JOINT PROGRAMMING INITIATIVE ON

Water Challenges for a Changing World

Climate Change, Water-Energy Relationship and New Pollution Threateners

SPAIN

1 Theme and area of the Joint Programming Initiative (JPI)

Water is a valuable resource which sustains all life on our planet. People need access to safe, reliable and renewable water supplies for health, agriculture and economic security. This new century will place great strains on our planet and lifestyles. Water management is facing greater challenges than ever before: population growth, climate change, emerging contaminants and, nowadays, dwindling public finances.

Water scarcity is growing mainly because the world's population is rising and standards of living are increasing, both of which elevate individual freshwater demands. Moreover, water resources are frequently threatened by waste disposals, releases of industrial pollutants, fertilizer percolation/runoff and coastal influxes of saltwater into aquifers as groundwater is depleted. The release of large amounts of greenhouse gases into the atmosphere is causing changes in our climate that are altering global patterns of temperature, rainfall and runoff, affecting water availability.

Since water is a scarce good it should be treated both technologically and economically. The size of the World Water Market is not well known. Goldman Sachs has estimated at $463 billion the world's water industry, that is, pumps, filters and other purification and sanitation equipment. Despite this figure, many countries suffer from economic water scarcity. A good example is sub-Saharan countries that lack the financial means to mobilise and utilize water. They only draw 5.5% of their renewable water resources and yet some 340 million people still lack access to safe drinking water.

Europe and other developed countries are not free from water management problems. An Associated Press piece, for example, caused much concern when it revealed that some 41 million Americans are drinking water containing relevant loads of pharmaceuticals.

There is an urgent need to develop appropriate concepts and tools for improved water management. A bridge must be built between water management practice and economic thinking. In allocating and using water in an efficient way, there are different levels of decision-making. New water technologies for achieving significant energy savings, water conservation plans and emerging water management concepts, like “virtual water” and “water footprint”, will significantly reduce greenhouse emissions, and will thus contribute to softening the effect of climate change on water resources.

On the other hand, there is evidence that the global climate is changing and that one of the major impacts of this change on humans and the environment occurs through water. Climate change is a fundamental driver of changes in water resources and an additional stressor through its effects on other external drivers. Policies and practices for adapting to and mitigating climate change can have impacts on water resources, and therefore, the way we would manage water could prevent the climate change.

1.1 Strengths

During the last decades the European water industry has built up a great competitive strength based on (WSSTP):

- Innovative supply and sanitation concepts, technology, knowledge and skills;
- Availability of financial resources.
- Wide experience in a number of industrial sectors.
- Close cooperation with R&D organisations and universities, including active involvement in R&D-projects.
- Expanding markets in the EU and beyond.
- Policies on sustainability, environment and energy of regional, national and European governments.
- A broad spectrum of efficient governmental structures, tailored to specific local needs.

1.2 Weaknesses

- A number of actors are not fully integrated, and many stakeholders are not involved.
- Fragmented and un-coordinated implementation of policies often leads to inefficient or even to unsustainable solutions.
- The water sector needs to develop the so called "curiosity for innovation"
- The water industry is too slow in studying and eventually adopting new technologies.

- Dispersed knowledge and expertise of water professionals.

1.3 Threats

The highlights of a worst case scenario could be:

- Safe and uninterrupted water supply and sanitation services may be seriously endangered.
- Domestic water use will increase significantly.
- Due to ongoing migration and increase in world population the demand for safe water and proper sanitation will spectacularly grow, especially in urban and peri -urban areas.
- The demand for water in food production will continue to grow (FAO).
- In addition, water demand for industry and energy generation will increase rapidly.
- Rapid climate change might lead to strain and shortages also in regions where this has never happened before.
- Extreme events will continue to surprise more and more areas without a proper and coordinated emergency response being available.
- Intensive use of land and water for agriculture will continue to contribute to resource depletion and diffuse water pollution.
- Water related cost in industry will increase due to stronger demands.
- River basins will not be managed in an integrated and sustainable way and downstream users such as agriculture and the environment will suffer.

