STRATEGY FOR THE MANAGEMENT OF WATER RESOURCES IN ISLAMIC WORLD

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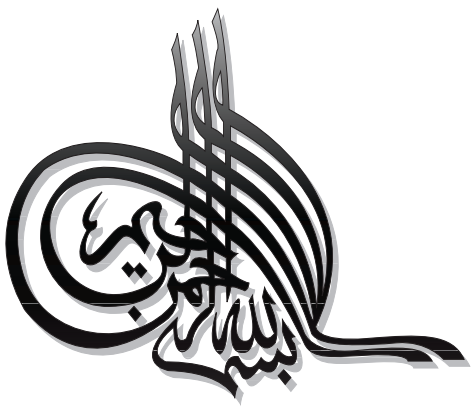
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Introduction

1- Importance of water resources and climate change in Islamic countries

Water is essential for life. It is vital to every civilization and to any process of development. Water has occurred in the Holy Quran in over 50 "Verses"and 40 "Suras", which emphasise the importance of regulatory water use, along with the conservation and rational exploitation of its resources.

The peculiarity of water is attributed to the fact that it is the second most precious creature of Allah, after Man. The property of water as one factor of life is depicted in the Holy Verse : "And God sends down rain from the skies, and gives therewith life to the earth after its death" (Sura Nahl, Verse 65). Water is not only vital, but every living creature owes its life to water : "We made from water every living thing" (Sura Anbiyaa, Verse 30).

It is true that Man has been able, throughout his long struggle with Nature, to subdue most of it and subjugate it to his needs, and that, thanks to science, he has been able to invent all he needed throughout history, but when it comes to his needs in terms of water, he is definitely unable to fulfil them just by trying to synthesize it or use a substitute for it.

Hence the need to focus attention on water issues in every time and place. The teachings of Islam point to the fact that Allah has created Man in the best of moulds and that everything in the universe has been created in a balanced way, for a special purpose. Thus, Almighty Allah has entrusted Man with the preservation of the resources He has bestowed on him, and requested him to use them in a proper and rational way, assuming his full responsibility in caring for them.

Scarcity of freshwater resources is expected to be the second most formidable challenge to the world in general and Islamic countries in particular in the 21st century, as a result of climate change, the emission of greenhouse gases, the climatic projections that are conducive to irregular seasonal precipitations along with their implications on water resources, a defective river system as well as a poor water quality, let alone population growth, pollution, drought and the dissipation of resources.

In this respect, various reports are depicting a grave situation in various regions of the world. Over 1.4 billion people in the developing countries have no access to clean and safe drinking water, and more than 450 million people are facing water shortages. Some areas suffer an acute shortage of water, causing aridity and drought resulting in famine and hunger. Most the third world's population has to walk at least 3 hours a day to fetch water. Besides, the number of refugees fleeing water and environmental crises has been on the increase, compared to war refugees.

Due to growing population, the demand for irrigation and drinking water is expected to rise by 20% in the coming 25 years. Since most of the developing countries rely on agriculture in their economies, the shortage of freshwater may cause food shortage in various regions of the world. An improper management of water resources has reduced crop production to a large extent, damaged the soil texture considerably and precipitated the rate of water usage. Water

pollution is a major cause of spreading epidemics which kill thousands of people every year, especially in the least developed countries. This pollution threatens also aquatic life, and as a result, freshwater animals are disappearing five times faster than land animals. The excess of water in the form of heavy rains and floods, in inadequately equipped countries, renders millions of people destitute and homeless.

According to the World Commission on Water report, during the past century, the world population tripled whereas the aggregate use of water has increased six times. 50% of the world's wetlands have disappeared in the past century, 20% of the freshwater fish are threatened with extinction, and most of the groundwater table is already deep and dropping by one meter every year. Besides, some groundwater sources are damaged permanently by salinization.

2- Challenges being faced by Islamic countries as regards water resources

The water problems have always remained an issue of concern to the governments in Islamic countries. However, such factors as population growth, an increasing demand for water, climatic factors, along with its correlation with other critical factors like poverty, food and nutrition, health and its impact on improving the socio-economic conditions, have called for drawing the attention of the highest authorities to take these issues more seriously. In this respect, the scientific committee on problems of the environment, affiliated to the International Council for Science, conducted a special survey called "GEO-2000". This survey addressed freshwater scarcity as the second most serious problem after climate change, while the problem of water pollution was ranked fourth in a list of 36 concerns.

The serious world situation of water resources is also reflected in data and figures which have been reported in developing countries, including countries of the Islamic world. The water scarcity, along with its deteriorating quality in most of these countries not only hampers the development process in the economic and social fields, but it also threatens their very existence.

The fulfilment of the population's needs in terms of drinking water is indeed one of the basic human rights, provided for in international treaties and customs. The international community is certainly fully aware of the importance of this issue. In fact, most international organizations and world, regional as well as local conferences have stressed the need to consider water as a top priority in long and short-term development programmes and strategies. In this respect, the Johannesburg Conference, held lastly, has issued the Declaration of the Third Millennium, whereby it stipulates that 50% of the globe's population should benefit from drinking water by 2015, and calls for the promotion of partnership between the private and public sectors in order to achieve this end, as well as for the fostering of the culture of water solidarity within and between countries.

By the year 2025, Islamic countries will suffer a water shortage. In fact, the present water situation in most of them is already critical. Therefore, Islamic countries have to intensify efforts and conduct further research and consultation, with a view to devising mechanisms liable to achieve the water security of these countries, by working out a strategy which takes into account all legal, economic, social, environmental and cultural aspects.

The problems encountered by Muslim countries are generally categorized as follows :

* unequal distribution of water, as some countries experience a critical water situation, while other countries know a convenient situation. However, the fact that the latter countries have plenty of water resources is not enough to make them secure when it comes to the potential of exploitation of these resources with a view to improving the living standards of the population and achieving sustainable development.
* The lack, in the countries undergoing a critical water situation, of appropriate financial and technological resources to deal with this shortage, while the countries with important financial means can afford, thanks to modern techniques, to have access to water, despite the very high cost of such a process.
* Some Muslim countries have plenty of water resources, as well as an appropriate drainage system, while other countries suffer from the gathering and stagnation of surface water, which eventually leads to epidemics.
* The growing scarcity of water along with its high cost, desertification, soil erosion and depletion of some water layers along with their over-exploitation. For instance, in some countries, the extraction of groundwater is excessive by 25% to 30%, compared to its recharge rate, which only causes the loss of their groundwater reserves and the deterioration of their quality. Moreover, some developed countries in South-East Asia witness a degradation of their water quality, let alone the extent to which their water is polluted and wasted, and the non-rationalization of its use, which led to the rise of the level of suspended deposits in rivers as a result of the corrosion of water canals.
* The pollution of water with organic matter, disease-causing substances, and toxic wastes, represents a serious problem facing the countries of South-East Asia. The low rate of oxygen has reached critical levels because of the organic content of water. In fact, Asian rivers are loaded with thrice as much excrements as the world levels, and ten times as much as the levels set by OECD. Also one third of Asians do not have clean water in a 200-meter perimeter from their residence. Besides, only 10% of their waste water is treated, and still with inadequate methods.
* The equipments, data and expertise available in Islamic countries are considered to be inadequate. Besides, in the absence of appropriate programmes liable to provide the qualified human resources, and as the research and training equipment is deficient, cases of mismanagement of water resources are reported more and more often.

3- Efforts undertaken by the Islamic organisation as regards water resources

In order to boost the scientific and technological development process in Islamic countries, ISESCO has elaborated a "**Strategy for the Development of Science and Technology in Islamic Countries**". The strategy was examined and adopted by the 18th Session of the Executive Council of ISESCO and by the 6th Session of the General Conference and was also approved by the 8th Session of the Islamic Summit Conference (Session of Dignity, Dialogue and Participation) held in December 1997, in Tehran, Islamic Republic of Iran. The first draft of the "Implementation Mechanisms" was prepared by ISESCO and presented to the Coordination Meeting of the Ministers of Science, Higher Education and Scientific Research of the ISESCO's Member States on 28th June 1999, which was held in parallel to the World Conference on Science in Budapest, Hungary. The amended version of the

strategy and the Implementation Mechanisms were later approved by the 9th Session of the Islamic Summit Conference (Session of Peace and Development-Intifada Al-Aqsa), held in November 2000, at Doha, State of Qatar.

The Implementation Mechanism of the Strategy for the Development of Science and Technology in Islamic Countries focuses on the protection of the environment and the sustainable development of natural resources, as they are among the most important fields of development in Islamic countries. It also stresses the promotion of useful technologies to reduce pollution and calls for drawing up specialized programmes to address major issues like control of deforestation and preservation of biodiversity, fisheries and aquatic resources, management of water resources, desertification control, waste treatment with a view to protecting the environment and sustainable management of natural resources.

The First Meeting of the Consultative Council for the Implementation of the Strategy for Development of Science and Technology in Islamic Countries, held in September 2001, inFes, Kingdom of Morocco, considered, inter alia, the water issue in the Islamic world and recommended ISESCO to set up an Expert Panel to prepare a strategy for the management of water resources in Islamic countries.

The Second Meeting of the Consultative Council for the Implementation of the Strategy for Development of Science and Technology in Islamic Countries, held in March 2003, in Rabat, Kingdom of Morocco, has devoted a particular attention to the problem of Water Resources Management, as it is essential for sustainable development in Islamic countries. It has examined the strategy's broad lines that are being prepared by ISESCO, after the latter has been acquainted with the suggestions of the Member States. The Consultative Council also recommended that the said strategy submitted to the Second Islamic Conference of the Ministers of Higher Education and Scientific Research in Islamic countries to be held from 6 to 9 September 2003, in Tripoli, Libya.

4- Broad lines of the Draft Strategy for the Management of Water Resources in Islamic Countries

The main elements of this strategy have been derived from the suggestions and contributions of the Member States. These elements can be summarized into Institutional Capacity Building, Education and Training, Research capacity Building, and the Assessment and Integrated Management of Water Resources.

4-1 Water resources management

The effective and sustainable management of water resources is an intricate process, which requires a comprehensive and innovative approach which is likely to improve the water situation in Islamic countries and lead to sustainable development, in keeping with the policies and agreements adopted at the international level. No strategy can be successful unless the interests of all stakeholders are taken fully into consideration. The strategy should also ensure all Member States could derive more benefits, taking into account their major demands for effective water management.

The increase in water demand, especially under limited, and sometimes non-renewable resources, along with the emergence of new lifestyles and industries, has led to a

considerably increased consumption. The problem becomes even more complicated when it comes to the countries sharing the same water resources or the same water course. There is a fierce competition going on between the fields of irrigation water and drinking water, between rural areas and urban areas, as well as between industrial facilities and tourist demands. Besides these factors, there is the increasing demand resulting from the growing population, the expanding urbanization and industrialization, while such plagues as desertification, environment pollution, along with the impacts of climate change, such as floods and drought, have come to rage through large stretches of the Islamic countries. All these factors have led to the quantitative and qualitative alteration of water resources, and impacted on water courses along with their storage in dams and lakes, as well as on groundwater, which has had adverse effects on water supplies.

In this respect, the integrated management of water resources remains the best option if we are to overcome this most serious problem. We cannot secure the fulfilment of all sectors' needs for this vital substance unless it is used in an optimal way.

4-2 Institutional capacity building

The integrated management of water resources should address all issues of the management of water resources, in terms of their interrelation, and of the water sector as a whole with a view to promoting effectiveness and sustainability. Since the water sector is characterized by horizontal and vertical relations, such a system would not be effective without an integrated methodology. In fact, several attemps have been made at laying down the constituting framework of the integrated management of water resources. The Rio Agenda 21 in its article 18 indicated several programmes and activities regarding the integrated management of water resources.

4-3 Research capacity building

The world is currently undergoing profound changes, consisting mainly in globalization, competitiveness and the quest for power through modern scientific knowledge. This requires a quest for the positive aspects of this world phenomenon and their use in the service of human development. Thus, we need to think up the best way of putting this positive side to use, with a view to developing water resources, which is only possible through further investment in terms of human resources. The latter are, in fact, the best way of facing the technological, scientific and computer challenges of the 21st century, especially that the present and prospective status of countries and nations is contingent upon the importance attached to scientific research.

As scientific research is at the heart of every development process, its promotion as regards water resources should be provided for in the strategies to be adopted and followed by all means. This requires indeed more emphasis on the establishing of a scientific research policy and on the allocation of the necessary funds thereto, as is the case in developed countries, with a view to developing water economy techniques, as well as techniques of sea water desalination, so as to reduce the cost of water and make it accessible to a wider population. The aim is also to develop such techniques as the treatment and recycling of waste water, water transfer, prevention of floods, etc.

4-4 The importance of legislation in water resources management

The integrated water resources management is based on a basic, developed legislation and applicable measures. However, the most serious problem encountered in the field is generally the variety of stakeholders in the field, who lack in coordination, let alone the presence of loopholes in the legislation and regulations in force, especially those related to the water resources protection and pollution.

