure capacity • Limited water supply • High peak water use	• Increase perceived value of water • Internalize costs and reduce use • Finance increase in infrastructure capacity	• Utility pricing to include full cost (water charges, sewerage charges) • Subsidies/incentives to efficient water use • Cooperative agreements with other users
Watershed, River Basin, Aquifer Management (River Basin Agency)	Water withdrawals exceed estimated quantity available (e.g. drought conditions)	• Capture full cost and reflect value of water (internalize external costs) • Regulate water use • Offer incentives to water utilities to reduce abstractions	• Water Abstraction Permits • Tradable abstraction permits • Water Abstraction Charges – Earmarked funds for watershed management initiatives and education
	Excess pollution loads to watercourses	• Limit nutrients from all sources (source and non-point)	• Tradable Effluent Permits / licenses • Pollution Charges • Voluntary agreements
		• Focused on point source discharges (industry and/or municipal)	• Tradable Effluent Permits / licenses • Effluent Charges high enough to encourage capital investments to improve treatment • Voluntary agreements
National water policy (State, River Basin Agency)	Undervalued water resources resulting in inefficient water use and/ or excess pollution	Various	• Pricing (as Incentive or Disincentive) • Investment tax incentives (State only) • Grants program for best practices • Tax rebates on high efficiency product purchases (State only) • Other forms of financing • Voluntary agreements

3.3 Institutional instruments and arrangements

Similarly to the previous section, this chapter presents institutional instruments and arrangements which can contribute to sustainable and integrated water management. Issues discussed involve:

- Command-and-control instruments (the traditional regulatory approach to change user behaviour);
- Decentralization, community-based management and public participation;
- Private sector involvement.

3.3.1 Command-and-control instruments

Command and control measures (CCM) refer to regulatory norms and standards that forbid or allow certain actions or outcomes. The "command" phase involves the definition of standards and allowable actions. During the "control phase" public authorities have to monitor and enforce the legislation, and in case of non-compliance initiate relevant procedures (e.g. fines, sanctions etc). With regard to water pollution, the types of standards can include:

- **Ambient standards**, which regulates the amount of pollutant present in the surrounding (ambient) environment. These types of standards cannot be directly enforced. Action requires that the sources of pollution are traced and regulated to ensure that the ambient standard is met.
- **Emission standards**, which regulate the level of emissions allowed but do not guarantee a specific ambient level of pollution.
- **Technology standards**, which require polluters to use certain technologies, practices, or techniques. While emissions standards require polluters to meet a goal for the level of pollution, but give the polluter freedom to choose the technology used, technology standards require a specific technology.

With regard to water use, a legal water standard or quota can be introduced that places restrictions on the amount of water that can be extracted for use. It will be effective if water users face substantial monetary penalties for not lowering water abstraction below this standard or not adhering to the quota. Table 4 outlines the main advantages and disadvantages of the Command-and-Control approach.

Table 4: Advantages and disadvantages of the Command-and-Control (CAC) approach

Advantages	Disadvantages
• Standards are a more widely understood form of environmental policy. • Standards are a pragmatic approach when there is uncertainty about the effects of pollution on the environment. • Political costs of standards are lower compared to market-based instruments.	• An 'optimum' standard is difficult to determine. • Users and polluters have no incentives to reduce pollution beyond the standard. • Penalties for violating standards tend to be too low and enforcement tends to be weak. • To be effective, standards need to be revised frequently, but in practice legislation tends not to keep up with the change. • Standards tend to be less cost-effective than other (economic) instruments. • The financial costs for meeting standards may be high to the users. There could also be political costs if the standards are stringent and users are adversely affected. • CAC is very difficult and costly to apply in cases of diffuse pollution, and has many times proven ineffective (e.g. groundwater abstractions)

3.3.2 Decentralization and community-driven management

Decentralization aims at enhancing local involvement in water services and it could refer to activities or to devolution (Van Beers, 2006). In the first case community planning and management is promoted, while in the second the devolution of responsibilities could lead to participatory decision making processes. Decentralized water management requires an institutional framework, defining at least:

- Relationships between administrative units (accountability and subsidiarity);
- Means to improve the ability of decentralized bodies to perform water management (e.g. technical advisors, personnel);
- Access to information;
- Financing schemes;
- Public participation processes;
- Conflict resolution processes;
- Areal jurisdiction of the decentralized authorities;
- Links with private firms and NGOs, in order to enhance local capacity to deliver services.

Community planning and management are also considered essential and supplementary to other measures that aim at influencing water user behaviour. For example economic instruments are being used for encouraging people to use water wisely and institutional arrangements are providing the enabling environment for improved water management efficiency. However local involvement engages the public to act in a desired way and when institutional and economic instruments can only be gradually integrated into the water policy, local involvement can be seen as the most efficient tool for improved water management (Figure 3).

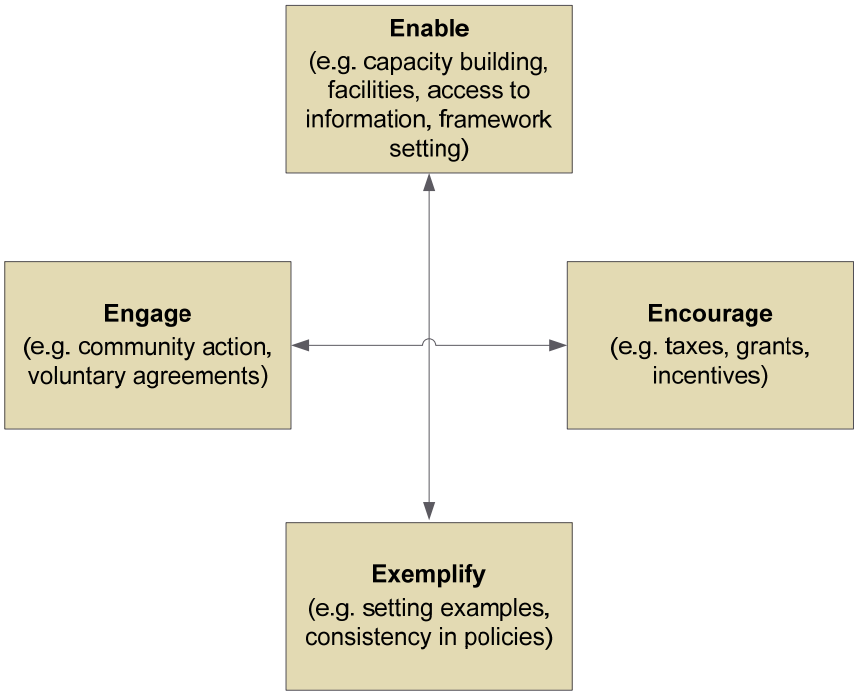

Figure 3: The four E's for behavioural change
(adapted from The UK Government Sustainable Development Strategy, 2005)

In general, the objectives of community-driven management are (Lockwood, 2004):

- Local society to be in direct or indirect control over the operation and management of its own water supply system,
- Development of ownership perception by the user community, and
- Contribution (financial or as human resources) of the community to the recurrent costs of running and maintaining the system.

There is no single institutional model for community empowerment; however there are four key elements that can make empowerment efforts successful (World Bank, 2002):

- Access to information
- Inclusion and participation
- Accountability (the ability to call public officials, private employers or service providers to account for)
- Local organizational capacity (ability of people to work together, organize themselves, and mobilize resources to solve problems of common interest).

Community-based water management

Community based management (CBM) is basically the involvement of the beneficiary communities in the management of water supply facilities. The focus of CBM is to pay attention to consumer demand for services, build community capacity to manage resources and facilities, and consider long term institutional arrangements for providing technical assistance to communities. Community management does not imply that communities must take care of everything or pay the full cost themselves. The idea of partnership allows for sharing responsibilities between supporting agencies and communities. The partnership is often widened to include the private sector, which may be contracted for service delivery by either of the other partners. The division of responsibilities between these partners can vary considerable, but should be agreed upon in advance. Many agencies and communities are working together to find solutions for efficient operation and maintenance of water supply systems and to find a strategy which assigns responsibilities to each of the partners, where each has a comparative advantage, and which places responsibilities in the whole project cycle at the lowest possible level (Wegelin-Schuringa, 1998).

Community management is increasingly accepted as the most appropriate model for providing sustainable water supply and sanitation services to rural communities. However, much of the success of community management to date has been at the level of the individual community or group of communities. In addition, despite the efforts put into developing community management during the implementation phase of projects the evidence is that without external support systems continue to fail before the end of their design lives.

The key factors for success at the implementation stage is the (baseline) level of community capacity, the existence of demand at community level, governmental and donor support in financial terms but also through a supportive policy framework, sufficient water resources and capacity of implementation agencies. The prerequisites for success during the sustainability phase involve the effective support of intermediate-level agencies, the appropriateness of the technology in terms of maintenance requirement, the availability of spare parts, the availability of funds (to finance support agencies) from either external sources or cost recovery and continuing availability of sufficient water resources.

Public participation

The development of the IWRM Process for more sustainable and socially equitable water resources management includes public participation aimed at ensuring that the interests of all stakeholders, including water users and the civil society are taken into account and adequately addressed. In a participatory process all citizens, both men and women, should have a voice, directly or through intermediary organizations representing their interests and throughout the process of policy and decision making. It should be noted that public participation does not mean decision making: it

facilitates consensus, and thus facilitates the implementation and enforcement of decisions taken. Public participation can take many forms. Initially it could mean accountability, transparency and access to relevant information. It could also mean communication among the various stakeholders who carry specific interests or competences in water management sector. At a higher level, it could mean public consultation during decision-making, offering the opportunity to raise objections against proposed decisions or processes based on extensive discussion among all parties involved in order to develop win-win solutions for all. At the highest level, it can involve the public at a deliberative stage, by assigning them impeditive power (veto), or even co-decision.

Various approaches have been developed, ranging from "Public Notice and Comment Requirement" procedures, like those implemented in many countries for Environmental Impact Assessments, "Public Hearings", where interested members of the public can make their views/objections/comments known to public authorities on a specific issue/decision, to more deliberative and co-deciding processes, that have led to the development of local "Agendas 21", or "Management Protocols/Contracts" signed by all parties involved. Table 5 presents the most commonly applied processes for public participation, and an overview of their advantages and shortcomings.

Table 5: Overview of most commonly applied methods towards public participation (adapted from Rowe and Frewer, 2000; Beirle, 1998 and Jeffry and Russel 2007)

Participation Method	**Nature of Participants /Time scale and duration**	**Characteristics/Mechanism**	**Advantages**	**Disadvantages**
Referenda and deliberative polls	Potentially all members of national or local population; realistically, a significant proportion of these. Vote cast at single point in time.	Vote is usually a choice of one or two options. All participants have equal influence. The final outcome is binding Deliberative polling compares reactions before and after opportunity to discuss issue or proposal	Straightforward and easily interpreted results Allows variety of means for communication Can provide opportunity for extensive debate and information-sharing in advance Large sample size extends involvement and can provide legitimacy to outcome	Does not provide information on reasons for choice Result can be significantly influenced by volume, quality and balance of information provided Low turnout may damage credibility of result
Public hearings/ inquiries	Interested citizens, limited in number by size of venue. True participants are experts and politicians making presentations. May last many weeks/	Entails presentations by agencies regarding plans in open forum. Public may voice opinions but have no direct impact on recommendation.	Provides opportunities for comments and questions Is highly visible, if well publicized Encourages discussion and flow of information	People attending may not be drawn from or representative of the local population Contributions may be limited by a lack of knowledge and lack of interest Event may be stage-managed by organizers or dominated by conflict, without means of resolution

Participation Method	Nature of Participants /Time scale and duration	Characteristics/Mechanism	Advantages	Disadvantages
	months, even years. Usually held during week-days/working hours.			Contributions may be dominated by particular individuals or by local, topical and personal concerns
Public opinion surveys	Large sample (e.g., 100s or 1,000s), usually representative of the population segments of interest. Single event, usually lasting no more than several minutes.	Often enacted through written questionnaire or telephone survey. May involve variety of questions. Used for information gathering.	Can provide statistically valid and representative information of opinions Allows responses from people who might not normally attend meetings Can be used to introduce and gather views on project options and choices Detailed analysis may allow correlation of support with social characteristics and identification of profile of supporters and opponents	Provides only snapshot of opinions, heavily dependent on level of information and opportunities for deliberation Costly to conduct additional surveys so that changes can be tracked as information is provided Poor or manipulative design can bias responses and allow misleading interpretations May be difficult to get reasonable sample size and access to some groups
Citizens' jury/panel	Generally, twelve to twenty members of public selected by stakeholder panel to be roughly representative of the local population Not precise, but generally involves meetings over a few days (e.g. four to ten)	Lay panel with independent facilitator questions expert witnesses chosen by stake-holder panel. Meetings not generally open. Conclusions on key questions made via report or press conference.	Allows participants to select and pursue own lines of enquiry and interact with experts and proposers Supports detailed and critical consideration of key issues and may identify areas of agreement or disagreement Can help identify relative influence of different types of argument, evidence and information on beliefs and responses Jury members usually value	Expensive to organize and run Requires significant time commitment from jury members and expert witnesses May develop unrealistic expectations if role and terms of reference are not agreed and clear May produce confrontational environment, not conducive to building trust and promoting consensus

Participation Method	Nature of Participants /Time scale and duration	Characteristics/Mechanism	Advantages	Disadvantages
			opportunity to make significant contribution to deliberation process	
Citizen/public advisory committee	Small group selected by sponsor to represent views of various groups or communities (may not comprise members of true public) Takes place over an extended period of time	Group convened by sponsor to examine some significant issue. Interaction with industry representatives.	Collective ownership of challenges and pressures All sectors engaged in selecting management measures/options	The key to success is to ensure "balance" among the members of the Committee. If participants are not representative of the wider community in terms of income and education, then recommendations are possibly not legitimate or helpful in reconciling/incorporating conflicting interests
Focus groups	Small group of five to twelve selected to be representative of public. Several groups may be used for one project (comprising members of subgroups) Single meeting, usually up to two hours	Free discussion on general topic with video/tape record-ing and little input/direction from facilitator. Used to assess opinions/attitudes.	Allows interaction and collective generation of understanding, ideas and concerns Can explore extent of understanding and basis of interviewees' responses Generates more detailed feedback than surveys and allows probing of initial responses Can show how understanding and views change over time and in response to information and interaction, and help identify relative influence of different types of argument, evidence and information	Detailed analysis is resource-intensive Without good facilitation group dynamics may allow domination by individuals or diversion from topic Awareness and understanding of issues may vary greatly among participants Should not be relied on, as sole point of contact with community or seen as necessarily representative

Participation Method	Nature of Participants /Time scale and duration	Characteristics/Mechanism	Advantages	Disadvantages
Written submissions		Open or targeted invitation to comment in written submission on proposal. Usually preceded by provision of information	Provides opportunity to distribute detailed comprehensive information Allows respondents to work together to formulate response Responses likely to be considered comprehensive and measured, and provide insights from local expertise Fits existing planning procedures in many jurisdictions	Response rates vary greatly by demographic characteristics Cost of printing and distributing documents can be significant May require more time than other methods, and analysis can be prolonged and resource intensive Without adequate and detailed response from commissioning authority, often seen as wasted effort.