1.4 Opportunities

- The World Water Council states: "Without major technological innovations there is little hope of bringing the water equation into balance. There is no doubt that many technological changes can help improve services for millions and reduce the stress on water systems around the world".
- Increase the activities of utilities and private companies which provide adequate water and sanitation services to people, industry, agriculture and nature, thus creating thriving businesses that export their knowledge and skills to the world.
- Development of robust water treatment methods requires advanced solutions to cope with limited availability and to provide water for people, industry and agriculture.
- Development of alternative resources such as seawater, brackish groundwater and treated wastewater. Reducing water withdrawals will help to balance supply and demand. New water technologies are an important part of the answer to this challenge.
- Cope with the increasing demand for water supply and sanitation services due to

population growth in urban and peri-urban areas. These cannot be met fully from traditional sources or with existing technology.

- Introduce new tools and methods to protect the environment against the impact of water and sanitation services.
- Management of water resources based on integration of technologies with social, economic and organisational measures to achieve sustainability in order to attain an efficient business.

This JPI will cover the management of water at different scales, *e. g.*, those promoted at large geological scales, such as initiatives to promote strategies to avoid catastrophic events derived from climate change (*e. g*., actions to prevent desertification or flooding due to persistent rains), or those promoted at industrial or agricultural scales to provide water for different human uses (*e. g*., water conservation, water recycling, water decontamination, water desalination, etc.).

Many other issues concerning water uses could be also considered in this JPI, for instance, water as a source of renewable energies (*e. g*., marine energy, hydroelectric power, water issues related to biofuels production, solar water heaters, etc.), as well as many social and economical aspects of water management and water policy. In this sense, a major aim will be the preservation and restoration of the quality and quantity of European water resources, thus ensuring proper implementation of the WFD. An equally main challenge is to contribute to mitigate and manage the risks and effects derived from floods and droughts, by implementing the EU'S Floods Directive and water scarcity and drought work, in coordination with the WFD. The quality of European water resources is vital to ecology, human health, and the economy. Research on putative damages to aquatic systems and the most likely causes can help to forecast the ecological, human health and economic outcomes of water quantity and quality problems and can provide different scenarios for addressing these problems. Good chemical status in Europe's water should come with healthy aquatic ecosystems. In this sense, good ecological status might bring new challenges. Moreover, research is required to assess the effects of global climate change on aquatic ecosystems due for instance to unexpected invasive non-indigenous species, and assess the impact of climate change on water resources for agricultural issues and finally on food security. Watershed management research can provide tools and expertise to diagnose and predict the causes of water quality impairment.

A watershed approach for protecting aquatic ecosystems and human health will also be a priority of this JPI. The foundation of the watershed approach is that it is believed to be more effective and efficient at addressing water quantity and quality problems than regulation of

individual pollutants, pollutant sources or independent regulatory or non-regulatory program implementation.

Source control management research will provide information and guidance on the design and implementation of control techniques and best management practices. It will provide expertise and tools to characterize, control and manage sources of water quality/quantity impairment in European water resources. A “source” is defined as any activity, facility, structure, or other anthropogenic influence that creates potential or actual degradation of water quality or aquatic/estuarine/marine ecosystems. By Source Control and Management we can follow the direct or indirect change in the characteristics of a source to prevent, reduce, or eliminate its detrimental effects.

The Water JPI will also be dedicated to providing cutting-edge research to improve the safety, reliability, and sustainability of drinking water supplies. Methods will be developed to improve our ability to analyse waterborne contaminants, measure exposure and elucidate health effects associated with waterborne contaminants. The projects will develop methods, models, and tools to analyze health risks, optimise approaches for treating and distributing drinking water, and improve the water infrastructure’s integrity, reliability, and sustainability.