4-5 Cooperation as a mainstay for strategies

Cooperation between Islamic countries can help work out the best policies possible in terms of water resources management. While developed countries and granting bodies have failed to meet their commitment to bring the official aids up to 0.7% of their GDP, in keeping with the recommendations of various international conferences, it is up to Islamic countries, under the present critical international situation, to take initiatives in financing water projects, according to the available potentials and capacities, through redoubling the efforts being extended by the development-oriented bodies and funds existing within Islamic countries, and putting to use all resolutions issued by specialized international institutions, concerning the reduction of the cost of financial transactions and the rate of interest on loans, and the support of the international efforts at cancelling the poorest countries' debts.

4-6 The importance of sensitizing and involving water beneficiaries in the water resources management

The water resources management, along with their rational use, requires in the first place the laying down of an "ethical code" which would regulate and monitor the rights and obligations as regards water. Sensitization and the participation of all stakeholders are a determining factor in the success of any strategy.

Chapter 1 : Legal and Regulatory Frameworks of Water Resources Management in Islamic Countries

We have to realize the difficulty of achieving sustainable development in Muslim countries, especially that the legal and regulatory frameworks pertaining to the existing water resources suffer some deficiencies and loopholes, let alone the fact that some of them use techniques that are incompatible with the modern ways of integrated water management. It is worth mentioning that the Islamic world will face formidable challenges in the third millennium as far as water is concerned, since it lacks the capacity and means, both on a preventive and curative level.

The water situation has become critical in many Muslim countries. While most of them have overcome the shortage of water, some of them still witness an extremely serious shortage. Besides, the fact that the majority of these countries lack autonomy in terms of their water sources only adds to the problems of development.

These factors being taken into account, the public policies for water resources utilization and management remain very far from the modern concepts of integrated management despite the efforts extended. The issue of bordering waters is also likely to exacerbate the water crisis in some Muslim countries.

Dealing with this situation requires further investigation so as to design the necessary mechanisms that are likely to achieve water security for the Islamic world, through the elaboration of a strategy of an integrated water management with a view to going along with climate changes and keeping up with the up-to-date management techniques. The intention is to alleviate the water crisis and to lessen its adverse effects on the population, environment and sustainable development.

Due to the huge progress of sciences relating to the water resources and their different uses, along with the subsequent problems, it is imperative to look for the kind of technology suitable to the development of water resources, and to design the up-to-date mechanisms and techniques liable to reform the laws in such a way as to make them compatible with the current and future situation of the Islamic world, so as to achieve sustainable security of water resources in Muslim countries.

1- Sources of Water Legislation in Islamic Countries

1-1- customs

The human gatherings which formed around water points set drastic rules regulating the water usage, distribution and ownership, in different geographical, climatic and human contexts. Such rules are still complied with today in some areas of the Muslim countries. As a result of the passing over of these rules, they have entered into legal force, since they have come to be a source of legislation in some Muslim countries in the field of water usage.

It is worth noting that the main difference between customary and Islamic law as far as water property is concerned lies in the link existing between land and water. While Islamic law

considers it is the land property which entails water property, customary law endorses the opposite view.

Some legal institutions, within the Sharia, such as the entailment of estate (*waqf*), are obviously affecting the customary system.

1-2- The Islamic vision of water issues

Islam has focused on the importance of water as a source of life. The term "water" has occurred in the Quran more than fifty times, across over fourty Surates. Emphasis has been laid on the importance of regulating water usage and preservation from being wasted and spoiled, as well as its rational and thoroughly responsible exploitation.

The Islamic Sharia is one of the fundamental sources of water legislation in the Islamic world, as it embodies many principles, which are listed summarily and in part as follows:

- water is the common property of all. There should be no obstruction to its use and exploitation though its ownership is allowed, especially when it comes to groundwater.
- the use of water by man and animals for drinking has priority over other uses even if it is meant to perform acts of worship. Therefore, nobody is allowed to prevent supplying man and animals with drinking water.

From an economic perspective, the Prophet (PBUH) said that, like fire and pasture, water is a common right to all Muslims. Moreover, according to modern legislation water is owned by society, i.e the State.

There are many Sharia provisions that address the issue of water usage and which could be referred to as an authority in terms of water legislation, as one could hardly oversee these provisions in Muslim countries.

1.3. Positive laws

All Muslim countries have now water laws which can differ in terms of their themes. These laws are either modern or simple and public, depending on the specificities of each country and the prevailing situation in which they have been adopted.

a- The existing state of affairs of Islamic water-related legislation

The water-related legislation in Muslim countries traces back to different periods in the 20th century. Laws have been set for many fields, such as planning, prevention, pollution and protection, etc. Joint initiatives between the private and public sectors have been tested, within the framework of projects that have been carried out in the fields of water economy and sanitary waste water, as well as the adoption of projects' impact assessment studies, the management of wastes, and systems of monitoring pollution at large.

b- The domains targeted by the water legislation

The water legislation, in Muslim countries in general, addresses primarily such issues as the determination of the type of water, the nature of water ownership, the water rights and the subsequent effects, as well as the restrictions being imposed on it. It also deals with the priority

of water distribution and the question of setting priorities in terms of water resources planning, development, preservation and sustainability, and the maximization of their economic, social and environmental benefits. These laws determine the easement as well.

Besides, they deal with such domains as protecting all water resources, including the classical ones, fighting pollution and quantitative as well as qualitative deterioration of water, soil erosion in basins, repairing the sewerage system in population aggregates in order to guarantee that rainwater flows freely without any risk of pollution, and reducing the negative effects of population and constructional expansion on water resources. They also regulate their entertaining aspect, including various water sports activities, excursions, water displacement, service stations and fuel tanks near water resources, and the setting up of tourist activities and other, as they have adverse effects on water resources.

These domains require the monitoring and restriction of some activities in a bid to protect the water resources and preserve them from misuse. They also call for the regulation of the recycling of waste water for their secure usage, and the consequences of having shared resources.

In order to energize these regulations, punitive sanctions and deterrent fines have been set according to the risks entailed by the use of this type of waste water. Appropriate laws have also been adopted in order to counter the negative effects of water-transmitted diseases or diseases resulting from an excess of water.

2. Common denominators between Islamic countries in terms of water legislation

As far as water is concerned, the Muslim countries have many basic principles in common, which could be summarized as follows:

* The water resources, be they superficial or subterranean, are deemed to be the property of the State. This principle is in line with the Islamic Sharia and the Constitutions adopted in the Islamic world with a few exceptions, as the water property in some countries has to do with customs and tradition, or with land. There are some countries that recognize the acquired rights.

* The State is responsible for water facilities, along with the private sector, when it comes to the design, implementation and management, including water distribution to the beneficiaries, according to public policy and the project's plan.

* Some States are in charge of public facilities, while the private sector undertakes the running of private facilities when it comes to superficial wells, irrigation networks in private landed properties, small dams, the extraction of water from wells, the exploitation of water sources, cracks, pumping stations, the promotion of natural sources, wells and geysers.

* Customs and tradition govern the issue of floods, as the population sets up dikes to counter inundations, or to immerse their lands in some cases. Due to the scarcity of water in some Muslim countries, a couple of them intervened to regulate the exploitation the great streams' water.

* Water usage is subjected to a prior authorization in some states, while in other states the authorization is not only required in advance, but it is also conditioned by many provisions.

3- The relative deficiency of the water legislation in Islamic countries

It comes out from the practice of the water legislation in Muslim countries that some deficiencies and loopholes make it ineffective in many fields and sites, which is attributable to the following factors:

* the multitude of the administrative units operating in the field of water resources, along with the multitude of their laws and systems. The water resources management in Muslim countries has not known much progress compared to the great efforts that have been put forth in the fields of investigation, prospecting, and dams' construction. These effort are still characterized by dispersal and overlapping attributions, whether in terms of water monitoring and conservation, or in terms of the production of drinking water. Modern, scientific rules require us to consider the technical as well as the legal and regulatory aspects, if we are to elaborate an effective water administration, capable of bringing into shape a drastic policy in the field of water resources management, which is considered to be limited in time and space.

* The double standards and inconsistencies in many laws, especially when it comes to the overlapping levels in the units in charge of water management; the lack of cooperation between one another; and the failure of the granting bodies to contribute massively to subsidizing the cost of water in general.

* The failure to put most laws into practice, which reflects badly on the water sector. It is mainly because of the occupation of lands bordering rivers (haphazard constructions), which leads to disasters like floods, the extraction of sand from river beds, turning watercourses into cesspits, where refuse and draining water are disposed of.

* The ineffectiveness of laws despite their modernity and their comprehensiveness in the field of surveying infractions, because of the absence or insufficiency of regulatory or effective mechanisms of implementing laws, and the inability of the sanctions to deter transgressors. As a result, the bulk of draining and industrial water is discharged in rivers, seas and oceans without undergoing the necessary purification, which leads to the deterioration of the water quality and to the pollution of seas. One can say that State laws and regulations are unable, on their own, to change people's behavior towards the management of water issues.

* Mis-coordination between the administrative units in their practice, which sometimes goes as far as boycotting, which requires us to provide a strong and binding coordination between all units in charge of water management. This coordination aims at finding some common ground for consultation, and achieving a frame of action far from rivalry and conflicts, whose goal is administrative efficiency in water management.

* The absence of administrative bodies able to ensure the follow-up of laws and to hold accountable their transgressors. The fact that water police responsibility is dispersed among several actors is the main cause behind the inefficiency of this body in carrying out its mission. In fact, the water resources are subject to dilapidation, depletion, pollution and random prospection, as well as the deterioration of water facilities.

It becomes clear from what has preceded that the majority of water laws in Muslim countries includes dispositions liable to preserve water and plan its monitoring. They make provision for treating used water before being discharged in the natural environment. However, everyday practice suggests the opposite, as water is more and more subject to nuisances (which is the case of the coasts of some Muslim countries and the watercourses existing in some industrial areas). These nuisances become so serious at times that they affect negatively the water quality.

* The lack of water awareness in the midst of Islamic societies in majority, which often makes them hostile towards laws. It is noted that water policies in Muslim countries have not covered the information aspect, which suffers a genuine failure to sensitize Muslim peoples so that they would change their behavior towards water.

The non-implementation of laws, or their failure to cover all fields pertaining to the use of water, along with the problems stemming from these uses, only impede the promotion of water and rationalization of its use, as a result of the multiplicity of the responsible departments, which are often unable to secure its preservation from deterioration and depletion, especially if there is no legal basis.

4- The international laws and regulations for the utilization and development of the shared water resources

Even if Muslim countries are bound by brotherly ties, the sharing of water, both nationally and internationally, leads to the breaking out of conflicts because of the deterioration of the water situation and the expected increase in its demand in the upcoming decades of the third millennium. Hence, water, which was once used to relieve tensions, has only become a source of tensions. In fact, it could lead to conflicts, which could turn into wars or serious rivalries among Muslim countries, or between them and their neighbors.

In the light of the Islamic teachings, it is possible to turn these conflicts and differences into ways of wider cooperation between Muslim countries by setting up common water projects, so that the countries located on a given watercourse would be able to benefit, equally and reasonably, from it in their respective territories, in the best way possible and in a sustainable manner. This exploitation could also be performed in a way which would provide enough protection for the watercourse, without any prejudice to the other concerned countries.

The administration of the common water basins in the Muslim countries is now a great concern, not to say one of the greatest challenges facing the Islamic world in modern times. It even represents one of the international conflict foci presently and prospectively, due to the rise of water demand. What makes things even worse is that most of these water basins and rivers are distributed over more than one country, along with the fact that these countries use different methods of exploitation. The use of water in a common river, for instance, by the upstream countries without the prior consent of the downstream ones could affect the inputs of the preservation of water resources in the latter countries, since taking water upstream leads to the diminution of water quantity required to meet the demands of the countries downstream, let alone the fact that the incoming water in the latter countries could be mediocre because of the bad quality of the returning water discharged by those upstream. Besides, as water is subtracted from the river downstream, the local content becomes very high. Hence the need for the watercourse countries to commit themselves to cooperation on the basis of equal sovereignty, territorial security, the exchanged benefits and good will, so as to derive the maximum benefit and provide protection for the watercourse, within the framework of an exchange of data and information, consultation and negotiation over the potential impacts of the prospective measures.

4-1 Rivers

Demand for water resources is increasing in Muslim States at a high rate, in the same way population growth and economic development do. Problems related to this increasing demand

and to the scarcity of water are awaiting most of these countries. The situation is even worse when many countries share the same water resource. Some maintain that the coming wars will happen not because of political disputes, but because of disputes over water resources.