Whatever the form of public involvement (information, consultation or full deliberation), the process should be carefully designed and founded on a thorough consideration of the following issues:

- Access to all relevant information: Information access is crucial to ensure that (a) all stakeholders are informed on the issues at stake, their impacts and causes and (b) trust can be built among all parties involved. Furthermore, disclosing information about water may also mobilize public opinion and urge users, polluters and authorities to take action. Experience has shown that although in many cases the quality of information available is good, the access of the public remains limited. Sharing information through the internet, disseminating assessments and surveys in plain language, and the organization of information meetings are first steps towards this process.
- Awareness and education, not only for the specific issue at hand, but also on the rights and obligations that each party has throughout the process.
- The building-up of the system of representation, in order to maximize social inclusion and ensure that all interested parties, including minorities and specific user groups, are adequately represented, in order to guarantee the legitimacy of the process and the decisions taken.

3.3.3 Private sector involvement

Public –private partnerships are being used for improving the efficiency of water services and could be achieved through several approaches (level of private involvement in management, construction of infrastructure, ownership). The related institutional framework must be formulated so as to ensure that all parties benefit from cooperation and responsibilities are clearly defined.

In all cases, the public authorities keep the responsibility for overseeing the activities, in terms of ensuring public provision of water. Table 6 below presents private's sector responsibilities in alternative partnership schemes.

Table 6: Forms of public - private partnerships (OECD, 2003)[1]

	Definition of performance Standards	Asset Ownership	Capital Investment	Design& Build	Operation	User Fee Collection	Monitoring of Performance and Fees
Fully Public Provision	○	○	○	○	○	○	○
Passive Private Investment	○	○	⊙	○	○	○	○
Design and Construct Contracts	○	○	○	●	○	○	○
Service Contracts	○	○	○	○	●	○	○
Joint Ventures	○	⊙	⊙	⊙	⊙	⊙	○
Build, Operate, Transfer	○	○	●	●	●	○	○
Concession Contracts	○	○	●	●	●	●	○
Passive Public Investment	○	●	⊙	●	●	●	○
Fully Private Provision	○	●	●	●	●	●	○

[1] **Legend:**
○ Public responsibility
⊙ Shared P/P responsibility
● Private responsibility

4 Identification of alternative options for the Egypt Case Study (Bahr Basandeila Canal)

4.1 Phase 1 outcomes: Identification of problems and objectives

The main problem experienced in Bahr Basandeila Canal concerns **water quality deterioration**, mainly attributed to the discharge of untreated wastewater (municipal and industrial effluents) and the unregulated use of fertilizers and pesticides in the agricultural sector. Additional causes of the problem include the lack of appropriate infrastructure for wastewater treatment, the limited awareness of farmers on best agricultural practices, and the poor maintenance of the water supply system. The problem, its causes and effects are further illustrated in the problem tree of Figure 4.

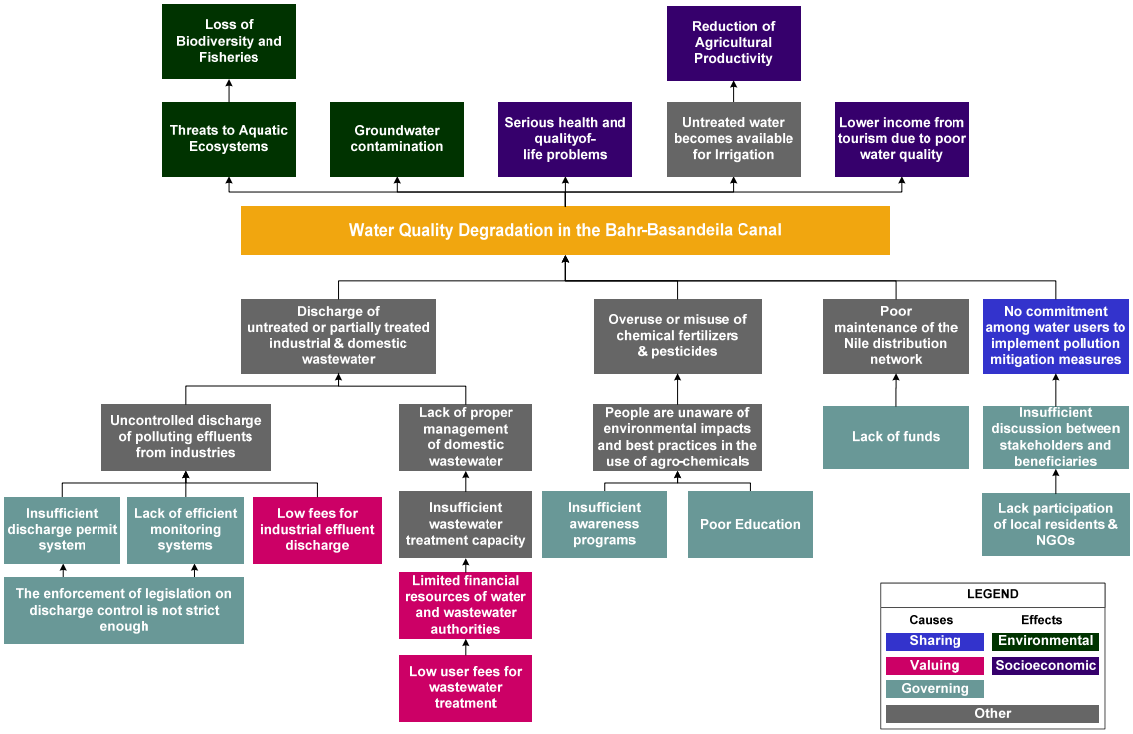

Figure 4: Causes and effects of quality deterioration in Egypt – The problem tree

The illustration of the objective tree resulting from the above analysis of causes and effects is portrayed in Figure 5. The resulting key policy objectives for reversing water quality degradation in the Bahr Basandeila Canal and therefore mitigate the corresponding negative impacts on human health and ecosystem degradation are:

- Control over the discharge of industrial effluents;
- Controlled and wise use of chemical fertilizers & pesticides;
- Proper maintenance of the Nile distribution network;
- Ensuring that quality standards for potable water are met;
- Ensuring adequate sanitation coverage in the Bahr Basandeila area;
- Commitment among water users to implement pollution mitigation measures and community empowerment.

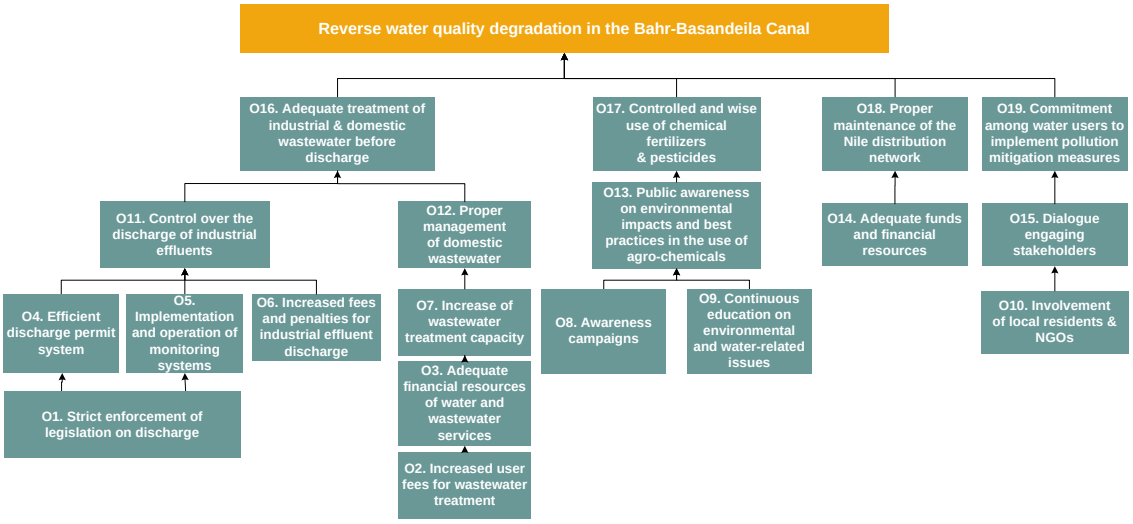

Figure 5: Objectives for addressing water quality deterioration in Egypt

4.2 Preliminary identification of alternative options

The proposed institutional, technical and economic instruments for the Egypt Case Study are presented in Table 7 and they were selected in accordance with the principles mentioned above. The strategy for reversing water quality deterioration in the Canal can comprise the following options:

- **Category A:** Options to minimize pollution from industrial effluents;
- **Category B:** Options to regulate the use of fertilizers and pesticides;
- **Category C:** Options to improve existing infrastructure;
- **Category D:** Options to strengthen the socio-economic and institutional environment (enhance coordination and integration of policies and among institutions involved, and enhance public involvement and commitment);
- **Category E:** Options to improve the knowledge base on water quality/emissions.

Table 7: Set of options proposed for the Egypt Case Study

Options	**Function**			**Targeted objectives**	**Pre-requisites**
	Overall (national) water policy and law	**Water management at the River Basin or Aquifer scale**	**Provision of Water Services**		
Category A: Options to minimize pollution from industrial effluents					
A1. Establishment of (stricter) effluent (emission) standards and technology standards for industrial establishments. Delineation of vulnerable/protected areas	X			O12	-
A2. Establishment of a discharge permit system		X		O4	A1, E1
A3. Surveillance,		X		O1, O5, O6	A1, A2

Options	Function			Targeted objectives	Pre-requisites
	Overall (national) water policy and law	**Water management at the River Basin or Aquifer scale**	**Provision of Water Services**		
monitoring and enforcement of legislation on wastewater discharge: • Penalties for non compliance with emission standards • Reduction of potential government subsidies in case of non-compliance					
A4. Establishment of effluent charge systems (e.g. pollution tax, pollution charge)	X (legislation)	X (implementation)		O6	A2, E1
A5. Voluntary agreements with industries to reduce wastewater production and discharge of polluting effluents	X (legislation)	X (implementation)		O11, O16	E1
A6. Environmental performance bonds for industries	X (legislation)	X (implementation)		O11, O16	E1
A7. Information campaigns for water pollution (impacts and mitigation measures)		X	X	O8,O9	A1
Category B: Options to regulate the use of fertilizers and pesticides					
B1. Taxation of agricultural inputs (e.g. on fertilizers - pesticides)	X (legislation)	X (implementation)		O17	-
B2. Economic incentives (grants, compensation payments, tax reductions on products, etc.) for shifting to organic farming	X	X		O17	-
B3. Voluntary agreements with farmers to reduce the use of fertilizers and pesticides	X (legislation)	X (implementation)		O17	-
B4. Information campaigns and training for BMPs in agriculture		X	X	O8,O9,O13	-
Category C: Options to improve existing infrastructure					
C1. Governmental financing for expanding or building new wastewater treatment facilities: • Subsidies	X			O7, O14, O16	-

Options	Function			Targeted objectives	Pre-requisites
	Overall (national) water policy and law	**Water management at the River Basin or Aquifer scale**	**Provision of Water Services**		
• Revolving Funds possibly with the support of other donors					
C2. Introduction of sewerage charges designed to recover cost of sewage collection and treatment (capital, O&M, rehabilitation costs)			X	O2, O3, O12, O14	-
C3. Improvement of technical capacity of water utilities: • Training of personnel • Soft/ tax free loans for buying equipment	X	X	X	O18	-
C4. Community-based management for water supply and wastewater treatment in rural areas	X (legislation)	X (support)	X (implementation)	O10, O15	
Category D: Strengthening the socio-economic and institutional environment					
D1. Information sharing and public access to information on water quality, environmental violations etc.	X (legislation)	X (implementation)	X (implementation)	O10	E1
D2. Integration of agricultural development policies with environmental issues	X			-	-
D3. Establishment of user associations, possibly also for the management of water use rights	X (legislation)	X (implementation)		O19	A2
D4. Information campaigns targeting the general public		X	X	O13	-
Category E: Improving the knowledge base					
E1. Development of databases on water quantity, quality, abstractions transparent to users		X		-	-
E2. Development of models and decision-support systems transparent to users		X		-	-

5 Identification of alternative options for the Syria Case Study (Barada River Basin)

5.1 Phase 1 outcomes: Identification of problems and objectives

The main problem experienced in the region **concerns water quality deterioration**, since the basin is densely populated and concentrates most of the economic activity of the country. Causes to the problem comprise: (i) the lack of infrastructure for wastewater collection and treatment, (ii) the excessive use of fertilizers and pesticides by the farmers, and (iii) the lack of adequate financial resources for maintaining existing networks or for constructing new ones.