This JPI will bring together stakeholders from public and private organizations that have the capacity for research and innovation. Partners may include universities, research institutes, industry leaders, companies, and a variety of stakeholders and practitioners. The water JPI will enable mutually supportive collaborations between science and engineering researchers and innovators, water managers and decision makers, industrial research and innovation leaders with a focus on the scope of the initiative. Success will be built on establishing and sustaining regional, national, and international research collaborations and developing effective industry partnerships.

The Water JPI will support research and innovation spanning the spectrum from knowledge creation to the translation of that knowledge into products, services, and public policies. It will accelerate the synergy among industry partners to develop new water conservation processes, technologies, intellectual property, and innovations that will help ensure the long term safety, health and sustainability of our water resources. The Water JPI will contribute to the creation of novel public policies and practices informed and supported by world-class research.

The JPI will support excellent researchers and innovators at all career levels, from brilliant and talented research trainees to world-class senior researchers; from those conducting industrial research and development to business interns; from junior entrepreneurs to

experienced business professionals with the goal of producing new discoveries, new technologies, and new knowledge leading to advanced decision making on the part of water managers.

The Water JPI will work towards strong and meaningful collaborations beyond European borders—nationally and globally—to capture and use expanding global progress in water research and cutting-edge expertise in water research and management.

Finally, this Water JPI will be created to coordinate the existing European programs to minimize overlapping and identify critical gaps in the water field. This will ensure that successful research management practices are widely adopted and will improve knowledge sharing between researchers and practitioners to speed up the transfer of research findings into policy and practice. The common research agenda and jointly funded activities that will be adopted will maximize added value from a transnational European approach.

1.5 European political dimension

From the Water Framework Directive (2000/60/EC) (WFD) to the European Water Partnership Water Vision for 2030 there is a long way to go and the Water JPI will be the instrument to close the gap providing the scientific bases to support the objectives of these and other political measures.

There is a number of European Directives related to water protection and management but one of the most important pieces of legislation in this area is the WFD. This EU legislation provides for measures against chemical pollution of surface waters. They are active on two levels - with Community wide selection of substances of concern and Community wide measures and a requirement that Member States take measures at river basin level against relevant pollutants. There is currently a transitional period until the year 2013 from the "old" framework of Directive 76/464/EEC to the new WFD.

The WFD was formulated to respond to the increasing demand by citizens and environmental organisations for cleaner rivers and lakes, groundwater and coastal beaches. When asked to list the five main environmental issues that Europeans are worried about, averaged results show that nearly half of the respondents are worried about “water pollution” (47%), with figures for individual countries going up as far as 71%. This demand by citizens is one of the main reasons why the Commission made water protection one of the priorities. Since the formulation of Directive the European Water Policy has tried to get polluted waters clean again, and ensure clean waters are kept clean. Commission presented the Water Framework Directive with the following key aims:

- expanding the scope of water protection to all waters, surface waters and groundwater
- achieving "good status" for all waters by a set deadline
- water management based on river basins
- "combined approach" of emission limit values and quality standards
- getting the prices right
- getting the citizen involved more closely
- streamlining legislation

The new Groundwater Directive (2006/118/EC) establishes a regime which sets underground water quality standards and introduces measures to prevent or limit inputs of pollutants into groundwater. The directive establishes quality criteria that take into account local characteristics and allow for further improvements to be made based on monitoring data and new scientific knowledge. The directive thus represents a proportionate and scientifically sound response to the requirements of the WFD as it relates to assessments on chemical status of groundwater and the identification and reversal of significant and sustained upward trends in pollutant concentrations.

The Directive 2007/60/EC on the assessment and management of flood risks entered into force on 2007. The Directive requires Member States to first carry out a preliminary assessment by 2011 to identify the river basins and associated coastal areas at risk of flooding. For such zones they would then need to draw up flood risk maps by 2013 and establish flood risk management plans focused on prevention, protection and preparedness by 2015. The Directive applies to inland waters as well as all coastal waters across the whole territory of the EU.