The Nile is considered among the largest common water basins in the Islamic world, as it is that between 10 countries. The importance of this river for Egypt and Sudan is attributed to the fact that it is the main source of water in both countries, while the other countries bordering this river are located in equatorial areas with high precipitations. A unified legal framework is presently being investigated, as a way of achieving a general agreement to preserve the historical rights of all the basin's countries, in accordance with the Geneva Convention.

The waters of the Tigris and Euphrates basin are extremely important to Syria and Iraq, which share it with Turkey. Syria pins high hopes on developing the Euphrates in its passage on its territory, as it represents more than 50% of the available water.

The question of sharing water of the Gange's river between India, Pakistan and Bangladesh, the Jouba and Chibili basins between Somalia and Ethiopia, the Senegal basin between Mauritania, Mali and Senegal, is a challenge which requires profound studies in terms of legislation and regulation.

Furthermore, there is the Jordan basin, which represents an intricate issue, as its water resources are considered to be relatively rare, let alone the considerable scarcity of water in the bordering countries, and the fact that this issue is related to the overall situation of the region.

4-2 Catchments

The Islamic world has overlapping and intertwined water basins. By way of illustration, there are the Walqash basins, which are common to Sudan and Erythrea, the Mjradah Wadi, which lies between Algeria and Tunisia, and Tafna, Doura, as well as Deraa between Morocco and Algeria.

The water resources in South East Asia are also facing some threats, such as pollution, lakes' asphyxia and colonization by harmful plants. The Muslim countries in this continent are contingent upon the increasing demand for water, due to the strong population growth, which leads to the emergence of the problem of drinking water supply.

4-3 Groundwater

It is noted that the present situation of underground water in the Islamic world is still favourable. No apparent conflict or dispute has erupted over this issue despite its increasing use in many instances. Egypt, Sudan, Libya have the Noubi sandy stone basin in common; the Huran basin is common to Syria, Jordan and Saudi Arabia; Arabia's Eastern region basin lies between Oman, the U.A.E., Yemen, Iraq, Jordan, Syria, Saudi Arabia, Bahrain and Qatar; the basins of the East Mediterranean are shared between Syria, Lebanon, Jordan and Palestine; there is also the final complex layer which lies between Algeria and Tunisia; and the Tludli basin which is shared between Mauritania and Mali; and the Higher Island basin which is shared by Syria and Turkey; and the Tindouf basin, which is shared between Morocco and Mauritania.

4-4 Water transfer from the rivers' basins

The 21st century will be referred to as "the era of geopolitical waters", since the fresh water sources are being controlled politically, technologically and economically. The water resources will become a world wealth rather than a national wealth which is under the control of a State, or the source States. The great powers' diplomacy will impose its water, economic and social policy on the world's countries.

In spite of the international moves over the permission of water transfer from the rivers' basins to other countries, the international laws, agreements and customs still prohibit this, and make a distinction between the rivers' basins and the superficial or hydrological basins.

The unstable situation of the shared water resources in the Islamic world requires that great efforts be made, so that it does not worsen to such an extent that it becomes irremediable. The first step towards preventing conflicts is the signing of common agreements which adopt standardized policies of the common usage, development and preservation of these resources, in such a way as to ensure supplying the population with water. The bordering countries should also consult one another, and if need be, create joint committees to settle the disputes which could break out over the use of water for the common interest of all parties.

5- Agreements and Conventions between Bordering Countries

Many Muslim countries share with one another on one hand, and with other non Muslim countries on the other, rivers and water basins. The agreements being concluded on the utilization of water is one of the sources that are considered while formulating water laws in all countries. The water laws adopted in a given country should be in line with the provisions of the agreements or conventions signed with another country bordering the water resource. This is considered one of the most important authorities that are referred to while interpreting or explaining certain clauses which are the source of disagreements, or while seeking solutions to critical issues. Contradiction between internal laws and regional ones could give rise to inter-state conflicts that may fall outside the jurisdiction of the concerned country.

Regional agreements set the standards and facilitate the procedures and role distribution for a better and rational management of water resources, based on equal and reasonable utilization and participation, with a view to utilizing the international watercourse to derive the best benefit possible, while complying with the factors relevant to the equal and reasonable utilization, as well as committing oneself to not causing a serious prejudice. These agreements consecrate as well the culture of consultation in order to remove or reduce the prejudice, and the discussion of the compensation issue and any commitment thereto, through cooperation on the basis of equal sovereignty, territorial security and mutual benefit, by creating joint mechanisms or committees in charge of the cooperation management, in the light of the acquired expertise of the internationally renowned joint mechanisms and committees. Hence the importance of the laws which assist in the drafting of agreements over the shared water resources, in the service of all bordering countries.

It is noted that there are still many obstacles to the implementation of the common water laws. These obstacles fall outside the jurisdiction of the relevant State authorities, as long as reaching any agreement about water utilization remains an unattainable goal, which requires a long time for the drafting, ratification and putting into effect of the agreement.

In this regard, it advisable to energize the regional board of the water resources in West Asia, which emanated from the Mardablata Conference, to design the institutional mechanisms enabling this board to perform the main task assigned to it in order to settle disputes, and to anticipate the development plans of the shared water resources, for the benefit of the region's countries.

In case there are no agreements between riparian countries, the international law principles would be the main authority for taking any decision about the utilization of shared water resources.

5-1 Agreements and international standards

The international community has set the fundamental rules and standards which regulate the utilization of common waters in terms of the rationalization of use and preservation from pollution, as well as their conservation and not causing prejudice to others. It should be noted that international agreements are not absolutely coercive, though they are seen as indicators which help the legislator to design the laws that best fit the practice, so as to ensure their sustainability and raise their economic, social and environmental utility.

It is worth noting that within the framework of this "water diplomacy strategy", the countries that are rich in water resources will be deprived of the right to exploit them, unless they do it within an international framework based on a fair and equal distribution of the water wealth among all the people of the world.

5-2 Settling disputes in friendly ways

The UN charter provides for the settlement, in a peaceful manner, of the disputes or conflicts existing between neighboring countries over the utilization of shared water resources, so as to ensure international peace and security.

In this regard, it is advisable to resort to negotiation, discussion and the design of mechanisms, so as to solve these differences through the creation of a joint committee with a view to investigating the issue from all perspectives, and finding solutions to contain the problem and offer suggestions. The coordinated efforts, along with the joint action, might help find solutions to the pending and complicated issues that are experienced by the conflicting areas through:

* focusing on the goals set in the Millennium Declaration about the water resources, and on assisting developing countries in achieving these goals, by providing the appropriate technologies and the necessary financial resources, by supporting regional cooperation, and also by taking into consideration the existing agreements and initiatives.

* Stressing the specificity of each watercourse, and the fact that there is no need to set a general framework regulating transboundary watercourses.

In order to ensure the success of a sound settlement, international law stipulates that each State should provide the other countries bordering the water basin with all data and information relevant to its utilization of these common resources.

5-3 Arbitration

In case negotiations between bordering countries fail to find the appropriate solutions that suit the parties through negotiation and joint committees, the case is submitted to a third party for a decision. If a solution which would be accepted by all parties is not reached, the case could be submitted to a neutral fact-finding mission, or an international committee of arbitration, or else submitted to an international court.

6- The regulatory framework of water resources in Islamic countries

The regulatory framework of water resources in the Islamic world consists of heterogeneous units and sub-systems, differing in terms of specialty and from a geographical perspective. Thus, there are multiple and various levels, though these units are overlapping, since each one of these elements depends on the means available to the other for carrying out the water-targeted processes.

These units are interconnected horizontally and vertically. They are also organized into commutative relations, as we could not set one apart from the others. But although they are part of the whole, integrated water management system, each one of these units has its own identity and characteristics.

The administrative regulation of water resources in Muslim countries is not composed of units or bodies that have arbitrarily come together and that are not linked to one another. It, therefore, first and foremost consists of interrelated parts, that are mutually complementary, so that water is eventually available for use and consumption.

Besides the operating and complementary units, there are advisory units that present suggestions and coordinate the various activities of the other operating units, with a view to reaching a coherent management that makes these units into essential points in the system management, both in the phases of planning and implementation.

These units can take on different forms in the Muslim countries, as they may be national councils, or committees that can vary geographically speaking. Besides the designers and supervisors of the water resources management, they include all users, as well as representatives of civil society.

Owing to the multitude of water uses and the disparities between the ratios of the production sectors and those of the households in all Muslim countries, each unit has its own goals, which are incompatible with the others'. This has had negative repercussions on the management of water resources, since the latter have become subject to many impurities while being used by beneficiaries, which makes it difficult to rationalize their management.

The rationalization of the water resources management in the Islamic world, through scientific and modern ways, requires us to set aside such obstacles by standardizing the water resources management, and by creating a competent, uniform body which would organize all water facilities.

The modern, scientific fundamentals of water management are based on a good organization, and require an appropriate regulatory mode which would rely on the determination of the frameworks' functions, the distribution of attributions between all units, the adoption of an effective planning, the effective monitoring of water uses, and cooperation without competition or rivalry.

The consideration of technical problems, along with the legal and regulatory issues, has become a fundamental goal, as adapting its management tools to the state-of-the-art, scientific administration has come to be one of the fundamentals of a good administration, which requires a standardized supervision and design in order to keep a uniform management, so as to be in line with the uniformity of the substance.

Chapter 2 : Strategy for water resources management – Potential for sustainable development

At the turn of the twenty first century, the socio-economic, institutional and technical water resources management framework has undergone considerable changes and reforms around the world. The stakes related to the hydraulic potential of countries suffering from the impact of drought, an increasing demand for water resulting from population growth, and the deterioration in water resources quality due to various pollution factors have made of the rational water resources management the only means liable to preserve sustainable socio-economic development.

The supply policy followed by most of these countries has proved to be of a limited use. Thus, an objective evaluation of the water policy in some countries shows that despite their track record in terms of dams construction and water storage, some failures have been noted, consisting mainly in the disparities existing between the various sectors and all the subsequent bad consequences on the rationalization of water resources, the nature of the projects implemented, which differ depending on whether there are located downstream or upstream from the water resources, the investments of the State in the field of recycled water treatment, as well as the dilapidation of large amounts of water on agriculture uses, and the loss of a considerable part of the dams' storage capacity due to their silting up.

The current deficiencies in the sector of water require of decision-makers a radical change in the attitudes of all stakeholders, particularly the public sector, which has to adopt quickly a policy of water resources management through the reactivation of the different tools available to them in order to promote a new culture of water resources management based on decentralization, participation and solidarity.

1- Nature of the strategy for water resources management

At the present time, water management in most Islamic countries deals essentially with supply. This is usually done through some expensive engineering techniques used at a high level. Costs constantly increase as water becomes rare and we find ourselves obliged to seek new resources in regions that are getting even distanced from inhabited areas, or under considerable depths.

Moreover, surface and underground water is becoming even more contaminated (pollution and salinity), which means that there is far less available water, unless there is an increase in expenses for water treatment.

The new strategy will be based on the management of water demand, which represents a viable management option, supplementing the supply management, and allowing the reduction of the problems pertaining to the overuse of water resources. Water demand management should allow the adoption of actions aiming at:

- Enhancing water economy by insuring a maximum efficient utilization;
- Preserving water quality and improving that of the water distributed to meet the demand requirements;
- Increasing water availability through the use of non-conventional sources

- Envisaging a differentiated water supply depending on the benefiting sectors and according to diverse degrees of water quality.

The application of the demand management strategy is carried out through diverse measures, which may be technical, or consist of awareness-raising campaigns, or else incentives.

Likewise, the granting bodies have shown a better appreciation and understanding of the issues related to water demand management in Islamic countries. Thus, decision-makers and granting bodies have had a regular access to information and provided for a return of information, particularly through the Islamic Educational, Scientific and Cultural Organization (ISESCO) and other organizations.

What is water demand management ?

Water demand management brings about positive as well as negative aspects at the regional level. At the negative level, the majority of the parties concerned with water management are interested only in the options available in terms of water supply issues. The positive side consists in the increasing changes adopted in the field of water demand management. To illustrate this, there is a more frequent recourse to non-conventional water resources in the irrigation field; let alone the significant endeavor to decentralize institutions, etc. It becomes thus imperative that all kinds of the above-mentioned water demand management measures should be promptly adopted in order to deal with the serious situation in the region. Water resources should also be managed in an integrated and global way.

2- Objectives of the Strategy

The working out of a water resources management strategy in Islamic countries aims at defining a middle and long term water resources development strategy that is coherent at the level of the countries of the Islamic world, so as to bring it into line with the objectives of the local plans of each country, which are among others:

- Food security;
- Securing the supply of drinking water to the population;
- Preservation and protection of water resources via the establishment of adequate legislative, regulatory, economic and technical mechanisms;
- Consideration of the protection of the natural environment in the objectives of sustainable social and economic development.

In general, by dint of its technical, environmental, and regulatory components, the elaboration of a water resources strategy will constitute a means of orientation facilitating political decision-making for a sustainable water resources management in Islamic countries.