Water management is centralized and decisions taken are not implemented in a coordinated way. Local authorities have limited involvement in the decision making process. Furthermore, in the absence of an integrated environmental policy, law enforcement remains is often insufficient or ineffective. Figure 6 presents a tentative analysis of the causes and effects of water pollution in the basin.

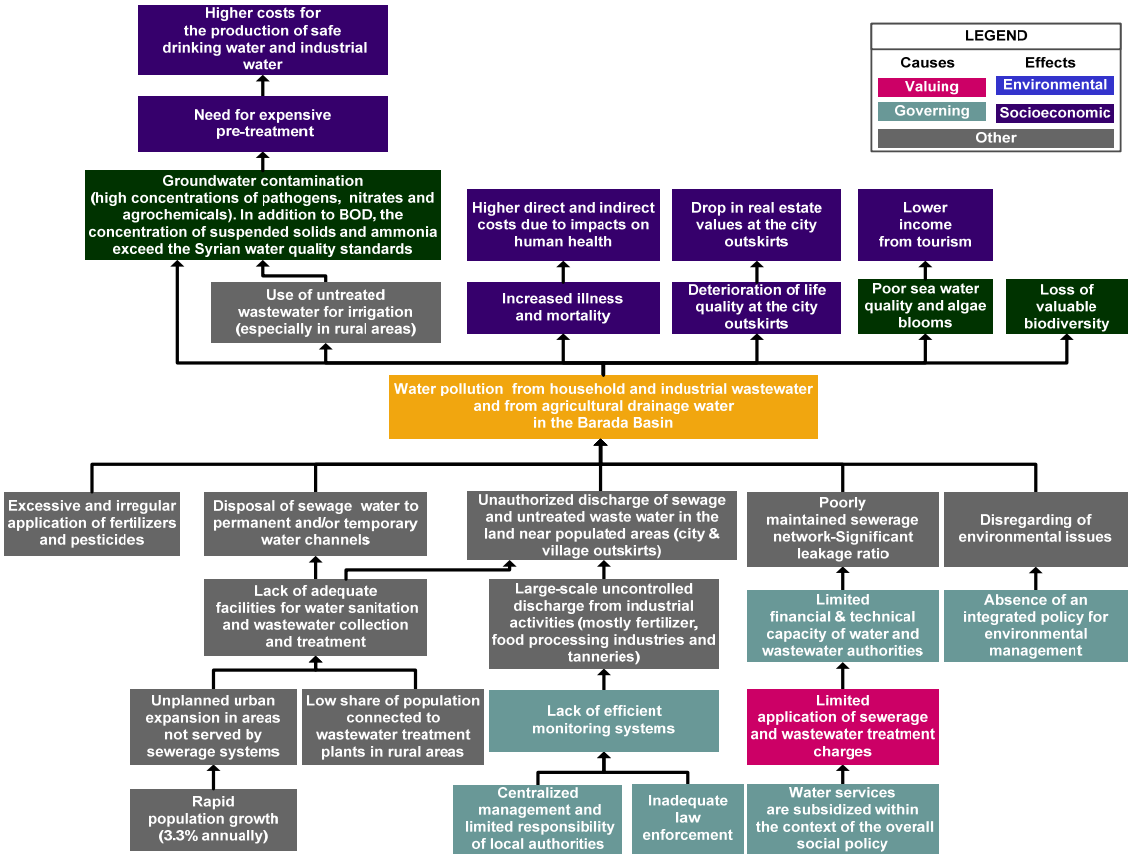

Figure 6: Causes and effects of water pollution in the Barada River Basin – The problem tree

On the basis of the mapped causal relationships, Figure 7 outlines a preliminary set of objectives that should be met for achieving the general goal of improving water quality in the Barada River Basin.

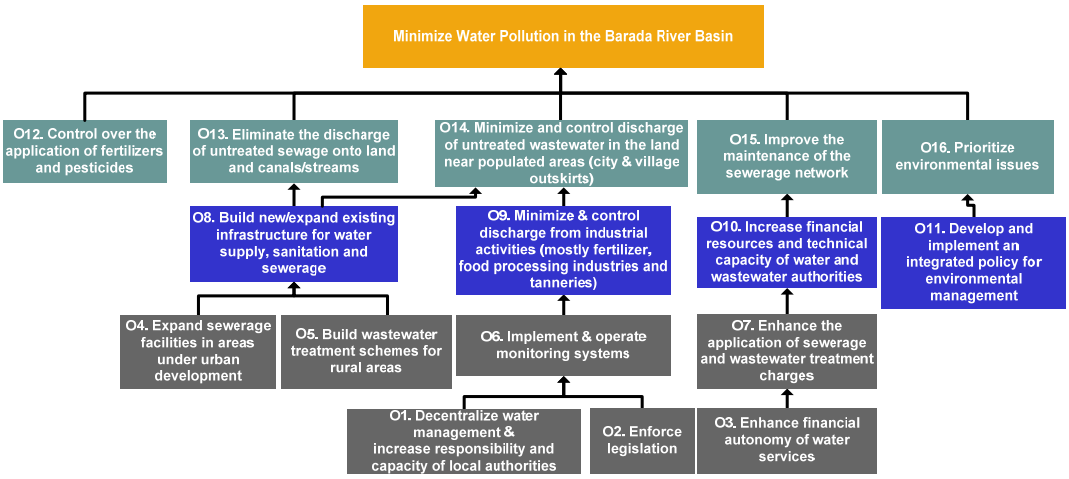

Figure 7: Objectives for addressing water pollution in the Barada River Basin

Five main policy objectives can be defined:

- Control over the application of fertilizers and pesticides;
- Elimination of the discharge of untreated sewage onto land and canals/streams;
- Minimization and control of the discharge of untreated wastewater onto land and in the vicinity of populated areas (city & village outskirts);
- Improvement of the maintenance of the sewerage network;
- Prioritization of environmental issues.

It can be argued that the development and implementation of new tools, like the "polluter-pays" principle, and cost recovery schemes, in combination with incentives for adopting environmentally-friendly practices and subsidies/grants for improving technology are required. In this regard, proposed options should aim at:

- Discourage environmentally damaging behavior, such as the discharge of untreated industrial waste that may impact on water quality and the environment in general;
- Provide incentives for industry to conserve/recycle water and treat produced wastewater; and
- Assist businesses to improve environmental performance and invest in technologies that favour minimum water use and maximum recycling.

5.2 Preliminary identification of alternative options

Table 8 below lists options that could contribute to minimizing water pollution in the Barada river basin. Similarly to the Egypt Case Study, where improved water quality is also the main objective, these options can be grouped into the following categories:

- **Category A:** Options to minimize pollution from industrial effluents;
- **Category B:** Options to regulate the use of fertilizers and pesticides in agriculture;
- **Category C:** Options to improve existing infrastructure;
- **Category D:** Options to strengthen the socio-economic and institutional environment (enhance coordination and integration of policies and among institutions involved, and enhance public involvement);
- **Category E:** Options to improve the knowledge base on pollution.

Table 8: Set of options proposed for the Syria Case Study (Barada River Basin)

Options	Function			Targeted objectives	Prerequisites
	Overall (national) water policy and law	**Water management at the River Basin or Aquifer scale**	**Provision of Water Services**		
Category A: Options to minimize pollution from industrial effluents					
A1. Establishment of (stricter) effluent (emission) standards, technology standards for industries and delineation of vulnerable/protected areas	X			-	-
A2. Establishment of discharge permit systems		X		O9	A1, E1
A3. Surveillance, monitoring and enforcement of legislation on wastewater discharge: • Penalties for non compliance with emission standards • Reduction of potential government subsidies in case of non-compliance		X		O2, O6	A1, A2, E1
A4. Establishment of effluent charge systems (e.g. pollution tax, pollution charge)	X (legislation)	X (implementation)		O7	E1
A5. Voluntary agreements with industries to reduce wastewater production and discharge of polluting effluents	X (legislation)	X (implementation)		O13, O14	A3, E1
A6. Environmental performance bonds for industries	X (legislation)	X (implementation)		O13, O14	A3, E1
A7. Information campaigns and training for water pollution mitigation and abatement		X	X		A1
A8. Provision of relocation incentives to industries /voluntary schemes for relocation		X	X	-	A1
Category B: Options to control the use of fertilizers and pesticides					
B1. Taxation of agricultural inputs (e.g.	X			O12	-

Options	Function			Targeted objectives	Prerequisites
	Overall (national) water policy and law	**Water management at the River Basin or Aquifer scale**	**Provision of Water Services**		
on fertilizers - pesticides)					
B2. Economic incentives (grants, compensation payments, tax reductions on products, etc.) for shifting to organic farming	X			O12	-
B3. Voluntary agreements with farmers to reduce the use of fertilizers and pesticides	X (legislation)	X (implementation)		O12	-
B4. Information campaigns and training for BMPs in agriculture		X	X	O12	-
Category C: Options to improve existing infrastructure					
C1. Governmental financing for expanding or building new wastewater treatment facilities: • Subsidies • Revolving funds possibly with the support of other donors	X			O4, O5, O8	-
C2. Introduction of sewerage charges designed to recover cost of sewage collection and treatment (capital, O&M, rehabilitation costs)			X	O7	D4
C3. Improvement of technical capacity of management bodies and water utilities: • Training of personnel • Soft/ tax free loans for buying equipment • Financing of the development of computer based tools (e.g. GIS databases)	X	X	X	O1, O10,O15	-
C4. Reform of water pricing policies in order to recover the costs of water supply provision	X (?)		X	O3	-
C5. Improvement of			X	O15	-

Options	Function			Targeted objectives	Prerequisites
	Overall (national) water policy and law	**Water management at the River Basin or Aquifer scale**	**Provision of Water Services**		
metering in the water supply network: • Tax incentives for obtaining and installing new metering equipment					
Category D: Strengthening the socio-economic and institutional environment					
D1. Information sharing and public access to information	X (legislation)	X (implementation)	X (implementation)	O11	-
D2. Integration of environmental issues in urban development policies (e.g. Environmental Impact Assessment and Planning)	X			O11, O16	-
D3. Decentralization of water management activities to the local (appropriate) level (principle of subsidiarity)	X	X	X	O1	-
D4. Capacity building for the application of enforcement mechanisms: • Training • Introduction of information technologies • Process control	X	X	X	O10	-
D5. Information campaigns targeting the general public (water conservation, waste management, environmental protection)		X	X	-	-
Category E: Improving the knowledge base					
E1. Development of databases on water quantity, quality, abstractions transparent to users		X	X	-	-
E2. Development of models and decision-support systems		X	X	-	-

Options	Function			Targeted objectives	Prerequisites
	Overall (national) water policy and law	Water management at the River Basin or Aquifer scale	Provision of Water Services		
transparent to users					

6 Identification of alternatives for the Lebanon Case Study (Damour River Basin)

6.1 Phase 1 outcomes: Identification of problems and objectives

The focal problem experienced in the Damour River Basin is **the decrease in the total amount of surface and groundwater of adequate quality (water stress).** The problem is caused by the uncontrolled discharge of industrial and domestic wastewater in surface water, uncontrolled surface water allocation and seawater intrusion in groundwater. Causes and effects are illustrated in Figure 8. As primary cause is outlined the lack of a coordinated management which could address issues like (i) law enforcement, (ii) public participation in the decision making process, (iii) financing and pricing policies, (iv) monitoring and (v) planning framework.