The recently published Commission Directive (2009/90/EC) lays down, pursuant to WFD, technical specifications for chemical analysis and monitoring of water status. The objective of this Directive is to establish common quality rules for chemical analysis and monitoring of water, sediment and biota carried out by Member States.

On the other hand, the Vision for 2030 was initiated by the European Water Partnership (EWP) in 2008 by an open multi-stakeholder process, including representatives from the EU Commission, the EU Presidency, the EU Parliament as well as leading multinationals and NGO’s. The Water Vision for Europe aspires to be a Vision for all people in Europe and around the globe. The Vision is formulated from a people’s perspective in a positive and proactive manner that seeks to encourage ownership by all. Putting people and values at its core, the Vision departs from the premise that only if we mobilise people and stakeholders around common values we will be able to achieve sustainability with regards to water in Europe. It desires to unite and stimulate people and stakeholders to act in partnership in order to solve

Europe's water problems and to contribute to solutions that will address the global water crisis.

The ten principles supported by the Vision 2030 can be summarized as follows

1. We treat water as our common heritage with an economic, social, environmental and cultural value for our societies. Water sustainability is crucial for us.

2. Water is an essential human need and we recognize the access to basic water supply and sanitation as a human right.

3. We manage our water resources sustainable within river basins across political boundaries including transboundary waters and we apply an integrated adaptive water management approach. We have adopted and implemented ambitious legislation such as the Water Framework Directive

4. We have achieved a true ´water democracy´ where we apply the principles of transparency, integrity, solidarity and equity and where all people and stakeholders are aware of their rights and responsibilities.

5. We have jointly achieved a culture where water resources are not wasted, spoiled or overused.

6. We have achieved a change of mindset, attitude and practices through raising water awareness and the application of appropriate instruments and incentives.

7. Water services have a price. We use water pricing and other economic instruments to achieve sustainable water use.

8. We are coping with the challenges of climate change as well as with the natural phenomena such as floods and droughts as we are continuously improving our adaptive, integrated management approach and we adapted our infrastructure and practices.

9. We apply appropriate technologies and have thereby continuously improved our water efficiency and minimized pollution to a level which is negligible with regard to human and environmental health. We promote and conduct research and development to continuously improve our know how on adaptive integrated management and innovative technological solutions and have achieved a fast track to bring those technologies to the markets.

10. Europe is a responsible partner in the world that actively promotes and supports the achievement of sustainable water management and universal access to water supply and sanitation in all countries. We have understood that sustainable water management is key to peace and security and to eradicate poverty and have made water a priority of our foreign and development policy.

It is worth to mention that waters which cross political boundaries have additional complexities brought on by strains in riparian relations and institutional limitations. Recent

studies, particularly in the field of environmental security, have focused on the conflict potential of these international waters.

Water is a fugitive resource. As water moves through the hydrologic cycle, it does not pay any attention to political boundaries and conflicts that often result between differing political units. These types of conflicts are referred to as transboundary water issues. Conflicts also arise between different groups in society, such as business interests and environmental groups, or between parties located upstream and downstream. Conflict can result from many factors. The sources of conflicts must be understood in order to manage water resources effectively. Three basic sources of conflict are conflicting goals, factual disagreements, and ineffective relationships (distrust and power struggles).

Transboundary water resources are increasing in importance as sources of freshwater worldwide. As much as 80% of water resources in the Mediterranean region are shared between two or more countries and in North Africa and the Middle East, transboundary groundwater is the most important source of freshwater. The 2003 UN Report (UN WWDR, 2003) entitled "Water for Life Water for People", listed 263 transboundary basins.

Taking into account all these considerations it becomes evident that one of the major aims of the Water JPI should be the "Social, Political and Economic Value of Water", that will be considered as one of the main working packages of the JPI.