3- Content of the Strategy

The water resources management draft strategy should allow for the consolidation of efforts already made by Member States of the Organization of the Islamic Conference (OIC) in terms of planning, sensitization and water resources management. This strategy aims mainly at :

- Evaluating the available reserves of surface and underground water resources (in quantity and quality) as well as its allocation to different user sectors. Particular attention should be given to non-conventional water resources (waste water, drainage water, sea water...), especially in countries undergoing a serious water storage;
- Formulating the alternatives pertaining to the supply of water resources, including the evaluation instruments likely to facilitate the opting for the best choice;
- Combining the technical approach with the social and cultural one, as part of an integrated water resources management which is based on objective and comprehensive knowledge;
- Identifying the different tools (legal, economic and technical) necessary for a qualitative water resources management (quality objectives, quality standards, protection measures, application of the pollutant-payer principle, etc....).
- Introducing and popularizing new information technologies in water resources management through the creation of a database and the provision of the softwares required for the exploitation of this database.
- Suggesting the necessary institutional measures for the implementation of this strategy, particularly concerning its organizational, legislative, economic and financial components.

The elaboration of this strategy document requires the categorization of Islamic countries in more or less coherent regional units at the hydro-climatic level to constitute the geographic cells of the planning process.

4- Quantitative water resources management

The draft strategy for water resources management in Islamic countries, in the long term, is based on the following axes :

4-1- Water resources assessment

The assessment of conventional as well as non-conventional water resources (recycling waste water, briny water, drainage water, irrigation water, desalination of sea water...) constitutes the basis of the whole planning process, as it should encompass all the necessary data for the quantitative assessment of the water resources.

a- Hydrological data

- Rainfall

To carry out the quantitative water resources evaluation, rainfall data at the different hydrographical stations should be collected over long periods of 40 to 50 years.

- Rivers water

The evaluation of surface drifting, the surveying of valleys' flows in time and space, over long periods and in a periodical way is an important stage in the process of water resources evaluation.

- Return flows

The control of the return flows is contingent upon direct management and surveying. In many countries, the management of return water, with its various uses, has never been integrated in water resources management for the simple reason that the economic

value of water has never been introduced. As this notion of value is inexistent, it will be difficult to reliably incorporate the volumes of return water in the water resources calculations.

b- Groundwater Resources

- **The water balance**

The evaluation of renewable resources of every water basin is the most important technical problem in the management of water resources. Consideration of the inter-annual variation of hydrological conditions and long periods of drought cycles is important in the evaluation of a given water basin's records and constituents.

Concerning the samples extracted, particular investigations should be conducted to have the best estimation of their values.

- **Piezometric data**

Piezometric data are of great importance to the evaluation of groundwater resources. Their collection should be assured periodically (humid period, dry period, etc) and stored in easily accessible databases.

- **Surveying and aquifers dimensions**

The direct recognition (through mechanical drilling) or indirect (through geophysical prospecting of aquifers) proves to be the basis of any evaluation of groundwater resources.

4-2- Forecast of water needs

4-2-1- Drinking water and water used in industry

The specific studies realised in each country should synthesize the principal characteristics of the demand for drinking water and water used in industry for each identified geographic entity (past evolution of industrial and drinking water demand, growth rate, rate of linking, networks output, equipment, public or private management of water, evolution of pricing …). A critical analysis of methodologies and forecasting adopted during previous studies will help overcome probable incoherence in future studies. The critical analysis should consider all parameters defining water demand and should be carried out through the study of all field statistical data.

4-2-2 Irrigation water

Specific studies should perform the evaluation of agricultural areas and corresponding water needs at the present time, as well as in the medium and long term. They should also describe and assess the evaluation procedure followed in previous planning studies. These needs should reflect the different objectives of national planning and consider the different agricultural reform and planning programmes. In addition, complementary investigations should be carried out to define potential lands for irrigation in small and medium hydraulic

measures (S.M.H) and large hydraulic ones (LH) according to the kind of water resources planning (dams, deductions of water stream lines, underground waters) and by stations.

Comparison of needs vs. resources

*** The first step of the strategy**

The elaboration, for each unit of planning or group of planning units, of the water resources planning and management schemes to satisfy water needs, will be processed on the basis of studies related to the evaluation of water resources, particularly in terms of their uses. These planning and water resources management schemes will include the construction of dams, determining of water stream lines, surveying of the types of underground water, as well as the possibilities of water resources development pertinent to water supply and demand management concerned with aspects aiming at cutting down water demand.

Complete simulation samples may also be outlined for every water resources development scheme. These simulation samples should take into consideration:

- Dams and water diversions contributions;
- Underground water resources
- Contributions of the water of intermediary pools, waste water, and return flow;
- Irrigation usage and consumption of large, small and medium hydraulic resources;
- Drinking water consumption by urban and rural populations and industry;
- Transferred waters (or transferable waters) to other areas;
- Localization of each resource, storage and derivation point.

Irrigation return flows should be carefully analysed, particularly in drought years to be evaluated in a suitable way and to avoid underestimate or overestimate of water resources.

The simulation's objective is to evaluate the performance of water resources planning schemes, to define allocations in deficit years, and to adjust the projects dimensions accordingly (dams, transfer works,…). A deep reflection over the criteria of acceptable deficits will be undertaken, taking account of the economic and financial aspects related to projects profitability and experiences which have been accumulated during drought periods.

*** The second stage**

The economic optimisation should be made with respect to two perspectives: economic efficiency and local and regional development. It will be carried out by a software suitable and adapted to the social and economic context of the state as well as to the natural conditions of water resources. The optimisation calculations are done on three phases: each level of calculation should rely on the results of the previous level.

At the level of each regional unit, the optimisation calculus aims at achieving the maximum valorisation of the different water resources volumes that may be allocated to that unit.

Concerning the pools and hydrographical areas bringing together many regional units, the calculations will seek to optimise the water resources planning and allocation systems for different exchange volumes with neighbouring pools in the form of transfers or water import.

All hydraulic systems to be revealed by estimates will be introduced in the optimisation programme in an adequate synthetic form.

The selection of the planning schemes and water resources planning and management liable to ensure supply and satisfaction of water needs should equally consider the sources and terms of financing investments and be based on a process of political participation of benefiting parties, which will allow the identification of the priorities of water resources planning as well as the level of participation in the financing of water resources development schemes.

5- Tools and methodologies of quantitative water resources management

The quantitative management of water resources has been among the first concerns of humans, particularly in arid areas. Man has thus been able to develop a number of technical tools, some of which date back to ancestral times (rainwater reservoirs refeeding underground basins through underground recharge or snow melting…). Among contemporary tools figure the appropriate models of help to decision-making, development of research in water economy and non-conventional solutions (artificial rainfall, recycling of waste water, desalination of sea water).

6- Improvement of water efficiency in irrigation systems

6-1- The existing state of affairs

The irrigation sector is the biggest consumer of water in arid countries (99%). Consequently, this irrigation deficiency deprives the sector of large quantities of water liable to enlarge arable lands in a remarkable way.

In Morocco, for instance, traditional irrigation entails the loss of 30 to 40 percent of water while the loss in irrigation through water sprinkling is estimated to be 10 to 20 percent. This is mainly due to dysfunction of boundaries, the poor condition of mobile water sprinkling material, the absence of a counting system for consumed volumes and farmers' tendency to over-irrigate.

6-2- Programs and measures to be adopted to improve the performance of irrigation systems

To improve the performance of irrigation systems, preserve hydro-agricultural equipments and ensure the irrigation water service durability, public authorities should work out programs and measures to contribute to the improvement of the efficiency of irrigation systems. This concerns among other things :

- The rehabilitation of irrigation networks;
- Financial incentives to farmers to make them use modern techniques of irrigation (localized irrigation);
- Promotion of the participatory management of irrigation via the creation and adoption of local structures (associations for irrigation water users).

7- Protection of dams against silt

The factors favouring the process of hydraulic erosion are of a natural and anthropological character. Natural factors are inherent in the expansion of mountainous areas, the existence of fragile substrata, tough climate and the weakness of the coverage rate. Anthropological factors result of the mounting pressure on natural resources exerted by rural populations through

disorganized exploitation of large forests and lands, and the extension of arable lands to marginal spaces, etc.

In highlands, the stakes pertaining to the erosion phenomenon are apparent at the level of the degradation of soil, which is the basis of any agricultural, pastoral or forest production, while such stakes in depressions could be noted at the level of the supply resources, which are a vital element for the economic and social development of states.

8- Usage of non-conventional water resources : desalination of seawater

The applicable techniques of water desalination are classified in three categories according to the principle adopted :

- Processes involving a change of state : freezing and distillation;
- Processes using thin plates, inverse osmosis and electro-dialysis;
- Processes working on chemical links: ions exchange.

Among the above-mentioned processes, the distillation and the inverse osmosis have proven to be effective in seawater desalination, as they are the most widely marketed in the world.

Certain Islamic countries undergoing a water shortage (Gulf states) have come to use this non-conventional resource as they have an important fossil energy reserve such as Petroleum as well as renewable energies.

9- Qualitative water resources management

The quality of water resources is persistently deteriorating, in line with the decline of the socio-economic conditions in different countries. To deal with this situation and preserve water resources, national strategies, at the level of each country, for water resources quality protection should be elaborated and strengthened.

9-1- Qualitative assessment of water resources

The deterioration of water resources quality is associated with the insufficiency of sanitation, the quasi-inexistence of purification systems, disposal of industrial waste in natural surroundings without any treatment, excessive pumping in aquifers, pollution spread due to the excessive and irrational use of fertilizers and phyto-sanitary products. Likewise, the growing production of solid waste adds to the degradation of surface and particularly groundwater.

The impact of pollution on water resources is often demonstrated through sanitary problems (water-caused diseases) and the degradation of the aquatic eco-systems, let alone the extinction of animal and plant species. The identification of the principal sources of pollution threatening the quality of water resources in each country is indeed indispensable.

Concerning sanitary waste :

The calculus base is equivalent to inhabitant “EH”. It entails :

- The specification of water flow coefficients per capita;
- The localization of domestic water flow and the specification of its volume;
- The estimation or calculation of rejected volumes.

Concerning solid waste:

The data concerning the principle pollution seats (wild waste dumps for example) should be identified. Pollution flow will be calculated by surface unit. As the major part of solid waste is put in non-regulated dumps (in some countries) that are neither geographically localized nor described, it has become necessary to survey all the solid waste sites (regulated and non-regulated) to define localization, surface and volume of waste. Moreover, waste characterization in each site is essential for an understanding of the pollution nature in these sites.

*** Definition of counter-pollution programs**

Concerning industrial activities :

Specific programs in defined areas should be carried out throughout the territory of each country. This concerns the regulation of water flows, definition of quality objectives, and request industrial factories to make periodical analyses and reports on their water flows.

Concerning domestic liquid waste :

Technical solutions to the treatment of domestic liquid waste problems should be adapted to the specifities of each country and oriented towards low and high-level natural treatment systems (lagooning, soil treatment system, etc.). These are cost-saving solutions requiring less maintenance.

Concerning mining activities :

For a better understanding of the situation, a detailed study of the impact of the mining industry on the quality of water is advisable for certain countries with far-developed mining activities.

Concerning solid waste :

For countries with hardly any controlled waste dumps or solid waste treatment systems, and to minimize the impact of solid waste on the quality of water, it is advisable to elaborate technical studies of the principal sites of existing or planned waste dumps.

Concerning agricultural activities :

The protection zones for underground water control should be strictly defined and regulated. Specific studies on pollution spread and its impact on the quality of water resources are necessary before suggesting or developing corresponding counter-pollution programs.

Study of accidental pollution

Accidental pollution constitutes a serious threat to surface and underground water resources quality. This kind of pollution necessitates specific means liable to reduce its impact on water resources.

Four kinds of accidental pollution can be identified :

- Transportation accidents;
- Domestic accidents (breakdown of waste water treatment stations);
- Industrial accidents (accidental throw away);
- Accidents of transfer and storage of hazardous material.

The objectives of the study of accidental pollution at the level of each country are :

- To determine the needs in terms of the necessary information for the elaboration of a national plan to control dumping.
- To provide a record of previous accidental pollutions.
- To study the trends in the transport of hazardous material and the resulting accidents.
- To draw up a list of the chemical substances and products transported throughout the countries.

Accidental pollution is inevitable. However, some measures can be taken in order to prevent the reoccurrence of accidental pollution incidents and to be prepared to deal with those that might occur in the future. The identification of the existing data and documents on accidental pollution will allow the elaboration of a database that will make it possible to elaborate a national plan to deal with accidental pollution. This database will be used in order to :

- Evaluate accidental pollution risks on the basis of specific chemical substances and products;
- Identify the regions that are most exposed to danger, and evaluate the risks of accidental pollution incidents.
- Determine the basic characteristics of the situations conducive to accidental pollution.
- Determine the needs in terms of legislation and institutional reform.