Since the end of war, a decentralization policy was theoretically adopted in the new constitution and particularly on the administrative level (which among others also concerns water management issues). However, such policy has never been put in practice for political reasons. This hinders the implementation of new economic instruments. Conversely, it is believed that decentralization if applied coupled with community driven management would constitute a better appropriate solution to the problem

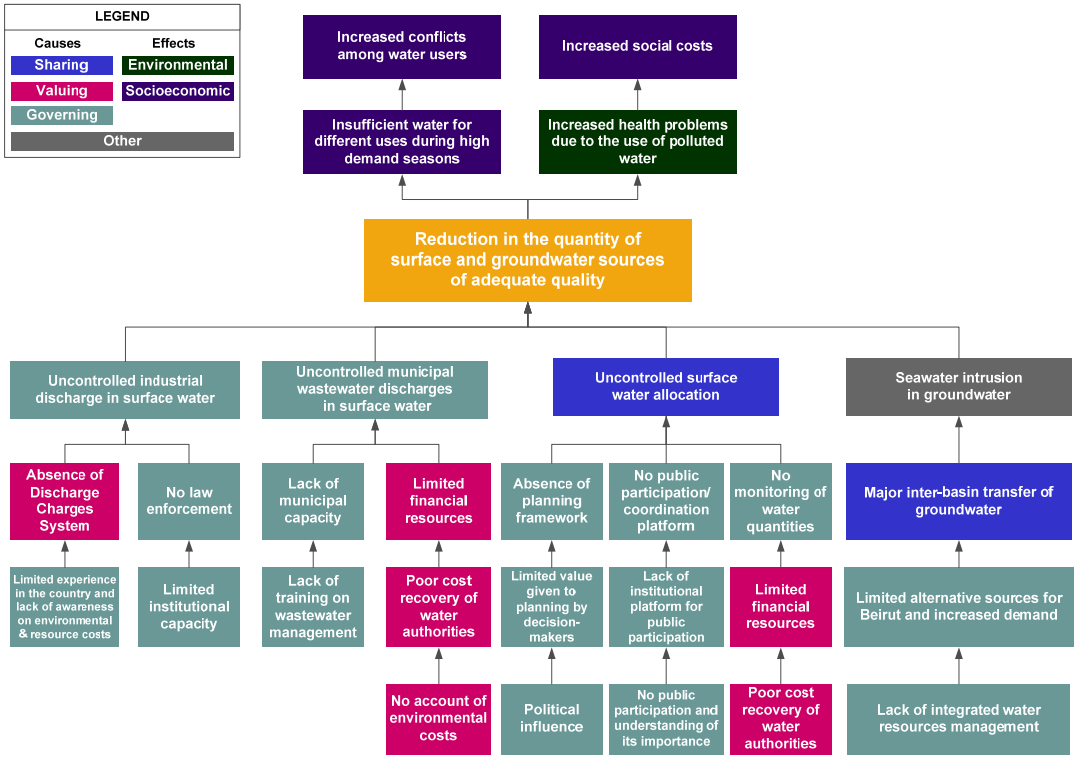

Figure 8: Causes and effects of water stress in Lebanon – The problem tree

The objective tree of Figure 9 defines sub-objectives, to be met through targeted instruments, for achieving the primary objective of providing "Water stress mitigation". The key objectives delineated are:

- Monitor and control over industrial effluents' discharge;
- Collection and treatment of domestic sewage;

- Agreement and control over surface water allocation;
- Regulation and control of groundwater abstractions, in order to minimize overexploitation.

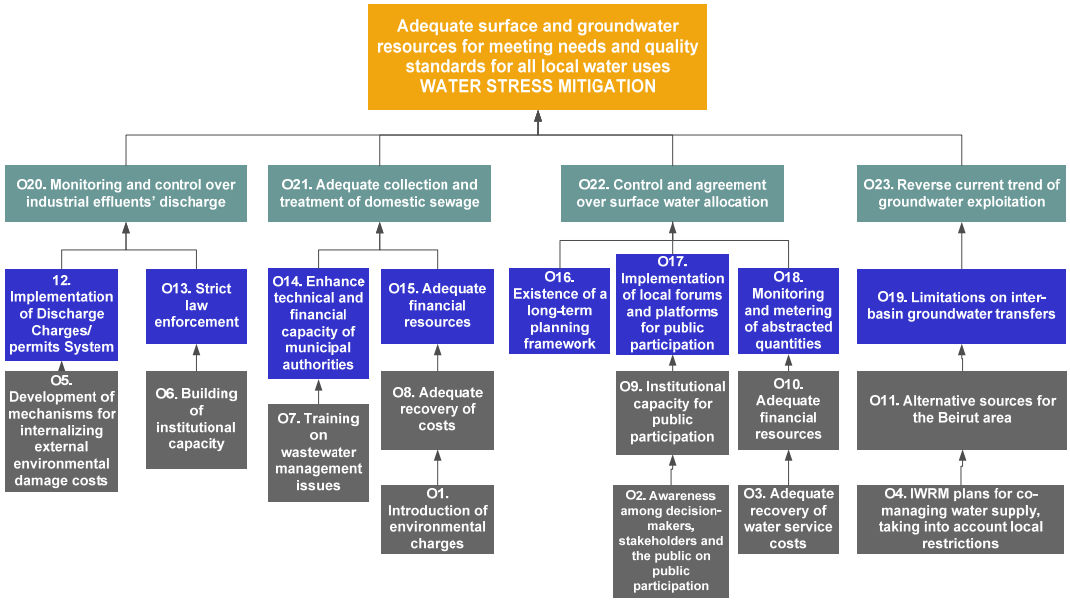

Figure 9: Objectives for addressing water stress in Lebanon

6.2 Preliminary identification of alternative options

The instruments proposed for mitigating water stress in Lebanon are either technical (e.g. wastewater treatment, monitoring networks), economic (e.g. pollution taxes) or institutional (e.g. enhanced public participation) and are presented in Table 9. The options are grouped in six categories:

- **Category A:** Options to regulate groundwater abstractions;
- **Category B:** Options to control industrial waste water discharge;
- **Category C:** Options to reach agreement in surface water allocation;
- **Category D:** Options to improve efficiency in water use;
- **Category E:** Options to improve sewerage collection and treatment;
- **Category F:** Options to strengthen the socio-economic and institutional environment;
- **Category G:** Options to improve the knowledge base on water resources.

Table 9: Set of options proposed for the Lebanon Case Study (Damour River Basin)

Options	Function			Targeted objectives	Prerequisites
	Overall (national) water policy and law	**Water management at the River Basin or Aquifer scale**	**Provision of Water Services**		
Category A: Options to regulate groundwater abstractions					
A1. Legal establishment of public property rights for groundwater	X			O11, O19	
A2. Establishment of a system for abstraction permits /use rights		X		O11, O19	A1, G1
A3. Surveillance, monitoring and enforcement of legislation on GW abstractions • Penalties for non compliance with limits specified by borehole permits • Reduction of government subsidies in case of non-compliance		X		O4, O23	A1, A2, G1
A4. Recovery of resource costs through abstraction charges	X (legislation)	X (implementation)		O4	A3, G1, F5
A5. Collective management of groundwater supply & of groundwater abstraction permits	X (legislation)		X (implementation)	O4	
A6. Financing of alternative water supply schemes	X	X	X	O23	
A7. Tradable rights for groundwater abstraction and use	X (legislation)	X (monitoring)		O23	G1
Category B: Options to control the discharge of industrial effluents					
B1. Establishment of a discharge permit system	X (legislation)	X (implementation monitoring)		O12	
B2. Surveillance,		X		O13,O20	B1, F5

Options	Function			Targeted objectives	Prerequisites
	Overall (national) water policy and law	Water management at the River Basin or Aquifer scale	Provision of Water Services		
B3. Establishment of an effluent charging system (pollution taxes, pollution charges)	X (legislation)	X (implementation)		O5	B1, F5
B4. Environmental performance bonds for industries	X (legislation)	X (implementation)		O20	B2, G1
B5. Voluntary or cooperative agreements with industries/hotels to reduce wastewater production and discharge of polluting effluents	X (legislation)	X (implementation)	X (for cooperative agreements)	O20	B2,G1
B6. Tradable emission permits	X (legislation)	X (monitoring)		O20	G1, F5
Category C Options to reach an agreement on surface water allocation					
C1. Tradable water use rights	X (legislation)	X (monitoring)		O22	G1, F5, C2, C3
C2. Establishment of surface water abstraction permits	X	X (monitoring)		O22	G1
C3. Monitoring of abstracted quantities		X		O18	C2, F5
C4. Water pricing to recover costs of supply provision & opportunity costs of surface water allocation			X	O3, O10	F5
C5. Cooperative agreement between upstream and downstream users		X (monitoring)	X (between water service providers)	O22, O17	
Category D: Options to improve efficiency in water use					
D1. Information campaigns targeting the general public (water conservation, efficiency in water use)		X	X	O2	
D2. Economic incentives for the adoption of efficient irrigation techniques (Grants and soft loans for changing irrigation	X	X	X		

Options	Function			Targeted objectives	Prerequisites
	Overall (national) water policy and law	Water management at the River Basin or Aquifer scale	Provision of Water Services		
equipment)					
D3. Economic incentives for the adoption of water saving techniques (water tariff, subsidies for the installation of water saving equipment, tax differentiation between conventional and water efficient appliances/equipment)		X	X		
Category E: Options to improve sewage collection and treatment					
E1. Governmental financing for expanding or building new wastewater treatment facilities	X			O15, O21	
E2. Introduction of sewerage charges to recover cost of sewage and wastewater treatment			X	O1, O8, O14	
E3. Improvement of technical capacity of water utilities: • Training of personnel • Soft/ tax free loans for buying equipment	X	X	X	O7, O14	
Category F: Options to strengthen the socio-economic and institutional environment					
F1. Information sharing and public access to information	X (legislation)	X (implementation)	X (implementation)	O2	F5, E1
F2. Establishment of participatory procedures at the local, regional and national level for the formulation and approval of water management plans	X	X (implementation)		O9, O16	F5
F3. Establishment of river basin water management authorities	X (legislation)	X (implementati			

Options	Function			Targeted objectives	Prerequisites
	Overall (national) water policy and law	**Water management at the River Basin or Aquifer scale**	**Provision of Water Services**		
		on)			
F4. Establishment of a river basin user association for the management of water use rights	X (legislation)	X (implementation)		O17	A1, C1
F5. Update of existing institutional framework to address issues of: • Water pricing policies • Enforcement mechanisms	X			O6, O9	
Category G: Improving the knowledge base					
G1. Development of databases on water quantity, quality, abstractions transparent to users		X	X		
G2. Development of models and decision-support systems transparent to users		X	X		

7 Identification of alternative options for the Cyprus Case Study

7.1 Phase 1 outcomes: Identification of problems and objectives

Cyprus is highly dependent on groundwater for water supply. **Overexploitation of groundwater** resources has resulted in the depletion of almost all inland aquifers, with **sea water intrusion** being a major problem in many coastal aquifers. Two main causes for groundwater depletion are mapped in the problem tree, presented in Figure 10:

- Limited groundwater (natural and artificial) recharge. The construction of large hydraulic schemes and dams has reduced the natural recharge of many riverbed aquifers, while inhabitants are still reluctant in using reclaimed water.
- Overexploitation of groundwater resources, which is mainly attributed to the lack of coordination in the existing groundwater management framework.

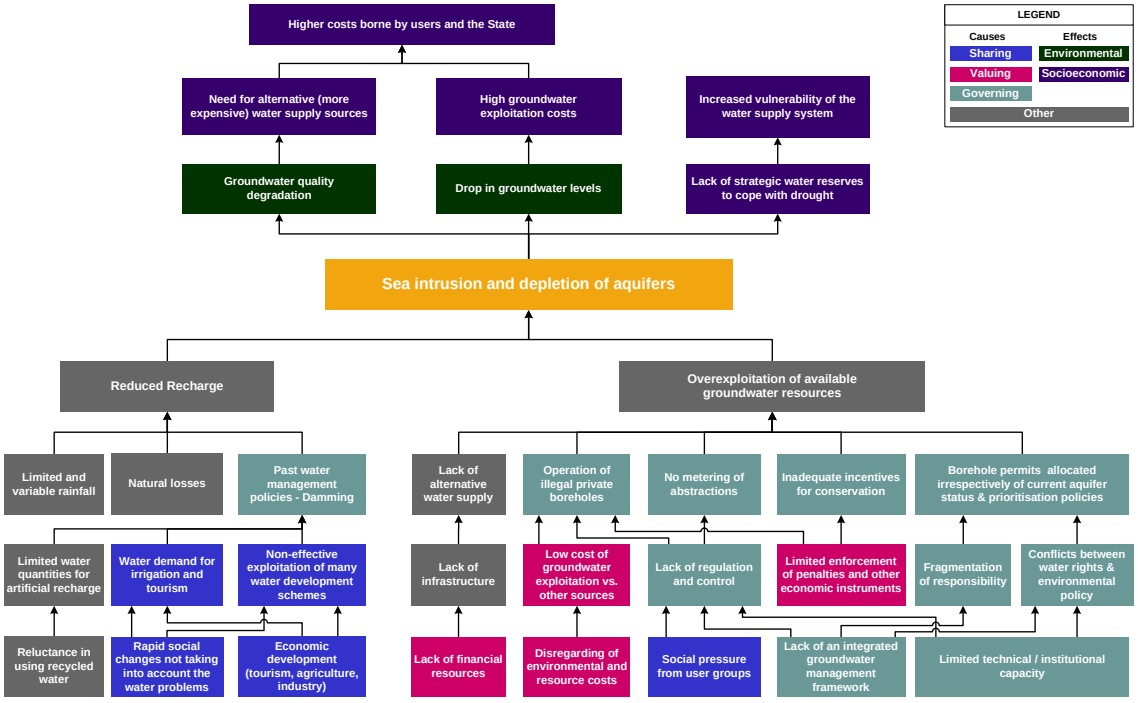

Figure 10: Causes and effects of sea intrusion and aquifer depletion in Cyprus – The problem tree

The region selected for the implementation of INECO in Cyprus is the Pegeia region and the corresponding aquifer. For a number of years now, since the time that the amount of water supplied from the Pafos Irrigation Project was reduced, the aquifer is under intensive overpumping. Although the aquifer is not yet subject to dramatic seawater intrusion, degradation of the water quality due to the excessive pumping has been observed in some locations. Total extraction in 1990 was 0.3 hm³. Extraction increased to 0.8 hm³ in 1995 and to 1.3 hm³ in 2000. A first protective measure that has been taken in the past few years has been to limit and decrease the extraction rates by forcing the farmers to use surface water from the Paphos Project (the coastal part of the aquifer area is included in the Paphos Irrigation Project). As a result, in 2005 total extraction was approx. 1.1 hm³, 1 hm³ for domestic water supply for Pegeia Community and tourist areas, and about 0.1 hm³ for irrigation.