2 Proposing GPC member/members

- The Austrian Federal Ministry of Agriculture, Forestry, Environment and Water Management (BMLFUW).
- The Belgian Federal Science Policy Office and the Flemish Ministry for Science and Innovation.
- The Cyprus Institute (CyI), The Energy, Environment and Water Research Center (EEWRC)
- The Dutch Ministry of Economic Affairs.
- The Estonian Ministry of the Environment and the Estonian Ministry of Education and Research.
- The Finnish Funding Agency for Technology and Innovation (TEKES) and the Academy of Finland (AKA).
- The French Ministry of Higher Education and Research.
- The Italian Higher Institute for Environmental Protection and Research (ISPRA).
- The Romanian National Authority for Scientific Research (ANCS).

- The Spanish Ministry of Science and Innovation.
- The Scientific and Technological Research Council of Turkey (TUBITAK).

3 Objectives

3.1 Main/specific objectives

The proposed JPI deals with one of the more important issues in European and global science for the 21st century: water. The main objectives can be classified within at least three major categories:

1. **Resource managing objectives.**
2. **Technological objectives.**
3. **Social, political and economical objectives.**

These objectives can be further expanded in a series of sub-objectives like the following:

- To stop the mismanagement of water, usually at the tail end of other equally important challenges such as population growth, climate change and pollution.
- To develop studies on the large picture of the water cycle, promoting actions at every cycle phase that result in water quantity and quality conservation.
- To carefully list and map the European areas affected by droughts, desertification and flooding, taking full advantage of existing research and information networks. To define management and technological actions aiming at alleviating these problems.
- To develop technologies to reuse and recycle water up to last consequences, treating and purifying water to the different standards defined for the very different uses.
- To study the impact of emerging pollution threats such as Pharmaceuticals and Personal Care Products (PPCP) and nanomaterials.
- To unveil all the water-energy connections.
- To investigate the social, political and economical implications of water management under a climate change scenario.
- To develop rapid appraisal methods to assess the water footprint of a place, a region or a nation.

3.2 Scientific program

The scientific program should cover the following topics and work packages:

3.2.1 WP1. The sustainable management of water bodies

- Strategies for the integrated management of water bodies, emphasising the integrated watershed approach:
  - Modelling tools to develop integrated water management plans.
- Sustainable optimisation of water management based on promotion of ecosystem natural processes:
  - Analysis of key ecosystem functions that can be involved in the sustainable management of water bodies, forming the potential background of a new management of water resources.
- To study and evaluate the hydrological interaction between different land use categories, especially in fragmented landscapes and considering different climate change scenarios. To integrate land owners and land managers in water issues.
- Natural disaster risks management and reduction measures:
  - To list and map the European areas affected by droughts, desertification and flooding.
  - To define the management and technological actions aiming at its alleviation.
- Protection of natural drinking water resources:
  - Identify potential drinking water shortage areas.
  - Establish a water demand baseline case for future demand forecasting.
  - Establish the cumulative effects of other resource-based activities.
- Synthesize groundwater data into integrated databases (prediction, availability, appropriate use):
  - Elucidate the interaction between surface and groundwater (deep and shallow). Promote conjunctive water use.
- Aquatic ecosystem condition indicators:
  - Assess the use of tools to diagnose the status of aquatic ecosystems.
  - Establish and test links of predictive models to biological responses.
  - Validate standard official procedures for ecotoxicological risks assessment under field conditions.
- Best guidelines for aquatic ecosystem management given global change:
  - Determine the ecological functions of riparian areas and establish their relationship to aquatic ecosystems.
  - Develop models for comprehensive analysis of in-flow requirements.

- Continue the development of flow management tools and models.
- Assess the impact of land use change on water resources.

3.2.2 WP2. Management and regulation of point and diffuse pollution

- Best methods for testing and remediation of polluted natural systems.
- Best "early warning" systems for public water systems.
- Regulatory practice, water quality objectives and standard settings.
- Cumulative effects of pollutants from agricultural, municipal and industrial sources:
  - Establishing balances of water pollutants at the watershed and water system levels
  - Elucidate the synergistic effects of pollutants.
  - Assess toxicity and environmental impact for relevant pollutants..
- Protection/preventative measures — less contaminants introduced into groundwater:
  - Investigate groundwater flow of pathogens and toxins.
  - Evaluate non-point source pollution of shallow groundwater.
  - Develop and compare groundwater remediation approaches.