9-2- Determining the tools and methods for qualitative water resources management

The objective will be the elaboration and the implementation of a program to protect water resources on a national level. This document will allow the identification of realistic strategies of pollution control in order to ensure a sustainable development in Islamic countries.

a- Defining the water quality objectives

Water quality objectives should be established on the basis of the current state of water quality and the pollution-related forecast, with a view to fulfilling, in the short, medium and long term, the population's needs in terms of available water with a suitable quality. For instance, the short tem objective (5 to 10 years) consists in the stabilization of the global state of water quality, whereas the long term objective will be the improvement of water quality to a given percentage in comparison with the current levels and the determining of a reference-value to assess the rate of pollution and make a distinction between natural and man-made pollution. This will be achieved through the elaboration of a program to prevent accidental pollution and a de-pollution program aiming at the reduction of pollution levels.

The quality objectives will make it possible to orient pollution control efforts and to establish, not only priorities, but also efforts in terms of law-making (e.g. maximum waste values), financing of operations, organization, follow-up and sensitizing, distribution of tools, provided these efforts are integrated in the legislative arsenal of each country and should be accepted and made known to all management partners.

b- Importance of water resources protection

In order to prevent water quality from becoming an impediment to sustainable development, integrated water resources management within the framework of hydrographical basins has to be adopted. It must be supported by all actors in the field of water and water users, and has to fulfill the relevant needs. In addition, all actors in the field of water should be involved in the management process.

The success of water resources protection program depends on the existence of a real coordination between water actors and partnerships with the private sector in particular, with a view to forming a financial partnership through the recovery of water usage or pollution royalties that should contribute to the financing of water protection and purification on the one hand, and which could serve as a deterrent on the other.

c- The Economic value of water

Water has an economic value, which is also called the global economic value, which amounts to the sum of the water usage value plus its intrinsic value. During the economic evaluation of water as a resource, water quality should also be considered. A more important value will be attributed to high-quality water. The direct usage value of higher quality water can be determined by referring to the market price of drinking water. As for the intrinsic value, which consists in the original value and the current value of water (the value attributed to water for its simple existence), it could be evaluated in terms of percentage of the usage value, following the country.

10- Elaboration of strategies for the protection of water resources

10-1- Pollution monitoring operations

The protection of water quality can be achieved through a series of actions and strategies allowing the achievement of the planned objectives in terms of water quality, provided these are set up in the suggested deadlines. These actions can consist in preventive measures (reducing pollution risks) or curative measures (depollution).

Prevention measures should be part of a program supported by sound legislation and financed with sufficient funds. This will reduce long-term investments aimed at the treatment of wastewater and the control of diffused pollution sources. By way of illustration, we can cite the protection perimeters, the prevention of diffused pollution sources and the elaboration of the accidental pollution prevention program.

As for the measures aiming to reduce the scope of pollution, various strategies can be suggested, relating to the treatment of domestic wastewater and industrial depollution.

a- Definition of protection perimeters for water resources

Given the multiple nuisance factors, resulting mainly of the extension of urbanism and the increase in industrial and agricultural activities, the definition of protection perimeters around the catchment areas of drinking water and water reservoirs destined for the production of dietary water is imperative.

In order to face this situation, three protection zones must be instituted around the public dietary water reservoirs, sources, wells, drillings, water conveyance and distribution.

- Immediate protection perimeter

This perimeter aims to protect installations from bacterial pollution and whose terrains need to be acquired and protected by the institution in charge of the exploitation of the installations. These terrains are an integral part of the works for which they have been acquired.

Close protection perimeter

This perimeter is destined to protect installations from chemical pollution and inside which all activities or works likely to be a source of permanent pollution are prohibited. In addition, inside this perimeter, all deposits or works representing a risk of accidental water pollution are controlled.

Distant Protection Perimeter.

Inside this perimeter, activities, works or deposits that represent a water pollution risk in view of the nature and quantity of pollutant products associated with them, are controlled.

The definition of protection perimeters should constitute an essential element of water resources protection strategy in Islamic countries.

b-Observation and Alert Systems

The objective of observation and alert stations is to prevent accidental pollution likely to endanger water supply to water and wastewater treatment plants, river water, or alluvial ground water. They can be set up on rivers, surface water and wastewater treatment stations and alluvial ground water.

Sampling is carried out continuously through automatic analyzers that make it possible to know, at any time, the quality level of the resource. Using this information, a computer model is built up that calculates the evolution of the polluted water during its transit between the alert station and the intake, on the basis of the river's hydraulic regime. Therefore, we obtain :

- The forecast graphic of the ground water passage in front of the intake.
- Arrival hour.
- Evolution of the concentration of the polluting factor concurrently with the ground water progression.

Alert stations are generally equipped with sampling devices that collect on a continual basis, and at given intervals, the water samples. These samples are transported to laboratories in order to be used, if need be, to precise the exact nature of the polluting factor and to carry out the treatability essays, that is to determine, for each treatment stage in the plant, the deduction that it allows with the existing treatment levels and through the use of crisis reactants such as powder active carbon.

The conjugation of the computer model and treatability tests makes it possible to define the measures to be taken in the plant.

Therefore, the time necessary for the arrival of the front of polluted water makes it possible to store the largest amount possible of drinking water in order to fill treated water reserves.

The second stage comprised between the arrival of ground water and the limit in terms of concentration of the polluting factor corresponding to the treatability maximum level will still be used in order to produce clean water, but with a crisis treatment. The level above the ground water will be too polluted to be treated, and the water supply will be guaranteed by reserves and intercommunications with neighboring networks.

The computer model offers the possibility to calculate the duration of this halt phase of the plant, which will make it possible for the distributor to use the emergency supplies in an optimal way. When the concentration diminishes and goes below the treatability level, the plant uses crisis configuration until the end of the pollution groundwater passage.

Continuous analysis is a quality management tool that is gaining more and more importance in water professions, particularly on the level of treatment units. It might also be considered as a monitoring tool that provides measures contributing to enriching the water quality databases. Continuous analyses have several application, among which :

- They are representative vis-à-vis the laboratory measures.
- Accuracy and repetitiveness of the obtained data.
- Real time monitoring of water quality.

This technology can constitute a very important tool to be set up in the treatment stations that supply big cities in Islamic countries.

c- Wastewater Purification.

Wastewater purification generally includes the following stages :

Phase 1 or pre-treatment : consists in eliminating rude elements, organic debris and minerals of significant dimensions.

Phase 2 or primary treatment : consists in eliminating the materials in , whose density is significantly different from water density, by making use of this difference.

Phase 3 or secondary treatment : consists in eliminating the remaining pollution, constituted of colloidal or dissolved materials, through the acceleration of the natural destruction of these elements through the action of microbe flora in the presence of oxygen.

Wastewater Purification Processes

- Surface spreading or filtration through the ground :

This purification mode can be adopted only after a serious geological study proving the possibility of its implementation, without impairing the receiving water body. Surface spreading has necessarily to be preceded by screening, fine screening, or even primary settling.

- Lagooning :

This is a natural wastewater purification process that allows a separation of the solid elements from the liquid phase by settling, and a biological purification mainly due to the action of bacteria. The process consists in placing wastewater in stabilization basins.

- Seepage infiltration :

This type of treatment requires very little mechanical equipment and provides very good quality water.

- Activated sludge :

The settled effluents are subjected to violent ventilation in activation basins where the organic matter is oxidized. This technique corresponds to the artificial acceleration of the auto-purification process in natural environments. The effluents from activation basins regain a secondary settling tank where the flocs sediment.

- trickling filters :

The principle consists in streaming wastewater elutriated on porous materials covered by a bio-film made up with purifying micro-organisms (bacteria, mushrooms, animals).

10-2 - Identification of Accompanying Measures

The success of pollution control efforts depends largely on the available financing and on the legislative and institutional framework. It rests on suitable and sustainable strategies of financing that satisfy the rigorous cost-benefit ratio analysis. It is significant to well measure the costs of pollution (costs of depollution, of health and environment degradation and in terms of missed opportunities), and the necessary budget to achieve water quality objectives, on the one hand, and to identify all the possible sources of financing for each considered type of action, on the other. In addition, it is necessary to evaluate the urgent character and the profitability of projects, in order to set up the definite priority projects, in a first stage, and to gather the necessary funds or to obtain rapid and sustainable financing.

For each action type, some financing modes are more suitable than others. Thus the private initiatives could be requested in the case of the control of industrial pollution, while the control of domestic pollution has a mainly public character. In many cases, it will be necessary to constitute joint partnerships public/private in order to reduce the costs.

For the case of some countries, law on water introduces the principle of payer-pollutant and the discharges authorizations that fix the limiting values of waste disposal and the royalties to be paid. The royalty can be of the type of royalties or taxes on disposal, according to the alteration of water, of fines in the event of non-observance of the legal standards, financial sanctions in the event of accidental pollution, and of the taxes on the polluting products.

It is important to develop knowledge of the real costs of water preservation, improvement and protection, in order to be able to determine the appropriate royalties and sanctions. The payer-pollutant principle has to be based on precise calculations approved by all the participants before the setting up of the program. The financial royalties and sanctions have to be discussed with the various pollutants, on the national level, according to national principles and water quality objectives, but the implementation has to be carried out on the local level in order to fulfill the local needs and conditions.

The financing of prevention, control and removal of accidental pollution can be achieved only through the adoption of a tax on the potentially polluting products and materials transported through the country. A similar tax could be imposed on the products used in agriculture, intended for the financing of diffuse pollution sources control.

10-3 - Monitoring Water Quality and Data Management

In some countries, we notice that the follow-up and the evaluation of water quality, is characterized by the intervention of several institutions, according to specific missions. In order to deal with this situation and avoid the accumulation of unused or unusable data, the strategy recommends that any collection and evaluation of data on the quality of water resources have to be accompanied by preset objectives and by an improvement of the standards of evaluation and distribution as well as the standards of data quality insurance and control.

10-4- A programme for fighting pollution

The objective of the programme is the reinforcement and the installation of an information communication and transmission structure and the preparation and coordination of the interventions in the event of disposal of polluting substances, in addition to the census of all activities and expenditure so as to fine the polluters that have been recognized as such.

10-5 Use of Information Technologies for Water Resources Management

Information technologies, mainly databases management systems, geographical information systems and mathematical models, are a very useful technical tool for water resources management.

The objective, within the framework of this strategy is the creation of a water resources observatory comprising a database related to a geographical information system and to a series of computerized mathematical models.

- The elaboration of technical tools to assist in decision-making

This base comprises the following models :

- models of simulation of surface water;
- models of forecasting of the contributions of water and floods
- models of optimization of hydraulic systems;
- hydraulic models of quality management and erosion;
- groundwater management models.

- The development of an interface that will allow :

- calculations and checking of the results;
- an easy communication between the models and the databases
- recording of the data;
- making graphic charts of a given zone;
- intelligent support of the system operating;
- providing information useful to decision-making

11- Socio-economic Aspects

This section aims at improving the economic and financial mode so as to allow the setting up of a water resources management strategy. It also aims at setting up national strategies to involve the users and the private sector in water resources management.

11-1- Pricing and Recovery of costs

The strategy aims at analyzing the existing tariff systems in various Islamic countries, establishing the guiding principles of water pricing, and establishing a methodology of water costing.

a- Diagnosis of the tariff systems

The objective here is to analyze and develop a water valorization system which should be set up by the institutions in charge of water resources management, and which takes account of the principles of a rational and sustainable water management and of the financial capacities of the population with low income, in rural and urban areas. This consists in carrying out a critical analysis of the tariffing systems in force applied on drinking water, water for industrial use and irrigation water, and to specify the factors that obstruct the setting up of a powerful water tariffing system.

The strategy thus aims at achieving the following specific objectives:

- Critical analysis of the tariffing systems in force, which aim at identifying the strong points and the weak points with the principle of covering all water mobilization costs;
- Identification of the real or predictable problems related to the current water pricing systems, particularly concerning the evaluation and the conservation of water resources, in terms of quality and quantity;
- The estimation of water mobilization costs included in the currently applied tariffs on irrigation water, drinking, water and water used in industry.
- The analysis of the level of investments recovery .
- The specific analysis of the contribution of water tariffs in the recovery of operation and maintenance charges for water management.

b-Water Tariffing Principles

Three primordial conditions should be fulfilled in order to follow an integrated water prices policy :

- Prices should be theoretically fair, fit and in conformity with the objectives set by the public authorities.
- Water producers and distributors should be able to recover the costs of the services they provide.
- Public authorities should state the objectives of the general policy, set the standards, provide the institutional and legal frameworks allowing a better effectiveness, define a favourable tax and subsidies system, and follow the performance of partners in the sector of water.

In order to achieve a sustainable use of water resources, it is necessary to reduce consumption, even when the consumers are willing to pay the average cost or even the marginal one. The evaluation of water costs on these two criteria does not guarantee that the water resources will not be overexploited.