Nowadays the aquifer is used primarily for fresh water supply and to a much lesser extent for irrigation. More than 5000 houses and tourist units are supplied by four water supply wells. The four water supply boreholes are located within the main irrigated area. One of these boreholes (borehole hydrologic number 4020) is in operation since 2004. In July 2007 another three new boreholes have been connected to the system. Since June 2004 additional water for domestic purposes has been supplied from Asprokremmos treatment plant.

However, Pegeia is known for its rapid tourist development resulting in the rapid expansion of the tourist area. Due to the growth of tourism in the Pegeia area and urban development, the demand on water has increased during the last years. Especially during the high water demand season of the year (3rd quarter), 0.8% of the total number of the water consumers, consume almost 25% of the total fresh water in the area.

7.2 Perceptions of local stakeholders for the management of groundwater in Pegeia

The perceptions of local stakeholders mapped during the Cyprus Stakeholder Workshop on the management of the Pegeia aquifer are:

- The Pegeia aquifer is a locally important aquifer, supplying the Pegeia Municipality and the expanding tourist area with domestic water.
- Although the Pegeia coastal aquifer is not yet subject to dramatic seawater intrusion, degradation of water quality due to excessive pumping has been observed in some locations.
- Being locally an important aquifer, it is crucial to protect the ground water resources from the **seawater intrusion** and other contamination mostly from agricultural activities.
- Measures that have to be taken can comprise:
  - Use of **small sewage treatment units** for every house or group of houses. The recycled water can be used for irrigation.
  - Control of **fertilizers**, in particular, and other **pollutants** used in agriculture;
  - Reduction of the probably significant losses in the distribution system;
  - There is probably over-consumption of water, especially during the summer period (many houses have swimming pools and use domestic water to fill the pools and replenish the water, which evaporates). Such cases have to be identified, and the appropriate measures have to be taken.
  - Reduction of the significant amount of domestic water abstracted from the aquifer to be used for the tourist units. A further suggestion is to use the aquifer to supply domestic water for the houses of Pegeia Municipality only and use desalination water for the tourist units.
  - The water table and salinity evolution have been monitored for several years in the Pegeia aquifer, but the monitoring network may have to be optimized.
- The existing and foreseen building permits exceed the capacity to provide water in Pegeia and will contribute to the depletion of the aquifer;
- The agricultural practices applied in the region (in terms of water quantities required and nitrates) have impacts on the aquifer condition
- There is a need to change the cropping patterns in the region (highly water consumptive at the moment);

- Due to the tourist development, the resulting seasonal variation of the water demand, has major impacts on the aquifer exploitation;
- There is a lack of a water conservation culture among the Pegeia residents;
- There is lack of information on the water issue of the area;
- The quality of the water in the aquifer is impacted not only by the current agricultural practices, but also from the lack of a sewerage system.

7.3 Preliminary identification of alternative options

Taking into account the perceptions of local stakeholders and authorities on measures that have to be taken to allow for protection and better management of the Pegeia aquifer, Table 10 suggests a set of options, grouped in four categories:

- **Category A:** Improving efficiency in groundwater use (domestic & hotel sector), and reduction of freshwater supplied by the aquifer;
- **Category B:** Measures to protect the aquifer from contamination;
- **Category C:** Options targeting awareness creation, and enhancement of public participation;
- **Category D:** Measures to enhance efficiency in irrigation water use, although agriculture is currently supplied mostly by surface water from the Paphos Irrigation Project. In this regard, such measures are of second priority, but should be considered within the framework of an integrated water policy for the entire river basin.

Table 10: Set of options proposed for the Cyprus Case Study (Pegeia Aquifer)

Options	**Function**		
	Overall (national) water policy and law	**Water management at the River Basin or Aquifer scale**	**Provision of Water Services**
Category A: Improving efficiency in freshwater use (groundwater)			
A1. Incentives for the installation of efficient water fixtures and appliances • Rebates for water saving equipment; • Direct subsidies on installation costs		X	X
A2. Disincentives for excessive water use • Increase of water rates, especially for large residential consumers; • Application of seasonal water rates			X
A3. Large increase of water tariffs for the hotel sector, in order to render small-scale desalination and water saving an economically attractive option (Revenue can be used for water saving – leakage reduction programs)			X
A4. Subsidies for the installation of decentralized wastewater systems, which allow for irrigation with grey water		X	X

Options	Function		
	Overall (national) water policy and law	**Water management at the River Basin or Aquifer scale**	**Provision of Water Services**
A5. Introduction of resource costs in freshwater pricing (abstraction charges) (Revenue can be used for water saving – leakage reduction programs)	X (legislation)	X (monitoring and implementation)	
A6. Government subsidies for leakage reduction and control programmes	X	X	
A7. Enforcement of water audits for large consumers	X (legislation)	X (monitoring and implementation)	X (monitoring and implementation)
Category B: Measures to prevent aquifer contamination			
B1. Voluntary or cooperative agreements with farmers to reduce the application of fertilizers and pesticides	X (legislation)	X (monitoring and implementation)	X (for cooperative agreements with farmer associations)
B2. Increased taxation on agricultural inputs (fertilizers and pesticides)			
Category C: Enhancing awareness and public participation			
C1. Regular awareness campaigns on water saving practices in the home		X	X
C2. Citizens' jury and panels to support detailed and critical consideration of key issues and may identify areas of agreement or disagreement		X	X
C3. Information disclosure through regular open meetings/hearings		X	X
Category D: Measures to enhance efficiency in irrigation water use			
D1. Economic incentives for the adoption of efficient irrigation techniques (Grants and soft loans for changing irrigation equipment)		X	
D2. Economic incentives for change of cropping patterns (Grants, voluntary agreements)	X	X	

8 Identification of alternative options for the Tunisia Case Study

8.1 Phase 1 outcomes: Identification of problems and objectives

The focal problem analysed in Tunisia is **Deterioration of available groundwater resources**. The problem is linked to current groundwater exploitation patterns, mostly for irrigation supply. Causes and effects of groundwater relations are mapped in Figure 11.

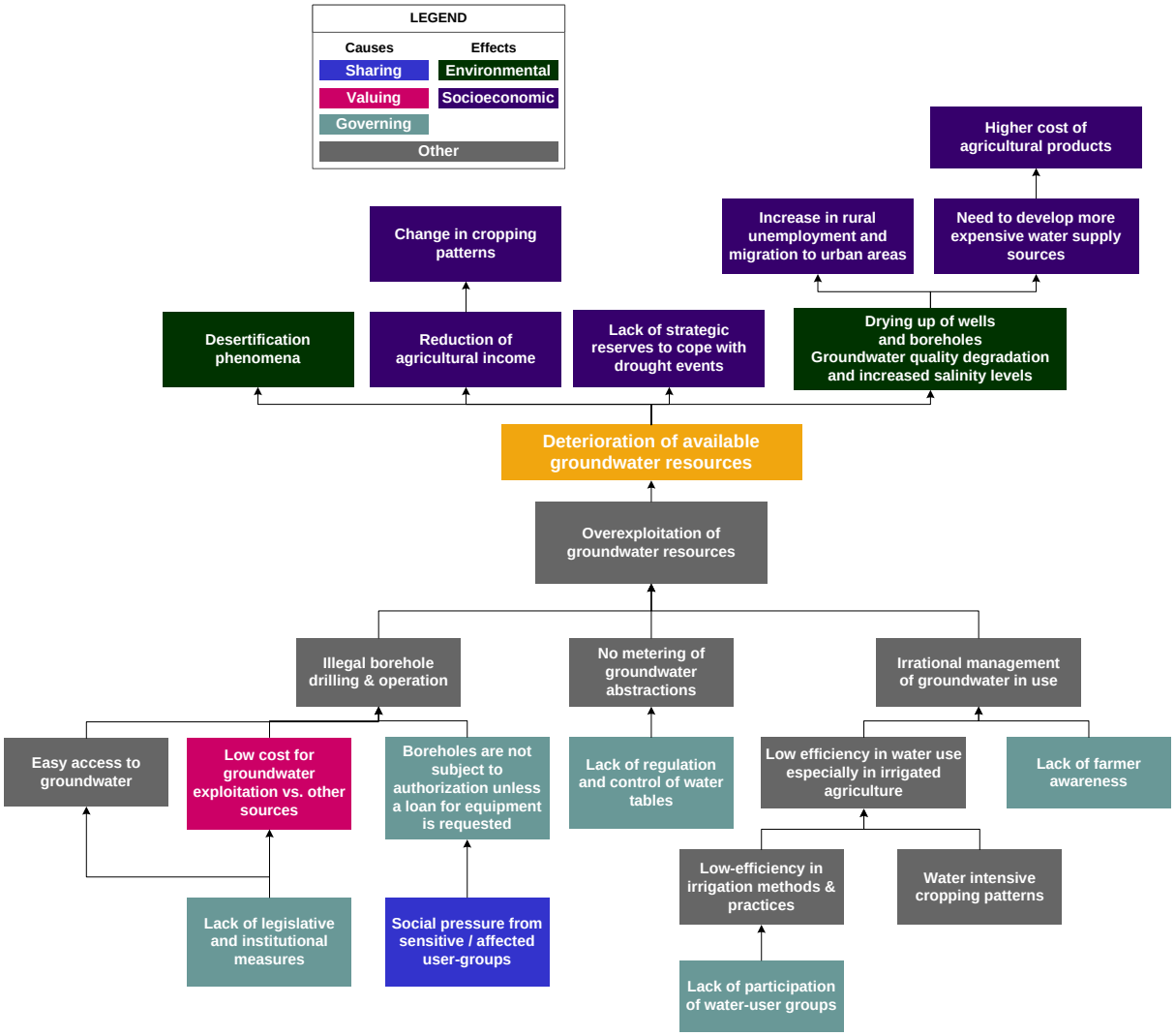

Figure 11: Causes and effects of the deterioration of available groundwater resources in Tunisia – The problem tree

According to the problem tree of Figure 11, the main (primary) cause of aquifer depletion is overexploitation, which is a result of:

- The operation of illegal (unauthorized) boreholes, whose operation is not monitored;
- The current irrigation practices and agricultural development patterns (low efficiency of irrigation methods, selection of low-value, water intensive crops;
- The lack of metering in groundwater abstractions.

Following from the consolidation of the problem tree, key possible objectives are identified. The resulting objective tree is a reversed version of the problem tree and describes the bottom-up step-wise process which should be followed for achieving the primary objective. In this case, the key objectives are two: (a) Reversing groundwater depletion and (b) Rationalizing groundwater use.

The objective tree is outlined in Figure 12. The primary (main) objectives resulting from the exercise are:

- Control and regulation over borehole drilling;
- Metering and regulation of groundwater abstractions
- Promotion of efficient groundwater use, especially in irrigated agriculture.

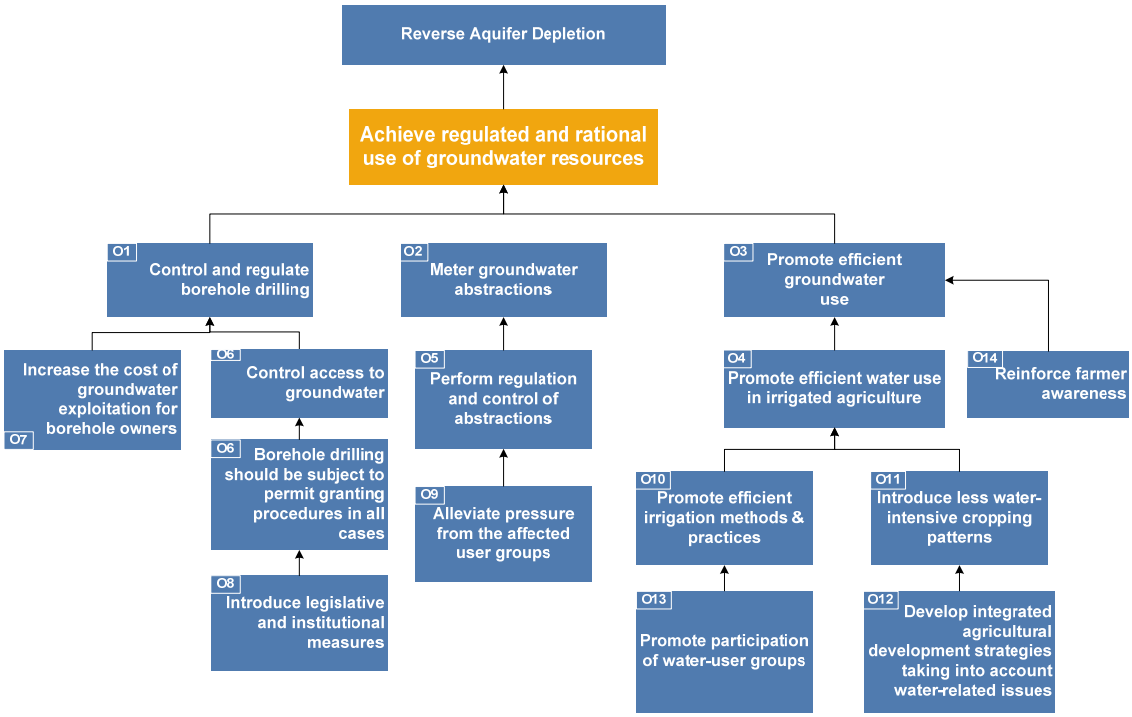

Figure 12: Objectives for addressing aquifer depletion in Tunisia

8.2 Preliminary identification of alternative options

Table 11 presents a set of proposed institutional and economic instruments (options) for the Tunisia Case Study. The list was drawn on the basis of the identified deficiencies and on international experience. Overall, it is perceived that an integrated strategy for mitigating aquifer depletion should be formulated on six categories of options:

- **Category A:** Options to control groundwater abstractions;
- **Category B:** Options to enhance efficiency in irrigation water allocation and use, and thus reduce groundwater abstractions;
- **Category C:** Options to enhance the use of treated wastewater for crop irrigation;
- **Category D:** Options to promote aquifer recharge with treated wastewater;

- **Category E:** Options to strengthen the socio-economic and institutional environment (enhance coordination and integration of policies and among institutions involved, develop collective management systems and enhance public involvement);
- **Category F:** Options to improve the knowledge base on groundwater.

Options listed are not exclusive and that in many cases they are mutually dependent. Prerequisites for implementation are traced in a separate column.

Table 11: Set of options proposed for the Tunisia Case Study

Options	**Function**			**Targeted objectives**	**Prerequisite options**
	Overall (national) water policy and law	**Water management at the River Basin or Aquifer scale**	**Provision of Water Services**		
Category A: Options to regulate groundwater abstractions					
A1. Legal establishment of public property rights for groundwater	X			O5, O8	
A2. Establishment of abstraction permit system		X		O1, O6	A1, F1
A3. Surveillance, monitoring and enforcement of legislation on GW abstractions • Penalties for non compliance with groundwater abstraction permits • Reduction of government subsidies to use sectors in case of non-compliance with environmental regulations		X		O2, O5	A1, A2
A4. Introduction of resource costs into GW pricing (e.g. abstraction taxes)	X (legislation)	X (implementation)		O7	A3, F1
A5. Voluntary agreements with farmers to reduce abstractions and compensation payments	X (legislation)	X (implementation)		O4	A3, F1
Category B: Options to enhance efficiency in irrigation water allocation and use					
B1. Economic incentives	X	X	X	O10	-

Options	Function			Targeted objectives	Prerequisite options
	Overall (national) water policy and law	Water management at the River Basin or Aquifer scale	Provision of Water Services		
B2. Training on appropriate irrigation practices		X	X	O10, O13	-
B3. Economic incentives (grants, compensation payments) for adopting less-water intensive crops	X	X		O11	-
B4. Establishment of collective management systems	X (legislation)		X (implementation)	O9, O3	-
Category C: Provision of alternative water supply (water reuse)					
C1. Establishment of standards for water reuse (quality of effluent, crops to be irrigated, etc.)	X			-	
C2. Governmental subsidies for reuse schemes	X			-	
C3. Monitoring of effluent quality		X	X		C1
C4. Water pricing to recover costs of supply provision					
C5. Pricing incentives (lower price for treated wastewater than surface water and groundwater pumping costs)		X	X		C4
C6. Information campaigns for the general public, training courses and seminars for farmers		X	X		
Category D: Aquifer recharge with treated wastewater					
D1. Establishment of standards for recharge	X			-	F1, F2
D2. Governmental subsidies for recharge schemes	X			-	
D3. Monitoring of effluent quality		X	X	-	D1
D4. Information campaigns for the general public					

Options	Function			Targeted objectives	Prerequisite options
	Overall (national) water policy and law	**Water management at the River Basin or Aquifer scale**	**Provision of Water Services**		
Category E: Strengthening the socio-economic and institutional environment					
E1. Information sharing and public access to information	X (legislation)	X (implementation)	X (implementation)	O8	
E2. Integration of agricultural development policies with environmental issues	X			O12	
E3. Establishment of decentralized coordination of activities in GW management	X	X	X	O8	
E4. Establishment of user groups, possibly also for the management of GW use rights	X (legislation)	X (implementation)		O9	A1, A2
E5. Information campaigns on "GW as a common good and not ones' individual property"		X		O9	
Category F: Improving the knowledge base					
F1. Development of databases on GW quantity, quality, abstractions transparent to users:		X		-	
F2. Development of models and decision-support systems transparent to users		X		-	

9 Identification of alternative options for the Algeria Case Study (Seybouse River Basin)

9.1 Phase 1 outcomes: Identification of problems and objectives

The focal water management problem in the Seybouse River Basin is **the pollution of the river mainly by domestic sewage and industrial effluents.** The water is of poor quality and is improper for domestic and agricultural use. The Seybouse River is an important water source, used mainly for the irrigation of large agricultural plains, extending from the Guelma region and up to Annaba city. The river has a total length of 240 km, and the basin extends over the administrative boundaries of 68 municipalities, located in 7 wilayas. River water is vital for sustaining the majority of economic activities in the region. Causes and effects to water pollution of the Seybouse River are mapped in Figure 13.

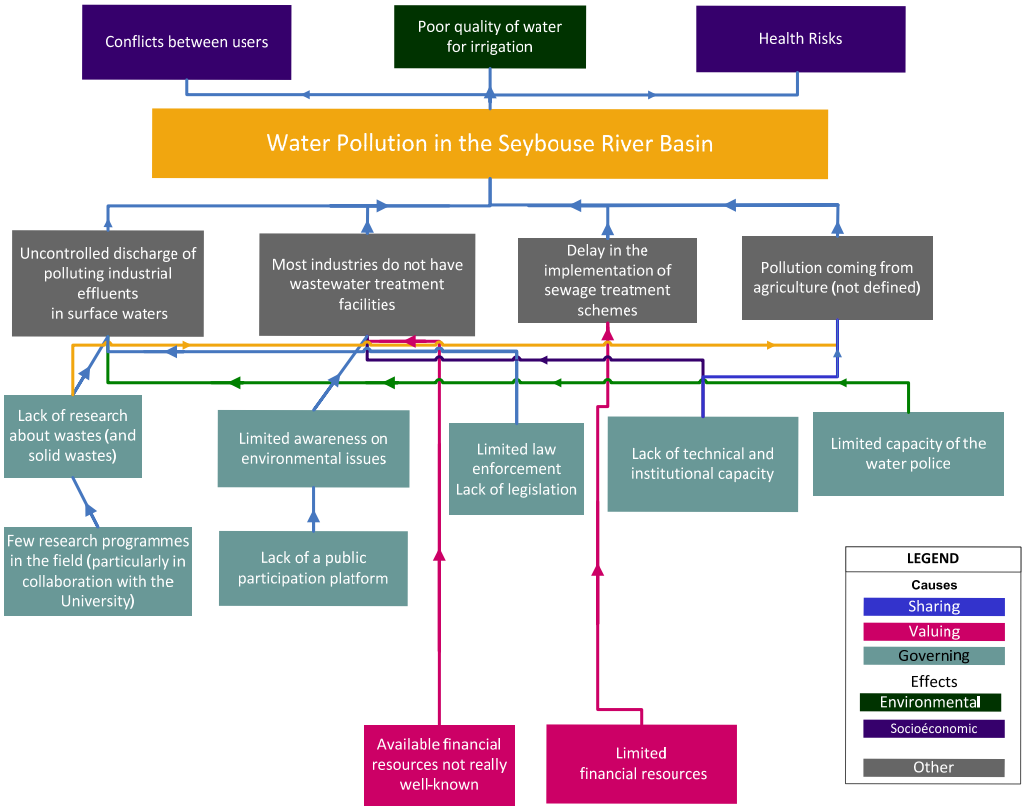

Figure 13: Causes and effects of pollution in the Seybouse River Basin – The problem tree

The Algeria workshop has not been implemented yet; Figure 14 presents a tentative objective tree, on the basis of the identified problem causes. As the implementation of sewage schemes is already underway, no additional objective can be described towards that end. Therefore, it is suggested to focus the analysis on institutional and economic instruments for promoting industrial effluents' treatment.

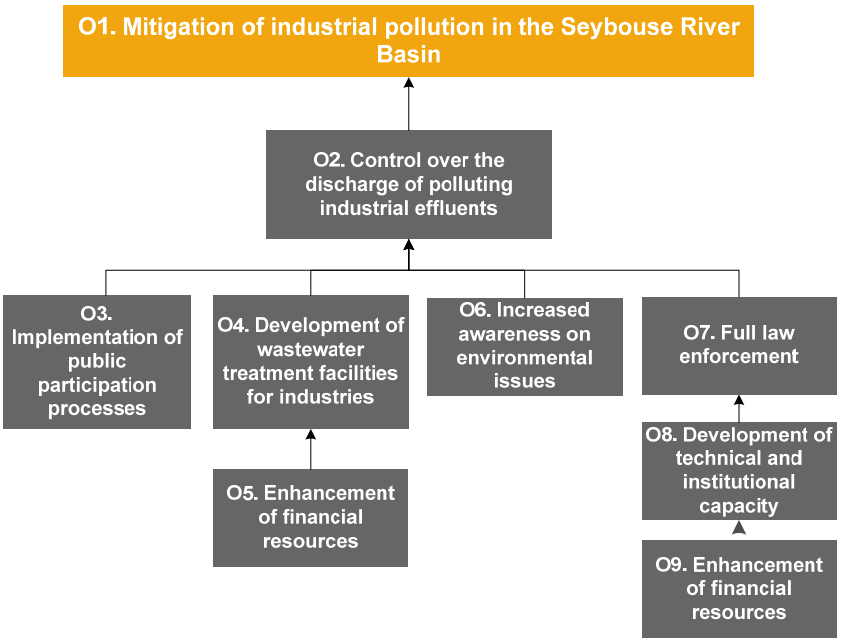

Figure 14: Objectives for addressing water pollution in the Seybouse River Basin

9.2 Preliminary identification of alternative options

Table 12 presents a set of proposed institutional and economic instruments (options) for the Algeria Case Study. The list was drawn on the basis of the identified deficiencies and on international experience. Overall, it is perceived that an integrated strategy for mitigating aquifer depletion should be formulated on three categories of options:

- **Category A:** Options to minimize pollution from industrial effluents;
- **Category B:** Options to increase the regulatory capacity of governmental authorities;
- **Category C:** Options to strengthen public participation processes in the River Basin.

Table 12: Set of options proposed for the Algeria Case Study (Seybouse River Basin)

Options	**Function**			**Targeted objectives**	**Prerequisites**
	Overall (national) water policy and law	**Water management at the River Basin or Aquifer scale**	**Provision of Water Services**		
Category A: Options to minimize pollution from industrial effluents					
A1. Establishment of (stricter) effluent (emission) standards and delineation of vulnerable/protected areas	X			O1	
A2. Establishment of technology standards for specific industrial processes		X		O1	
A3. Establishment of discharge permits				O1	A1, A2

Options	Function			Targeted objectives	Prerequisites
	Overall (national) water policy and law	**Water management at the River Basin or Aquifer scale**	**Provision of Water Services**		
A4. Surveillance, monitoring and enforcement of legislation on wastewater discharge: • Penalties for non compliance with emission standards • Reduction of potential government subsidies in case of non-compliance		X		O2	
A5. Implementation of effluent charge systems (e.g. pollution tax, pollution charge)	X (legislation)	X (implementation)		O2	
A6. Voluntary agreements with industries to reduce wastewater production and discharge of polluting effluents	X (legislation)	X (implementation)		O4, O5	
A7. Environmental performance bonds for industries	X (legislation)	X (implementation)		O4, O5	
A8. Seminars and training on wastewater treatment and water recycling in the industrial sector		X	X	O3, O4, O5	
A9. Revolving funds for financing collective effluent treatment schemes	X			O5	
A10. Grants, tax incentives for relocation	X			O4, O5	
A11. Tradable emission permits	X (legislation)	X (implementation)		O2, O5	
Category B: Options to increase the regulatory capacity of governmental authorities					
B1. Improvement of technical capacity of management bodies and water utilities: • Training of personnel • Soft/ tax free loans for buying equipment • Financing research for the development	X	X	X	O8	-

Options	Function			Targeted objectives	Prerequisites
	Overall (national) water policy and law	**Water management at the River Basin or Aquifer scale**	**Provision of Water Services**		
of computer based tools (e.g. GIS databases)					
B2. Capacity building for the application of enforcement mechanisms: • Training • Introduction of information technologies • Process control	X	X	X	O8	-
Category C: Options to enhance public participation & involvement					
C1. Information sharing and public access to information	X (legislation)	X (implementation)	X (implementation)	O3	-
C2. Citizens' jury and panels to support detailed and critical consideration of key issues and may identify areas of agreement or disagreement	X (legislation)	X (implementation)		O3	
C3.Information campaigns targeting the general public (water conservation, waste management, environmental protection)		X	X	O3	-

10 Identification of alternative options for the Morocco Case Study (Oum Er Rbia River Basin)

10.1 Phase 1 outcomes: Identification of problems and objectives

The focal problem analysed in the Oum Er Rbia Basin is related to inefficient and wasteful water use in the agricultural sector. The problem results from increased demand, combined with low efficiency, especially in irrigation distribution networks and in the currently adopted irrigation practices (non-efficient irrigation methods and water intensive, non-economically sustainable cropping patterns). Past policies have targeted the increase of supply through surface water mobilization, the construction of irrigation networks to cope with the increased agricultural demand, governmental subsidies for facilitating the introduction of drip irrigation and wastewater treatment and enhancement of the knowledge base on water resources and their use. However, demand growth and increasing water stress necessitate new responses and instruments for reducing losses, introducing non-conventional supply sources and managing demand especially in the agricultural sector. Figure 15 presents the above considerations mapped through the problem tree exercise.