The marginal costs of water mobilization and production increase with time, given that sites of future dams are less and less favourable (long distances, unfavourable geological and hydrological conditions, deeper wells, more polluted resources, etc).

11-2- The Elaboration of a water cost evaluation methodology

A model should be suggested with the aim of evaluating the cost of water on a geographical entity (the catchment area for example) on the basis of an analysis of expenses and charges incurred by the elaboration of the studies, the mobilization of water resources, along with the management of transport and distribution of water. This water tariffing methodology has to be established for irrigation water as well as drinking water and water used in industry. The royalty to be calculated will be based on an analysis of the marginal costs (that is the additional volumes provided by these works with respect to the costs of mobilization and the annual charges).

In order to calculate the water mobilization cost, we suggest that an evaluation should be made, over 10 years, of the sum of investments and of the increase of the volume that has become available, while calculating marginal costs in the long term. Thus, the cost of water mobilization amounts to the price entailed by adding the marginal costs of the facilities, in the long term, to the average charges pertaining to the exploitation and maintenance achieved by the institutions in charge of the water resources management, according to each unit of crude water distributed among the user sectors.

Chapter 3 : Towards an integated water resources management in the Islamic world

In order for the Muslim countries to be able to face the great challenges of the third millennium as regards water, the integrated administration of water resources through modern ways requires redoubling our efforts in the legal, regulatory and technical fields. It has become necessary to agree on setting strategies of cooperation in the field of the conservation of the available water resources in each country, as well as the scientific cooperation to rationalize water consumption and agree on a full-scale method of preserving water resources from pollution in its various forms. It is advisable that these strategies be undertaken between the States that have shared water resources or unified political mechanisms.

1- The Legal Field

A water legislation is required, as it regulates the various uses of water, and defines the appropriate techniques for its management. There is a need to use new methods and modern techniques in order to elaborate legal texts, and to adopt the method of full-scale evaluation in order to measure the extent to which the projects and programs are compatible with the reality and achieve the sought results. There is also a need to create mechanisms of anticipation. The collection of data would be a first step towards futuristic planning, the creation of data banks, the coordination between these banks, and the promotion of the legal culture of the human resources operating in the field of water resources.

Nevertheless, however important the legal and technical aspects are, their effectiveness is contingent upon the climatic conditions, even if modern technology has offered great potentials of investment, as it has alleviated the water crisis in some Muslim countries. This technology requires, however, heavy investments which cannot be afforded by all Muslim countries, though there remains a possibility within the framework of technical and financial cooperation, either between the States of the North or those of the South, or else within the framework of cooperation with the specialized, financial international organizations. It is worth noting that the future of the coming generations depends on this possibility.

The integrated management of water resources is based on a basic, modern legislation and workable measures. However, the irremediable problems reside in the multiplicity of the actors intervening in the field of waters, in their lack of a strong coordination, and in the presence of important loopholes in the laws and regulations in force, especially those related to the protection of water resources and the anti-pollution measures, etc.

Despite the measures undertaken against water pollution, this water management remains ineffective. This is shown by the spreading of water-transmitted diseases, such as typhoid, meningitis and poliomyelitis.

In order to develop the legal frameworks of water resources in Muslim countries, the latter have to redouble their efforts if they are to ensure water security in the Islamic world. These efforts consist in designing general rules and principles that inspire the drafting of new, comprehensive water laws which suit the situation and specificities of every Muslim country, or at least the amendment or finalization of the laws in force, supplementing them with the basic, general principles governing the rules of the integrated management of water resources,

while they are based on the linkages between both subterranean and surface resources. These resources should also be submitted to an integrated investment plan and take account of the modern techniques that have affected the modes of irrigation, discharge and utilization of treated and return waters.

The standardization of criteria and definitions aiming at harmonizing the water laws within the Islamic world requires the setting of a unified reference law of water resources that includes the basic rules of a rational management, which consist in basin-level management and the management of demand rather than supply. It also calls for the application of the-polluter-pays principle and that of sustainable development, as well as the creation of a police for the riparian water resources, the energizing of the State water police, the adoption of a water tariff policy, and courts entitled to settle disputes. It needs as well the issuing of new laws aiming basically at closing the loopholes in the existing water laws, or at their finalization, concerning the following issues:

* the restrictedness of water resources in Muslim countries and the variability of their produce;
* the coast law, as most Islamic seashores are subject to many types of pollution;
* the law on the protection of seasides against erosion;
* the passing of a law adopting new measures related to arsenical pollution of subterranean waters;
* the passing of a law that regulates the general rules and joint measures to ensure the shares of Muslim countries lying downstream from the mouth of rivers, when it comes to international rivers;
* a law providing for anti-desertification, anti-drought and anti-floods measures;
* a law providing for measures against the pollution of waters, including the continent-originating sea pollution, and prohibiting the discharge of untreated, sanitary and industrial waste water into the seas and oceans;
* a law addressing the multiplicity and inconsistency of the uses of water, while there is no alternative to it;
* a law on the pricing of the water resources and the imposing of taxes on the air pollution;
* the passing of a law on non-classical waters along with their usages;
* a law on the adverse effects of water resources in the case of extreme scarcity and extreme abundance alike;
* the passing of a law on drinking water;
* the importance attached to the principle of the sustainability of water resources;
* the setting of a comprehensive strategy in order to determine the sites at risk because of desertification and drought, and also the setting of objective, measurable standards while assessing the projects and programs, with a view to defining their profitability and interest for Muslim countries.

2- The Regulatory Aspect

The integrated management of water resources in Muslim countries requires the defining of the responsibility lines and the relationships between all units. Since the water resources need a unified management to be in line with the unity of the matter, the comprehensive perspective

towards water calls for standardizing the supervision in such fields as the investigation, prospection and the design of schemes, so as to create a framework that makes it possible to allocate quantities to all uses, and to entrust each unit with the attributions that suit its technical and regulatory specifications.

By doing this, along with the passing of the necessary laws, the integrated water management will have found a favorable context for the investment of the water resources in a rational way, so as to put an end to the inconsistency and multiplicity of action, with a view to raising the utility and profitability.

As the water resources are increasingly subject to many impurities, it becomes necessary to further control water consumption, define more clearly the attributions of every unit, and achieve cooperation between the control departments, local communities, and the judicial bodies entitled to rule judgments over the water-related infractions.

In order for the integrated water management to coordinate between all units, it should have a regulatory character on all levels. Besides, the regulatory framework of the water police should be supported, with a view to improving the effectiveness of monitoring over all water uses to preserve it from any impurity. This is only possible through sturdier efforts on the part of the units in order to achieve the unity of work, hence the unity of the purpose of using water in a rational way. However, the conservation of water resources presupposes the adoption of modern methods to involve the public in the responsibility along with the government, and to arouse its enthusiasm so that its participation would be stronger. It also implies that the Islamic countries experiencing a critical water situation carry out radical reforms on the institutional level, regarding the management of water resources and the change in the patterns of behavior.

3- Privatisation and water users' participation in water resources management

In many developing countries, the state conceived and planned irrigation networks according to its own needs, without consulting the users. The weakness of this step lies in the difficulty in maintaining irrigation networks for long periods. Often, the institutions in charge of irrigation sought to set up new networks, at the expense of the maintenance of those that already existed. Once the building works completed, many organizations are often unable to ensure the necessary exploitation and maintenance. Those that take a royalty for the consumed water in order to cover the exploitation and maintenance expenses have difficulties in recovering them, because farmers often refuse to pay a poor quality service. Thereafter, public subsidies intended to cover exploitation and maintenance expenses are often used to finance new works.

For these and other reasons, the participation of farmers in the management of irrigation is regarded as a means of stabilization, if not a means to increase the share of irrigations networks. A new method should be devised, consisting in increasing the participation of users, which facilitates the circulation of information, gives consumers the impression that they control the situation, and encourages them to ensure the installations' continuity. These principles are absent in many systems managed by public authorities. As long as they do not have a say in the initial design and planning of the public irrigation system, farmers do not feel concerned by its maintenance. Examples show that when farmers' experience and knowledge are taken into account in the planning and implementation of irrigation systems, the results are

much better. In addition, farmers are more willing to contribute in the maintenance if they benefit of the system's good functioning.

Another step consists in encouraging farmers to develop irrigation through a private commercial system or the equipment of private wells. These and the communal systems have considerably contributed to the development of irrigation.

International experience makes it possible to bring into shape four conceptions that are different from the participation in the management of irrigation water and that can be adopted within the framework of this strategy, namely :

- the creation of water users associations;
- the delegation of the functions of the public management institutions to water users associations;
- the adoption of royalties for irrigation services;
- the development of private irrigation.

- The case of drinking water supply systems

In most developing countries, water and purification services work badly, and maintenance problems are chronic. Given that leakages are not repaired, that the old drainpipes are not replaced, and because of illegal connections and the lack of water meters, a high proportion of supplied water is not counted. In industrialized countries, this proportion ranges between 10 and 15 % of the net production of water. The proportion can reach 50% in developing countries.

a) Supply of water to urban zones

In urban zones there are four principal systems of the involvement of the private sector in water management. This is done through service contracts, management contracts, leasing contracts and concessions.

Within the framework of service contracts : the public water service concludes a contract with a private company stipulating that the company provides specific services such as the reading of meters, invoicing, the recovery and exploitation of the equipment.

Within the framework of a management contract : The contractor assumes entire responsibility for the exploitation and the maintenance of the water supply system and is free to take routine decisions.

Within the framework of leasing : a private company leases the equipment from the authorities and assumes the responsibility for the exploitation and maintenance. The contractor is in charge of operation fees and the replacement of the material whose economic lifespan is limited, the public authority being responsible for the fixed assets.

Within the framework of a concession : a private company finances the investments for the fixed assets and the operation capital. The installations remain the property of the companies until the end of the concession, and then they are handled back to the authorities.

These provisions were adopted long ago in various Islamic countries, with a view to achieving a better water management. The strategy will try to popularise these management modes in order to benefit from their advantages whenever the social context is favourable.

b) Water supply to rural zones

The success of a small number of drinking water supply programs in the rural zones, implemented by the World Bank in Africa has shown that there is a link between the community's involvement in the conception of projects, the users' participation in the exploitation, maintenance and the quality of the provided services and consequently to ensure the durability of water services.

The merits of the community's participation do not need to be proved. Consequently, a radical change of the attitudes of the public actors towards the adoption of a participative approach in every intervention in rural areas is necessary.

4- Sensitization and Social Responsibility in Water Resources Management

Islam is an authority and charter which guides people in their behavior in general, and in the water resources management in particular. Man is seen in Islam as a vicegerent on earth whose task and responsibility is nothing more than ensuring the utilization of all resources, including the water resources, in a rational, fair and sustainable way. It has turned out from the experiences of the pioneer countries in the field of water resources management that participation consists in spreading a feeling of ownership through the involvement of the stakeholders who can influence policies, alternative designs and the investment options. The increasing participation of local communities in the water management will undoubtedly increase the chances of improving the modes of selection of projects, services accessibility and cost recovery.

The rational water resources management, through raising the awareness of the public and all users about the responsibility incumbent upon them in using these resources in a rational way, requires us to take into account the role played by the population, which makes their participation very significant for the development and preservation of water. Most recommendations of the international conferences stress the positive side of this participation. Moreover, the majority of developed countries having abundant supplies of water involve consumers in the integrated management of water resources thanks to the instruction efforts and focusing on the nexus between water resources and the cultural and economic aspects of societies, through educational and research institutes and institutions, as well as the NGOs and international governmental institutions. Such an approach aims at striking a viable balance between water supply and demand. The fact that the above-mentioned institutions are overlapping makes it easier to find solutions to the water problems not by having recourse to mere technical reasoning, but rather by adopting a global approach based on visibility and stabilization.

The creation and promotion of irrigation systems will enable the public to participate in the water management and prompt it to assume its responsibility in using water in a rational way, and see to it that water facilities are preserved from deterioration and waste, which allows the State to get progressively freed from the maintenance and protection costs. Some forms of

cooperation have begun to emerge between governments and the private sector regarding the protection of water resources in particular, and the environment in general.

The mass media play an extremely important role in liberalizing people's outlook on the issue of water, and in rationalizing their behavior while using it. They also show its importance and the risks that are entailed by its loss or scarcity. They are also effective in complementing the efforts made in water-related fields. Hence the necessity to include awareness- raising into the plans of preserving natural resources in general, and protecting the water resources in particular. In this regard, it is imperative to devise strategies and plans of water resources management, an to economize on their use, relying on Islamic concepts and means in the general sensitization campaigns. It seems the absence of a public participation and the fact that consumers are misinformed are the two main reasons behind this gap.

Besides, the management systems in place within Muslim countries are often inappropriate, due to the prevailing central management regime and to the local operators not assuming their responsibility regarding the issue of water. Furthermore, the private sector suffers the slackness of administrative procedures, which affects the effectiveness of the measures undertaken.

In order to consecrate social responsibility regarding water, the following measures should be undertaken:

* the incorporation of the Islamic teachings on water conservation in the Friday sermons, in education and in the mass media, so as to enhance the general awareness of the importance of dealing with the issue of water scarcity. This requires the redoubling of efforts and coordination between all stakeholders, so that they take part in the integrated water resources management.
* The setting of a comprehensive, interactive strategy regarding the economy in water use, involving all consumers and all relevant potentialities, such as religion and politics, along with the local actors.
* The promotion of the participation of civil society in the water resources management, and the implementation of related strategies and programs, and the creation of civil society organisms, and the setting of a legislation in support of its participation.
* The organization of training sessions for the supervisors of the literacy campaign to integrate the strategic aspect of the water resources, as well as the importance of economizing on them, into the literacy programs.
* The organization of information campaigns with a view to improving the citizens' behavior towards the water resources, health, and employing the Islamic teachings in this regard.

5- Cooperation between Islamic countries in the field of water resources

The most important condition in the problem-solving and good employment of water resources is the existence of systems aiming at a rational use of these resources instead of their exhaustion. Rational use means the use of small amounts in the long run in place of rapid use in the short run.

The concern about the issue of the water resources exploitation mechanisms along with the emphasis on the importance of their optimization is not new. More than thirty years ago, the World Bank has been working towards developing many strategies including capacity building. However, the problem lays in the fact that the traditional way is characterized by impatience, and the leniency to consider institutions as a static fact, and an all-inclusive means of honoring commitments and securing rights.

To shed light on the different mechanisms liable to promote relations among Islamic countries, we will expose the various fields which could lead to the exploitation of water resources according to modern techniques, with a view to securing a sustainable security to the water resources in the Islamic countries, as well as food security, provided such fields are exploited in a modern and methodological way.

5-1- Cooperation

An exemplary society is one that follows the model of well-structured human societies and avoids discord and hostilities. To achieve this purpose, Islam has recommended cooperation for the well-being of all members of the Muslim nation. God says : "Help ye one another in righteousness and piety, but help ye not one another in sin and rancour". From this perspective, cooperation in good and righteousness leads undoubtedly to accord on every fruitful endeavor considered a source of joy in life or in the hereafter.

In this respect, cooperation can work out the most feasible policies to manage water resources as well as widening our knowledge of some influential factors in the official and unofficial practices and implement policies to come up with the best means to manage water resources. This brings to the fore the dynamism, flexibility and solid reasoning of Islamic rules in meeting the challenges faced by Islamic countries concerning fundamental issues such as the issue of water. This is clear through :

- The realization of pioneering local development projects to limit the scope of the phenomena of desertification and drought;

- The elaboration of mechanisms to protect the ecological systems of joint watercourses, and to prevent, minimize and fight against pollution which may cause considerable harm to other countries from among the joint water course countries or their environments;

- The elaboration of techniques and practices to deal with pollution, and maintain installations, facilities and other works related to a given international water course, and its protection against deliberate pervasive actions or those resulting from carelessness or nature's forces;

- The setting up of an all-inclusive strategy to designate sites threatened by desertification and drought in Islamic countries;

- Support of Islamic countries in the preparation and implementation of its strategies and national and quasi-regional work programs to fight against desertification and minimize the effects of drought;

- Contribution to the enhancement of national and local policies and institutional arrangements liable to optimize water resources and their utilization methods;

- Cooperation on the basis of fairness in sovereignty, regional security and mutual benefit to realize the utmost profit from the international water course and provide it with enough security;

- The preparation of lists of the goods to be prohibited from being used in the international water course or limit and control its use;

- Promotion of benefit from the international water course, and its protection and control in a reasonable and exemplary way;

- The Sketching out of the international watercourse's sustainable development plans and work towards the implementation of adopted plans.

5-2- Financing

The heavy debt burden and the brain drain towards the "North" in addition to national catastrophes including drought, desertification, social regression resulting from illiteracy, poverty and illness constitutes one factor leading to the deterioration of the water problem. The Islamic countries are no longer able to bear the consequences of this fact, particularly in a context characterized by a decrease in capabilities and increase in needs, which necessitates the adoption of a bold approach and the reformation of the mechanisms undertaken in financing.

The existing financing resources of projects pertinent to water resources in Islamic countries can be summed up in three principal public and foreign sources:

Public financing consists in the amounts allocated by the state from its public expense balances for water resources. This shows that public financing consists of all transferred expenses seeking to secure supply water to all productive sectors.

Foreign financing consists in the foreign transfers allocated by granting bodies in the form of donations and loans in addition to "softly-paid" loans in case these are government institutions. Foreign financing plays an increasingly important role in financing investment in the field of water resources in Islamic countries whenever these countries are poor in terms of resources and modest in their growth level. The states are also required to find the role that can be played by the private sector in this regard.

5-3- Scientific Research

Islam calls for knowledge and learning and did not put limits or obstacles to knowledge. The Prophet (PBUH) said : "seeking knowledge is an obligation for every Muslim". There is no limit for learning, and man is supposed to remain in a continuing learning process whatever his age or knowledge. The Almighty God says: "but say : O my Lord ! advance me in knowledge". The care for and concern about scientific research certainly determine the future and the position of states among nations of the world. In the same way, Universities cannot perform their role unless scientific research contributes effectively to economic and social development.

Research economically and scientifically entails deep thinking about the means of its investment, and the highlighting of the steady interaction between the world of economics on the one hand, and technological research, development and innovation on the other hand.

The concretization of scientific gains in the form of skills, expertise, techniques and technologies leads definitely to guaranteeing sustainable development. Within this framework, it is desirable to enhance capabilities in the research field and the transfer of technology in the following domains:

- Enhancement of the capabilities of the research and academic centers in the Islamic countries, particularly in the field of water economy, desalination, purification and recycling of waste water, and the techniques of combating desertification, soil erosion, meteorology, and protection against flood....

- Facilitation of access to modern techniques of information and communication, which open new horizons for the orientation of the use of resources in the Islamic countries.

- Development of the desalination techniques with the aim of reducing its costs and making it accessible to all.

- Promotion of scientific research to the level required to face challenges and achieve the desired development through associating university research with development projects.

- Carrying out studies, making the necessary legal, institutional and economic reforms, and working out a model bringing together integrated administration of water and the participation of the public to make use of water in a well-planned way liable to serve the interests of the community;

- Allocating financial resources to higher studies in universities and specialized higher centers to work on the better management of water resources and economy in its consumption.

5-4-Technology Transfer

The twenty first century is considered to be a decisive period laden with challenges that should be overcome to meet expectations. This period is characterized by the impacts of globalization on the productive structures including agriculture and industry. The outcome of these impacts cannot be controlled unless the science and techniques liable to achieve a planned development strategy are acquired.

In this respect, The international scientific community, donor parties and United Nations Organizations should be oriented towards promoting the capabilities of academic and research centers in the Islamic countries, particularly in the field of programs development, consolidation of capabilities related to the local priorities of each region, the most important of which are desalination, new and renewable energies, development of traditional techniques and the use of modern irrigation means promoting a rational use of water. Besides, it is required to extend the use of plants varieties adapted to local environments, especially the scarcity of water, the rise in temperature and salinity degrees, to transfer and develop modern techniques suitable for water resources, encourage researchers, and provide a better scientific practice

considered as one of the reasons for the advancement and persistence of developmental action. Raising awareness about the importance of scientific reflection, research in fields of sustainable development, advancement of action means, and the pushing forward of society to advanced levels of progress and development in furthered speed and with less costs should be associated with all this.

5-5- Enhancement of knowledge capabilities in the field of water resources management

The transformation of scientific gains, in the form of skills, expertise, techniques and technologies for the well-being of people, leads to human, social and economic development devoted to valorizing scientific and technical knowledge through :

- Taking action to fight against illiteracy among women, representing a high illiteracy level, in the countryside and in cities via providing learning conditions particularly in the countryside, and removing the hurdles that stand against the accomplishment of learning objectives, and making available the means required for its promotion.
- Giving importance to Islamic information media on women and water issues, considered as immediate and primary. Emphasis should be put on programs and information material targeting women to upgrade their level and make prevalent social consciousness of water.
- Using on a wider scale the pilot projects in sanitary water drainage as well as in the treatment and safe recycling of waster water.
- Exploiting the available water resources in a reasonable way, sketching out special programs to rationalize its consumption, and searching for unpreserved water resources including rainfall waters and unconventional resources.

5-6- Human Resources Development

At the turn of the twenty first century, and with the events and new changes taking place in the world, leading to the promotion of the value of globalization and competition, joining of forces, seeking power through information, revolution in science, communication and genetic engineering, investment in human development has become the weapon of this century, especially that Islamic countries are in need of promoting the values of innovation, exploration, and respect for the intellect. In fact, getting people ready to face the future is part of the global re-construction of this future. People are the real fortune of the Muslim nation, being the means and the end of any developmental endeavor.

Investment in human capital is a non-ending operation. Human development concentrates, besides the impacts of the improvement of nutrition, health and education levels on productivity and economic advancement, on the furtherance of productive skills and promotion of innovative potential. Here, we have to ask the following question : Why should we be concerned about human development ? The answer comes readily as : development will not persist after foreign aid and loans from the World Bank and the International Monetary Fund have ceased.

5-6-1- Formal Training and Continued Training

Training aims to develop the skill of the person dealing with water resources. The meaning of skill development is embodied in the promotion of the level of the person’s capabilities to improve and upgrade their professional status through carrying out their duties and assuming

their responsibilities. Developing the person's skill is highly valued as it provides them with the necessary means to perform properly through :

- Building scientific, technical and legal capacities at the Islamic level, and energizing specialized organizations and centers for research and strategic studies.

- Working out a plan framework for training sessions in the water resources field.

- Including issues dealing with water resources and economy in its consumption in the educational programs;

- Sketching out plans at the level of directorates for training and continued training in the water resources filed.

- Setting up integrated programs in training and continued training in the fields of investment techniques, the development of water resources and its modes of exploitation in different usages, and highlighting of the particularity of each country.

- Exchanging visits between instructors, supervisors and technicians of all Islamic countries in the water resources field.

5-6-2- In-service Training

In-service training is the most important integral component in filling the gaps existent in the educational system and its revitalization. Investment in human capital is indeed the most rewarding kind of investment. For this reason, It is imperative to organize regular training sessions to keep the trainees updated on all new and modern techniques of water usage (irrigation, industry, drinking water, tourism) and the techniques used to economize in water consumption, fight against desertification, perform water desalination, etc. This will enable the trainee to acquire knowledge and expertise. To make the training achieve its objective, it is advisable to convince the trainee of the profitability of the training and his own commitment to its practical purposes.

6- Database

To face these inconsistencies, it is advised to observe the scientific and legal competencies in the water resources domain in the Islamic countries, draw a map of human capital displaying the Islamic countries undergoing shortage or need in this capital, work out the necessary mechanisms allowing the free movement of this human capital within the framework of cooperation and experts exchange, and enhance scientific and practical research.

It is also recommended to provide and develop national and regional centers for information documentation, its preservation, retrieval and management. The administration of these centers should be entrusted to the concerned states, and the different regional institutions should concentrate on developing regional strategies for water resources management in neighboring water courses and rivers and underground water sources, in accordance with the principles of fairness and equality, along with the clarification of the importance of having recourse to a strategy relying on water demand. It is also advisable to set up information rules, joint

geographical information systems, and an early warning system to observe and control the phenomenon of desertification.

7- Mechanisms

To strengthen relations between Islamic countries in the field of water resources, and enhance cooperation in all technical, legal, organizational, field-specific and sensitization domains, the mechanisms listed below can turn out to be a primary condition for the success of the strategy to be adopted by Islamic states.

- Institution of a consultative council for water resources in Islamic states, whose role will be to prepare and sketch out Islamic policies in water resources, and set up an Islamic law for water. When these Islamic countries shall agree on the institution of an Islamic law on shared waters, the establishment of pilot projects including all situations may become feasible in the Islamic countries.

- Institution of an Islamic center for water resources to be concerned with the basic studies for the development of water resources in Islamic countries. Its main duties will be to :
  * Carry out studies to set incentive taxes for investment in water saving techniques in industry and agriculture, and discounts on the use of domestic appliances consuming less water along with loans, discounts and technical assistance;
  * Devise an integrated methodology to organize and develop water resources management and other associated activities to make it compatible with the water resources integrated management method in accordance with the unity of the material;
  * Develop the techniques of water markets' organization as it is the case in developed countries. The growing scarcity of water in Islamic countries and the increase in its costs in the black market have led to the emergence of disorganized water markets. The existence of these markets may lead to inconsistent practices in the absence of the necessary institutional, economic and legal procedures.