Figure 15: Causes and effects of low efficiency in irrigation water use in the Oum Er Rbia Basin – The problem tree

The Morocco workshop has not been implemented yet; Figure 14 presents a tentative objective tree, on the basis of the identified problem causes.

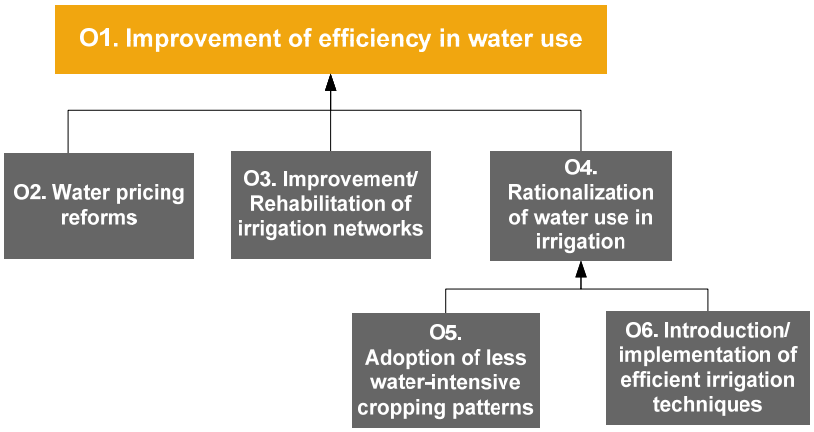

Figure 16: Objectives for addressing wasteful water use in the Oum Er Rbia Basin

10.2 Preliminary identification of alternative options

Table 13 presents a set of proposed institutional and economic instruments (options) for the Morocco Case Study. The list was drawn on the basis of the identified deficiencies and on international experience. An integrated strategy for addressing the problem can be formulated on the following categories of options:

- **Category A:** Options aimed at offering incentives to farmers for shifting towards more efficient irrigation practices;
- **Category B:** Options aimed at offering incentives to water user associations for better managing irrigation networks.

Table 13: Set of options proposed for the Morocco Case Study (Oum Er Rbia Basin)

Options	**Function**			**Targeted Objectives**
	Overall (national) water policy and law	**Water management at the River Basin or Aquifer scale**	**Provision of Water Services**	
Category A: Improving efficiency in irrigation practices				
A1. Incentives for the installation of efficient irrigation equipment • Rebates for water saving equipment; • Direct subsidies the installation costs	X	X		O2
A2. Introduction of IBR in irrigation water pricing (low rate for consumption lower or equal to theoretical requirements, high rate for excessive water use)		X	X	O2
A3. Introduction of resource costs in freshwater pricing (abstraction charges) (Revenue can be used for water saving – leakage	X (legislation)	X (monitoring and implementation)		O2

Options	Function			Targeted Objectives
	Overall (national) water policy and law	**Water management at the River Basin or Aquifer scale**	**Provision of Water Services**	
reduction programs)				
A4. Tradable water shares or quotas	X (legislation)	X (monitoring and implementation)		O1
A5. Voluntary agreements with farmers to implement efficient irrigation techniques		X		O1
A6. Training and information campaigns		X	X	O1
Category B: Improving efficiency in irrigation water supply				
B1. Introduction of resource costs in freshwater pricing (abstraction charges) (Revenue can be used for water saving – leakage reduction programs)	X (legislation)	X (monitoring and implementation)		O3
B2. Community based management of water use rights	X	X	X	O3

References & Bibliography

Alsop R., Bertelsen F.M., Holland J., 2006, Empowerment in Practice: From Analysis to Implementation, The World Bank

Beierle T.C., 1998, Public participation in environmental decisions An Evaluation Framework Using Social Goals, Discussion Paper 99-06, Resources for the Future.

EFILWC, European Foundation for the Improvement of Living and Working Conditions, 2000, Economic instruments for sustainable development, Available at: http://www.eurofound.europa.eu/pubdocs/2000/76/en/1/ef0076en.pdf

Heinz I., 2007, Co-operative agreements and the EU Water Framework Directive in conjunction with the Common Agricultural Policy, Hydrology and Earth System Sciences Discussions, 4, 1593–1624

Helling L., Serrano R., Warren D., 2005, Linking Community Empowerment, Decentralized Governance, and Public Service Provision Through a Local Development Framework, SP Discussion paper No. 0535, The World Bank

James D. (1997), Environmental Incentives: Australian Experience with Economic Instruments for Environmental Management, Environmental Economics Research Paper No.5, Consultancy report, Commissioned by Environment Australia.

Jaspers G.W. Frank, 2003, Institutional arrangements for integrated river basin management, Water Policy 5, pp 77–90.

Jeffry P. and Russel S., 2007, Participative planning for water reuse projects. A Handbook of principles, tools and guidance, Handbook prepared within the framework of the Aquarec project on Integrated Concepts for Reuse of Upgraded Wastewater. http://www.aquarec.org.

Kraemer R. Andreas, 1995, Economic Instruments and River Basin Institutions in Germany, Berlin.

Kraemer R. Andreas, Zulma Guzmán Castro, Ronaldo Seroa da Motta, Clifford Russell, 2003, Economic Instruments for Water Management: Experiences from Europe and Implications for Latin America and the Caribbean, Inter-American Development Bank, Regional Policy Dialogue study series.

Lockwood H., 2004, Scaling Up Community Management of Rural Water Supply, Thematic overview paper, IRC International Water and Sanitation Centre

Lyon P.T., Maxwell W. J.,2003, S elf-regulation, taxation and public voluntary environmental agreements, Journal of Public Economics, 87, pp 1453–1486.

Wegelin-Schuringa M., 1998, Community management models for small-scale water supply systems, Discussion Paper for workshop on “Public-private partnerships in service provision for community managed water supply scheme”, IRC International Water and Sanitation Centre.

McCauley S. David, Anderson Robert, Bowen Richard, Elassiouty Ibrahim, Mahdy Elsayed, Soliman Ibrahim, Shehab Hisham, 2002, Economic instruments for improved water resources management in Egypt, United States Agency for International Development/Egypt.

Mirand M., Dieperink C., Glasbergen P., 2007, Voluntary agreements in watershed protection. Experiences from Costa Rica, Environment, Development and Sustainability, 9, pp 1–19.

OECD, 2003, Public-Private Partnerships in the Urban Water Sector

OECD, 1999, Household water pricing in OECD countries, Working Party on Economic and Environmental Policy Integration, ENV/EPOC/GEEI(98)12/FINAL.

Ostrom, E., 1990, Governing the Commons; The Evolution of Institutions for Collective Action, Cambridge University Press, Cambridge.

Panayotou T., 1994, Economic instruments for environmental management and sustainable development, UNEP, Environmental Economics Series Paper No. 16

Policy research Initiative, 2004, Economic Instruments for Water Demand Management in an Integrated Water Resources Management Framework, Synthesis Report, Canada

Robinson J. and Ryan S., 2002, A Review of Economic Instruments for Environmental Management in Queensland, CRC for Coastal Zone, Estuary and Waterway Management, The University of Queensland

Rowe G. and Frewer L. J. (2000), Public Participation Methods: A Framework for Evaluation, Science Technology Human Values, 3, 25, SAGE Publications

Soussan J., 2004, Water and Poverty; Fighting poverty through water management, Asian Development Bank

Sawyer D., Perron G., Trudeau M., Renzetti S., 2005, Analysis of Economic Instruments for Water Conservation, Project# 337-2005, Final Project Report, Marbek Resource Consultants Ltd.

The UK Government Sustainable Development Strategy, 2005

Van Beers P., 2006, Decentralized water management and sustainable rural water supply, Sustainable development of water resources, water supply and environmental sanitation, 32nd WEDC International Conference, Colombo, Sri Lanka

World Bank, 2002, Empowerment and Poverty Reduction: A Sourcebook, PREM

Zabel T. F., K. Andrews, and Y. Rees, 1998, The Use of Economic Instruments for Water Management in Selected EU Member Countries, J,CIWEM, 12, August.

Appendix: Description of economic instruments

I.1 Market instruments

Market instruments comprise the establishment of transferable rights to use/pollute water and the creation of efficient markets in which the rights can be traded. Market instruments have the advantages of offering a non-political means to solve conflicts over water rights, ensuring optimal allocation and efficiency and limiting the need for overall planning and management. In practice, where established, water markets operate in far from perfect conditions, due to natural monopoly, high sunk costs and numerous externalities.

Markets are often built over existing resource management frameworks and therefore may co-exist with other institutional arrangements and associated property rights systems. There are basically two types of such arrangements: community-based management (associated with common property of a resource) and state controlled (e.g. through licensing).

The following paragraphs outline the principles for two types of tradable rights/permits (Kraemer et al., 2003):

- Tradable water abstraction/use rights and tradable water shares, for quantitative water resource management. Water rights are usually temporary and limited (transferable rights to use water without right of abuse);
- Tradable discharge or emission permits or tradable water pollution rights, for the protection and management of (surface) water quality. Such pollution rights can relate to point or to non-point sources, and trades can even be arranged among different kinds of sources.

Tradable emission (discharge) permits

Tradable emission permits involve the definition of an aggregate level of allowable emissions for each watershed, which is then allocated among polluters either according to the level of output (e.g. production volume) or their current emission levels (Panayotou, 1994). Since the aggregate emissions quota is set at or below the current emission levels, an artificial level of scarcity is created, and permits obtain a market value (a price). In this context, producers with a deficit of permits or with expansion plans must secure emission permits either by reducing their emissions or by obtaining permits from other users who are able to do so at a lower cost than themselves. The advantage is that the desired reduction of emissions, and therefore the desired level of environmental quality is attained at the minimum possible cost to society. Furthermore, a strong incentive is provided for continued efforts to improve efficiency and develop improved technologies, since the excess allowable quota for a firm can be sold and thus an additional profit can be assured. The prerequisite is that emission permits are fixed in number and freely tradable.

In principle, emission permits should not be initially issued the free of charge, as this is equivalent to assigning users with property rights over the environment or at least with a use right, up to the amount specified by the permit. Thus, the permit entitles the polluter to the present value of profits arising from the free disposal of the allowable amount of emissions. If instead, permits are sold or auctioned, the revenue raised by the state can then be passed to the citizens.

The establishment of a system of emission permits has in general a rather high management costs as it requires: (a) proper definition of the watershed and impacts of diffuse and point pollution from the

various sources (b) monitoring of water quality and establishment of models correlating emissions and ambient quality (c) capacity to monitor and inspect individual emission sources, so as to ensure that the emissions are below the limit allowed by the permit, and (d) a system for approving and recording credits, offsets and trades among the permit holders.

Tradable water shares and tradable water use (abstraction) rights

Tradable water shares work in a similar way. The water authority issues to water users in an area a share of the total available supply. Users are free to use water as they want (use it for their own purposes, sell it to other users, store it for future use or sell it back to the water authority). The instrument can improve water distribution, water resource conservation and possibly environmental protection, as new supply expansion schemes become unnecessary. The instrument implies ability to measure and monitor water use. Its implementation can become easier if water quotas can also be allocated to water user associations instead of individual users; the associations can then allocate water to their members using their own allocation rules and monitor water use using their own monitoring mechanisms. In this case, water service costs (i.e. costs for the operation, maintenance and rehabilitation) of infrastructure are recovered through other (fiscal) instruments, such as service charges.

I.2 Fee-based measures

Environmental taxes and charges

Definitions

This category of instruments involves water abstraction charges and taxes, and water pollution charges and taxes. In the pertinent literature, the terms “charge” and “tax” are often used interchangeably. By definition, charges are “prices” for public goods or publicly provided private goods. They differ from market prices for private goods because they are not market determined but are administratively set by a government agency, a public utility, or other types of regulated natural monopoly. This contrasts them with taxes which are not payments for “services” but a means for raising fiscal revenue. A major difference is that taxes are connected to the budget, forming part of the general government revenues while charges are extra-budgetary, aiming to recover cost for a specific public investment (Panayotou, 1994).

Revenue earmarking

In spite of the terminology used, the emerging issue is the use of revenue from environmental charges. The common and most appropriate practice is that revenue is earmarked for explicit water management purposes, so that revenue is indirectly returned to those liable to pay.

In its simplest form, earmarking involves allocating resulting revenues to the group that paid for the originating taxes. Usually, different formulae are used to raise and disburse revenues. Such simple earmarking usually has little environmental effect and transaction costs can be high. However, such systems can be useful, for example, in mutual insurance schemes.

More complex is the French model of raising “redevance” which recycles revenues back to those who contributed to them. In fact, those who contributed have a moral claim on their contribution and can expect a subsidy when it is their turn to make pollution control investments. Such system can be useful to spread the burden of heavy investments, especially in the context of comprehensive investment

programs implemented over a long period of time. Depending on the degree of solidarity among the water users within a river basin area, such schemes can either work for the basin as a whole or be segmented according to sectors or regions.

Finally, earmarking can be relaxed so that revenue does not go back to those who paid, but is used instead to finance typical governmental functions, such as water and groundwater monitoring, modeling, research and technical development, or information disbursement.

Water abstraction charges

Water abstraction charges are charged for the direct abstraction of water from surface and groundwater. Charges can be different depending on the source, the specific conditions and can be set to reflect the relative water scarcity.

Except for raising revenue, abstraction charges can induce a change in user behaviour resulting in lower water demand and a reduction of water leakage (incentive measure). If the tax is set to reflect marginal costs of water abstraction, it enhances the cost effectiveness of the service provided.

Pollution charges

A water pollution charge takes the form of a direct payment based on the measurements or estimates of the quantity and quality of a pollutant discharged to a natural body of water (not a sewer). Pollution charges are an important step towards the realization of the polluter-pays principle even if their calculation is not based on estimates of damage costs. By levying a charge on pollution, a clear signal is given that society is no longer willing to bear the costs of pollution and that at least part of the costs of the damages caused should be recovered directly from the polluter. To provide adequate incentives, the charge must be high enough to be effective in directing and encouraging pollution control measures.

Pollution charges can also be can be structured in a way to provide a progressive incentive in pollution control.

Water supply pricing

The water pricing instrument has the primary goal of financing water supply provision, but can also provide incentives towards more efficient water use and allocation. Different price structures send different signals to consumers. Generally, water pricing can be performed as follows:

- **Flat pricing** involves charge a constant fee regardless of the volume used. They are widely applied for recovering water service costs in cases that metering has not been introduced or is extremely difficult and costly to implement. Their advantage is that they produce fixed revenue, and therefore can provide revenue stability but offer little or no incentive for water saving.
- **Uniform rates** charge for the volume used at a constant per-unit fee. Uniform rates are easy to apply and easily understandable by consumers.
- **Decreasing block rates** (DBR) charge a volumetric rate that decreases for higher levels of use. They reflect per-unit costs of production and delivery that go down as customers consume more water. Although in some cases, DBRs reflect the actual financial cost of water delivery, they offer no incentive for water saving and are not applicable in the case of increasing water scarcity (i.e. when marginal costs for water supply provision are increasing).

- **Increasing block rates** (IBR) charge a volumetric rate that increases for higher levels of use. They are the most popular form of water pricing in domestic water use, as they offer easier cost recovery than uniform rates, they are considered to impose conservation incentives on large users and provide water at an affordable rate to poorer users. However, they also have shortcomings, as discussed by Boland and Whittington (2000), which can be summarized as follows:
  - Difficulties in setting the initial block;
  - Conflict between revenue sufficiency and economic efficiency;
  - Absence of simplicity and transparency;
  - Socially unfair in the case of shared connections (i.e. more than one user sharing the same connection), which is often the case for poorer households in developing countries.
- **Seasonal rates** charge a higher price during the peak demand season, and can offer a further incentive for water saving e.g. in outdoor water use.

Sewerage and effluent charges (indirect emissions)

Sewerage charges are tariffs paid for the discharge of used water into the sewer system (domestic and other effluents). Sewerage charges have the objective of providing water utilities with financial resources for wastewater collection and treatment.

In most OECD countries, revenues for sewerage collection and treatment are largely based on volumetric charges, as applied to public water supply provision. The continuing trend toward more incentive-based charging for the public water supply system therefore generally leads to more *wastewater* revenues being recovered through volumetric charging, which then reinforces the incentives to use the water *supplied* more carefully (OECD, 1999).

I.3 Other fiscal instruments (taxes on inputs and outputs)

Although not as efficient as direct environmental taxation, taxation on inputs (e.g. fertilizers) and final products (e.g. industrial or agricultural production) has the advantage on relying on existing administrative arrangements. Such taxes can reduce the use of polluting inputs but provide no incentive for pollution abatement; their ability to act as an incentive for pollution reduction depends on their level being high enough and the demand for the product elastic enough to discourage the consumption and thus production of the product.

Environmental taxes on final products are particularly suited to the control of consumption-related pollution, because consumers are made aware, through higher prices, of the environmental consequences of their choices.

I.4 Financial instruments

Subsidies

Generally, subsidies can have two main objectives: either they are instituted to compensate users for a cost they incur in response to a required action or a prohibition, or subsidies are put in place so as to set the necessary incentives for achieving a desired, but not required, action. Subsidies are economic instruments that may lead to inefficient situations. However, they can create the necessary incentives

to stimulate a change in user behavior towards environmentally friendly conduct or induce investments in environmentally friendly production techniques, thereby mitigating or eliminating negative effects.

The outcome in terms of environmental improvement and static economic efficiency is exactly the same except for differences in the transaction cost between collecting taxes and paying subsidies.

Investment tax incentives

Governments facing growing budget deficits, do not usually favour environmental subsidies; yet most governments are rather generous with **investment tax incentives**. The most common such instruments are investment tax credits and accelerated depreciation for pollution control equipment and waste treatment facilities. While their impact on the budget is no different than that of subsidies, investment tax incentives are popular with governments because, (a) their costs are hidden from public scrutiny and hence are an expedient way to provide hidden subsidies, and (b) they give an appearance of promoting environmental protection without reducing competitiveness. Of course, the latter is not assured since the instalment of the mandated (and subsidized) pollution abatement facilities does not guarantee their efficient functioning.

Other financial instruments

Other financial instruments such as **revolving funds, green funds, relocation incentives and subsidized interest or soft loans** (for projects with significant positive externalities), may be justified as means for internalizing positive externalities or environmentally minded investors' willingness to pay for socially responsible investments, and instruments for mobilizing additional financial resources for conservation, environmental protection, and sustainable development.

I.5 Liability systems and assurance regimes

Liability rules and various types of bonds can provide strong incentives to avoid environmental impacts, and to clean-up and restore environmental damage. Both types of instruments imply consistent monitoring and enforcement of charges by the governmental authorities responsible for environmental regulation (PRI Project, 2005).

Liability systems

Liability systems aim at inducing socially and environmentally responsible behaviour. They intend to internalize and recover the costs of environmental damage through legal action and to make polluters pay for the damage their activity causes. To that extent, they can be considered as the most “traditional” expression of the “polluter-pays” principle.

Normally, liability laws include fines, and other forms of sanction in the case of non-compliance with existing environmental regulations. Their aim is two fold: first they aim at inducing polluters to make more careful decisions about the release of pollution according to the precautionary principle, and, second, they seek to ensure the compensation of victims of pollution. They can provide a rather powerful incentive when the expected damage payments (or incurred costs) exceed the benefits from non-compliance. The frequency with which liability cases are brought to the courts and the magnitude of damages awarded influence ex ante the behavior of potentially liable parties. Advantages and disadvantages/limitations are summarized in Table 14.

Environmental performance bonds

Environmental performance bonds are economic instruments that aim to shift responsibility for controlling pollution, monitoring, and enforcement to individual producers and consumers who are **charged in advance for the potential damage** (Panayotou, 1994). Therefore, their main difference from liability systems is that they internalize environmental risks ex ante (before) and not after environmental damage has occurred.

The general principle of performance bonds is that the supervising government agency is guaranteed sufficient funds, in the form of a bond or security, to cover the cost of rehabilitation in the event of failure by the enterprise concerned. The arrangement has thus evolved similar to risk insurance, where guarantees of rehabilitation or restoration are obtained by payment of a risk premium to a bank, insurance company or other financial institution.

The success of the tool requires adequate monitoring and enforcement mechanisms within the government. The move towards self-regulation should produce cost savings in government administration, but there is a risk that self-regulation could reduce the effectiveness of environmental controls. One potential disadvantage of performance bonds is that they may not be able to compensate for irreversible environmental damage. Thus where large-scale irreversible damage is possible, it may be more effective to rely on direct regulations (James, 1997).

Table 14:Advantages, disadvantages and limitations of liability systems (adapted from Kraemer et al., 2003 and Panayotou, 1994)

Advantages	Disadvantages/Limitations
• Pollution control through the decentralized decisions of polluters to act in their own interest (incentive towards self-regulation) • Environmental liability laws constitute a significant step towards the application of the polluter-pays principle. • Compliance costs are also reflected in prices of end-products and therefore contribute to the principle of ecologically honest prices.	• Damage is assessed and damage costs are recovered ex post • Not applicable in cases of diffuse pollution, where it is impossible to identify and link individual polluter(s) activities to the negative environmental impact • Not recommended for developing countries with poorly developed legal systems, or with cultures that very rarely use courts to resolve disputes or award damages

I.6 Voluntary agreements

Voluntary agreements (VA) are increasingly considered as a potentially useful environmental policy tool. They can be defined as *"a contract between the public administration and the user (or the user group) in which the user agrees to achieve a certain environmental objective and receives a subsidy to change its technology or practices."* The agreement is bilateral and requires a voluntary element on both sides.

Voluntary agreements can present advantages when compared to the traditional "Command-And-Control" approach, based on regulation and enforcement. They can provide quick progress due to rapid and cost-effective implementation, and allow for flexible and adjusted adaptation to technological options and market sensitivities. Furthermore, they can help to achieve policy objectives faster than mandatory requirements and statutory rules.

In general, VAs cover a wide range of responsibilities by the contractor or contractor(s), including (EFILWC, 2000):

- Periodical reporting on performance;
- Implementation of best practices;
- Improvement of efficiency;
- Public information on environmental performance;
- Raising awareness on environmental issues.

In principle, three types of voluntary agreements can be distinguished (Lyon et al, 2003):

- Unilateral agreements refer to self-regulatory actions in which users/polluters initiate a public pledge to improve their environmental performance;
- Public voluntary agreements refer to the commitment of participating firms to make efforts to meet program goals established by the regulatory agency and in return, they may receive technical assistance and/or favorable publicity from the government;
- Negotiated voluntary agreements, where the regulator and users/polluters jointly set environmental goals and the means of achieving them.

Voluntary agreements in the industrial sector

VAs are broadly applied in the industrial sector. Environmental objectives that can be pursued involve, for example, reduction of CO_2 emissions, reduction of discharged pollution loads, improvement of energy efficiency, reduction of water consumption etc. Self-regulation through VAs have become increasingly popular in industrialized countries over the past two decades. Their application in developing countries is also being enhanced; however in this case, the adopted objectives for the implementation of voluntary environmental programmes are quite different. While in industrialized countries VAs aim mostly to encourage firms to "overcomply" with mandatory regulations, in developing countries VAs aim mostly at helping users address non-compliance with mandatory regulations. This non-compliance is mostly due to the weak capacity of authorities to enforce regulations, and to the inability of firms to respond to stricter emission standards. In developing countries VAs usually entail four types of commitments:

- First, a group of industrial firms agrees to make investments to comply with the pertinent legislation, within a certain period of time.
- Environmental authorities on the other hand, agree not to sanction the firms for non-compliance during the grace period.
- Then, regulatory authorities agree to make the investments needed to eliminate barriers to the enforcement of regulations, e.g. by promulgating missing regulations.
- Finally, environmental authorities promise to subsidize the firms' investments in pollution control.

The key issue in the overall process is the wide publication at the local level.

Voluntary agreements in agriculture

Similar agreements are also applied in the agricultural sector, where regulation becomes increasingly complex. Their aim can be to reduce pollution from agricultural activities or to control surface and groundwater use. The participation of farmers in such control programs is encouraged by means of positive incentives (e.g. tax returns, subsidies etc.). Such programs try to convince farmers (through education) of the advantages of fine-tuned groundwater control.

Especially with regard to groundwater use, voluntary agreements are efficient, since they rely on specialized knowledge of participants about local conditions. When costs and benefits are not equitably distributed among affected parties, both parties can bargain about compensation payments. The allocation of such payments depends on the assignment of rights. Acceptability is not an issue, since it is a voluntary regime. Because of these advantages, participation of farmers in planning and decision-making at the local level is becoming more common.

Cooperative agreements in the agricultural sector

Cooperative agreements are an evolved form of voluntary agreements, entered into as a result of negotiations between farmers and water utilities, with direct or indirect involvement of water authorities (Heinz, 2007).

Cooperative agreements allow for significant benefits for all parties involved as:

- Farmers get compensation payments and save costs by improving their production methods;
- Water utilities save treatment costs or supply enhancement costs, which also benefits their customers (lower charges for water services);
- Water authorities and water utilities save costs of remedial measures.

A reported limitation to the broad implementation of Cooperative Agreements is that in many cases (e.g. in the UK), legislation does not allow the passing on of costs of the agreements to the water consumers as part of the water utility's operational cost. In fact, Cooperative agreements violate the "polluter-pays" principle (i.e. the polluter – farmers, are compensated instead of paying). However, experiences report that CAs can establish win-win situations for all the involved parties and help to reduce environmental pressures on water bodies.