8- Information Network

To communicate with the largest number of people benefiting from the institutions attached to the Islamic Educational, Scientific and Cultural Organization in the field of water resources, and to extend its radiance to the Islamic countries, it is required to establish a website on the Internet to achieve the following objectives :

- The preservation of the competencies, be they technical or legal in the water resources domain, found in the Islamic countries, to benefit from the expertise and capabilities which the Islamic countries can boast in this field;

- The preparation of a water monograph for all Islamic countries and its publication on the Internet to facilitate its exploitation by specialized international or regional bodies or by researchers or other parties.

Chapter 4 : Recommendations and Conception of an Action Programme

From what has preceded one can say that the water situation has become critical in many Muslim countries. Although most of them have overcome the obstacle of water shortage, there are still some which witness an extremely serious water shortage. Also, the failure of most of them to have full autonomy in their water resources can only add to the complication of the development issues. Hence, it is imperative to derive the necessary mechanisms to achieve water security in the Muslim countries.

The impediments to development can be summarized as follows:

1- The general problems relating to the assessment, development and exploitation of water resources

1-1. The general problems of water resources

In the light of the analysis of the water situation in the Islamic world, we can classify water-related problems into two main categories.

First category :

Attributed to natural factors, it consists mainly in the problem of scarcity and shortage of conventional water resources. The geographical position of the Islamic world lies behind this water shortage, in addition to the successive waves of drought that have raged through most Islamic countries.

Second category :

This category is induced by artificial factors relating to human activities affecting the water and environmental balance. One particular example of these activities consists in the water policies adopted, which have to take into account modern basics, such as sustainability, equal distribution and environment safety. As to the population policies adopted, they have been unable so far to put an end to overpopulation, which puts some constraints on the water resources, both quantitatively and qualitatively, and contributes to a great extent to the worsening of the water shortage. This calls for a judicious population policy in order to face this situation.

Water problems could be summarized as follows :

- The unequal distribution of water, as some countries witness a critical water situation while some other countries have a suitable water situation. Yet the availability of water resources for these countries is not enough to make them secure, that is making it possible to exploit these resources, utilize them to improve the living standards of the population, and achieve sustainable development.

- The non-availability, for the Muslim countries witnessing a critical water situation, of enough financial and technological resources appropriate for dealing with this shortage, while the countries that have considerable financial means can have access to water, using modern methods despite the exorbitant cost of such processes.

- Some Muslim countries have abundant water resources, as they have a suitable sewerage system, while other countries suffer the accumulation of surface waters, whose stagnation brings about epidemics.

- The increasing scarcity of water, the rise of its cost, its draining off, along with the process of desertification, soil erosion, the depletion and overexploitation of some water layers. This only damages the groundwater reserves. Also, some developed countries in South East Asia are experiencing a poorer quality as far as their waters are concerned, as well as a higher degree of water pollution and dilapidation as they are failing to rationalize its use, which has increased the quantity of suspended sediments in the rivers' water as a result of the corrosion factors affecting the water canals.

- The contamination of water by organic matter, pathogenic substances and toxic wastes represents a serious problem facing Muslim countries.

In the light of the above-mentioned factors, the general policies regarding the use and management of water resources still fall short of the modern concepts of integrated management despite the efforts being made. Moreover, the issue of riparian waters is likely to make the water crisis even more serious in certain Muslim countries, as many of them derive most their renewable, surface or groundwater resources from water resources that are shared with neighbouring countries.

Moreover, the legal and regulatory frameworks governing the existing resources suffer some deficiencies and loopholes, and the utilization of some of them is done according to methods and techniques that are inconsistent with the modern techniques of integrated water management.

What we are referring to here is **capacity building** with its three components :

The institutional frameworks, human resources along with the legislation, which are extremely important, as they support water policies, programs and projects. In fact, the multiplicity of the institutional frameworks, the weakness of coordination mechanisms between them, the failure to take into account environment considerations, the irrelevance of the water legislation, the lack of qualified scientific and technical executives, the absence of many modern specialties, the insufficient number of scientific research institutions, along with the lack of coordination and of information exchange among them, are all the features that characterize, partly or fully, the institutional frameworks of the Muslim countries. It is, therefore, imperative to overcome these obstacles, which impede the water sector and weaken its performance.

1-2. The problem of assessing and developing water resources

Despite the great efforts that are being extended to assess and develop water resources in various Muslim countries, there are still many problems that obstruct these endeavors, namely the lack of know-how about the water resources, as many of the elements of the hydrological

cycle remain unknown in many countries, the lack of information on the deteriorating quality and pollution of water and the **sensitivity** of water environments to pollutants, as well as their **quasi-stagnancy**, and the inaccuracy of the assessment of the seasonal rivers' water, etc. By and large, the Islamic world's resources remain undetermined. This lack of knowledge is a main impediment to water resources assessment, as it leads to unrealistic planning which could cause considerable damage and bring about many other problems hampering the water resources management and development, in addition to the limited use of modern and appropriate technologies in the water sector, such as the large-scale use of modern monitoring networks, computer systems, information systems, mathematical models, systems analysis and other water resources assessment technologies. There is also a need to use modern technologies on a wider scale in rationalizing water use in agriculture, industry, as well as the domestic uses, and non conventional water resources techniques.

1-3- Water uses problems

The problems become apparent when there is a growing demand for water in the various sectors, especially in the agriculture sector. In fact, most waters exploited in the Islamic world are used in irrigation, leaving over huge quantities that are wasted, which is inconsistent with agricultural production. In addition, the lack of infrastructure, including the system of water pipes and sewage, its treatment plants, irrigation and disposal channels, and all accompanying operating and maintenance devices, all make the water problem even worse, and creates other problems, at the forefront of which are water wastage and pollution.

2- The broad lines of the proposed solutions within the framework of the Strategy

Upon analysing the above-cited problems, and according to their varying degrees in Muslim countries, some broad lines could be put forth as a solution to such problems. As a matter of fact, each country could envisage to adopt one or more of these solutions to overcome the difficulties facing it, and the solution is not necessarily unique for all countries:

- Deriving the maximum benefit from rain water, to be used directly for irrigation or to be stored through the setting up of dams, mountain lakes and surface tanks. Are also subsumed under these benefits the techniques of rainwater harvesting and utilizing it in agricultural soil through building chains and planting trees. There are lessons to be learnt from some countries in the Islamic world with regard to both the techniques to be used and the anti-flood measures.

- Developing new principles, such as water desalination and waste water treatment. Water desalination has become an alternative in its own right in many countries. There are some of them, in fact, which have made considerable progress in this field, especially the countries, and some other which still consider it as one of the strategic choices due to its high cost. Therefore, there is a dire need to support scientific research with a view to developing the water desalination technique and improve its performance. Sanitary, agricultural and industrial water treatment and recycling can also be an alternative, since a large amount of this water is wasted.

Muslim countries are called upon to set up an information network on water desalination and recycling, so as to create an Islamic **nucleus** for desalination-related research and technology development.

- The shared water resources are undoubtedly among the main issues that the Islamic world should be concerned with, especially regarding rivers with external sources and deep groundwater reserves. It is then a must to pursue dialogue between States with a view to signing permanent agreements for sharing the waters of these basins on an equitable basis, after a study of the shared water resources has been conducted or updated.

- Any adopted policy must take into account the existing objective circumstances and external factors affecting it, and should be founded on a sufficient, accurate and clear scientific basis. It should also aim at sustainable development, without any prejudice to the environmental balance. Such factors also include the availability of information and data through water monitoring networks (quality and quantity) designed to prepare databases allowing to make the right and necessary information available at the right time and place.

Moreover, using, on a wider scale, modern techniques allowing an accurate water resources assessment like the mathematical models for groundwater flow and pollution and hydrological models for surface water, and using the Geographical Information Systems contribute to the best decision-making in any development process.

In order to achieve this goal, the following conditions must be fulfilled:

- The availability of the technical, administrative and legal framework which guarantees the implementation of the water policy and its requirements, like the restructuring of the various sectors concerned with water issues and enacting the appropriate legislation.

- Involving the parties directly concerned with the water policy, such as the beneficiaries of water utilization, while assigning an economic value to water in development policies so that it could be no longer wasted and polluted.

- Continuous qualification along with training on the various techniques play an important role, as it allows a better assessment of the water resources and the improvement of the management, protection and rationalizing of the use of such resources. Scientific research is no less important, as it contributes to removing obstacles and finding effective solutions to the water problems. Thus, it is necessary to support scientific research which takes into consideration the circumstances prevailing in the Islamic world so that they provide the appropriate solutions through techniques maximizing the benefits derived from the water sources with a view to protecting and exploiting them on a sound technical and economic basis.

In order to be able to establish a standardized policy for developing water resources in the Islamic world, attention must be focused on the development of the Islamic world's water information systems within two complementary trends. **First**, the support and development of the water databases on the national level for the countries that have made good progress in this

area, and the focusing on standardizing the methodologies used and making them compatible with one another in order to facilitate the collection and exchange of information between Muslim countries, particularly the ones sharing surface or groundwater territorial basins. This trend consists, on the other hand, in backing the efforts being made in the other countries, which are still in the phase of setting up water databases.

The **second** trend consists in setting an Islamic database covering the Islamic world and giving top priority to the data collected about the basins that are shared between Muslim countries, as it is considered to be one of the most important databases in the Islamic water network which allows the exchange of information pertaining to the basins that are common to the riparian States for a better management of water resources. It is then crucial to set an Islamic water information network, which consists in a national network as well as an Islamic one.

- As regards capacity building and human resources development, they must receive special attention so as to fulfil the water sector needs. **Hence the need to work out a territorial program in support of the national programs in the field of formal and in-service training and awareness-raising in the water sciences**. Further interaction must also be achieved between universities, research Institutes and water institutions, since the responsibility for water sciences curricula lies with these institutions. This program could cover, among other things:

  - Defining the needs of Islamic countries in terms of professional and legal senior executives in the long and medium terms.
  - Determining the priorities and the fields of training on the short term.
  - Elaborating a mechanism to co-ordinate the national, regional and international training programmes.
  - Electing a work board entrusted with elaborating scientific and legal theoretic and practical syllabi and programmes geared to sessions to which great Islamic attention is attached, according to the priorities defined by the Member States.
  - Performing the activities scheduled in the programmes through a training network.

3- Recommendations

The shortage of water resources in the Islamic world is all the more increasing as the available resources do not suffice to meet the ensuing demand. Therefore, the Islamic countries are called upon to step up their efforts to face this potential shortage in the future. It is also indispensable for the Islamic countries to draw up a strategy for water security geared to ensuring food security in the Islamic world. The dearth of water resources is all the more increasing and its corollary pollution is more and more spreading. In the light of this situation and the possibilities of its ramifications in the future, we suggest the following recommendations which may serve as guidelines for any strategy :

3.1- In the field of measuring and assessing water resources :

Promoting knowledge of water resources and continuously bringing it up to date in order to check the mutations that the increasing demographic growth may yield. This can be achieved through assessing the quantities of renewable waters, the permanent strategic water reserves and the quality of water, while making use of the new technology.

3.2- In the field of developing water resources :

Developing water resources in the light of water policies and available means and stepping up efforts through programmes geared to exchanging information in terms of traditional and developed technology in the field of promoting water resources. Supporting current studies, and conducting the necessary research which is conducive to generalizing experiences in the field of desalination and recycling of water falls within the set of suggestions aimed at promoting water resources.

3.3- In the field of managing water resources and rationalizing their exploitation :

Re-elaborating water policies by integrating the sectoral water policies into the comprehensive economic and social development plan geared to managing water resources in such a full-scale way as to ensure the promotion of the situation of water resources and protecting them in terms of quantity and quality. Incorporating, into the national legislation of each country, the "polluter-paies" principles as well as the principle of "Sustainable development", working towards implementing them, and creating a water police.

3.4- In the field of water and environment legislation :

Water-related legislation, regulating the diverse uses of water and defining appropriate management techniques, are all the more indispensable that it is substantially important to draw on the updated programmes and avail of modern technology in elaborating legal texts, adopting a comprehensive assessment approach to gauge the extent to which programmes and projects are adapted to reality, and the feasibility of the predefined objectives, and devising mechanisms geared to apprehending future changes. It follows from the above that gleaning necessary information and data, within legal data banks, the basis for future planning. There is also an urgent need for mustering efforts in this field to achieve joint coordination between Islamic States and cooperation with the competent organisations.

3.5- In the field of scientific research :

Scientific research should be attached ample importance geared to promoting and assessing conventional and non conventional water resources, rationalizing their exploitation, preserving them and protecting them from pollution. It follows that the Islamic States are called upon to work towards achieving mechanisms to avail scientific research of support and necessary funding.

3.6- In the field of promoting human resources :

Developing human resources-related strategies geared to achieving the objectives of an integrated water resources management. The realization of these objectives hinges upon the elaboration, within an Islamic network, of education curricula aimed at raising awareness and continuing training programmes to keep up with the scientific and technological changes in this field.