3.2.3 WP3. Water Treatment and Water Reuse Technologies

3.2.3.1 WP3.1 Drinking Water

- Improvement of conventional treatment processes:
  - Adsorption and ion exchange.
  - Oxidation processes.
  - Membrane filtration for removal of dissolved and particulate matter.
- Innovative water treatment processes.
- Disinfection and management of disinfection by-products.
- Occurrence and removal of micro-pollutants:
  - Hazard analysis and detection methods of water pollution.
- Management of the aesthetic (organoleptic) quality of drinking water.
- Management of water treatment residuals (waste streams and sludge).
- Operation and optimisation of drinking water treatment plants:
  - Instrumentation, control and automation.
  - Monitoring data management for decision-making.
  - Assuring facility safety and security.

  - Preparedness of the existing treatment facilities to deal with emerging (new) risks.
- Managing and maintaining water supply networks.
- Drinking water management and sanitation in emergency situations.

3.2.3.2 WP3.2 Urban and Industrial Wastewater Treatment

- Advanced biological processes and technology.
- Advanced physic-chemical processes and technologies.
- Occurrence and removal of hazardous substances in wastewater.
- Improvement of conventional processes:
  - Biofilm processes.
  - Oxidation processes in wastewater treatment.
  - Membrane systems for wastewater treatment.
  - Anaerobic processes.
  - Phosphorus and nitrogen removal and recovery.
- Sludge and biosolids management:
  - Minimization and valorisation (energetic).
- Elimination of odours and volatile emissions.
- Modelling wastewater treatment processes.
- Operation and optimisation of wastewater treatment plants:
  - Instrumentation, control and automation.
  - Monitoring data management for decision-making.
- Wastewater reclamation and reuse.

3.2.3.3 WP3.3 Water-Energy Relationships

- Energy use in water distribution.
- Energy use in water treatment.
- Water use in energy production.

3.2.4 WP4. Social, Political and Economic Value of Water

- Economics, pricing and financing of water services:
  - Effect of water pricing on water use.
  - True economic value of water.
- Strategic asset management and long-term planning:

  - Strategic management of water resources in urban water systems.
  - Customer management, consumer concerns and public awareness.
  - Economic instruments for water quality and quantity management.
- Demand management and water conservation:
  - Legal and economic frameworks for efficient water allocation.
  - Economic growth models and databases to allocate water demand.
  - Basin planning and decision-making approaches.
- Measuring and improving performance and sustainability:
  - Indicators and benchmarking.
  - Water cycle input and output factors impacts and interactions.
- New concepts in water management
  - Virtual Water.
  - Water footprint.
- Social dimensions, solidarity aspects, access to water and Millennium Development Goals:
  - Institutional development and transboundary cooperation.
  - Disaster preparedness, response and recovery.
  - Human resources development and training of water professionals.
- Understanding water rigths and water conflicts
  - Conflict resolution techniques.
  - Identifying key issues and developing new scenarios to mitigate conflicts for water uses.
  - Cross-border cooperation between countries.

3.2.5 WP5. Training and mobility activities

One of the main targets of the Water JPI will be directed at improving the training of researchers. To stimulate the mobility of researchers across the partner's countries and labs will be also an objective of this JPI. These activities will contribute not only to the European cohesion policy, but also to transfer the knowledge and technological excellence within the participants. Therefore, specific instruments will be created to support these activities in the call for proposals. The EU has a long track record of supporting young researchers through various programmes and it will be not very difficult to implement specific instruments in the Water JPI for this important group of people. The international projection of these activities will be also

considered within the training and mobility plans.

3.2.6 WP6. Dissemination of results

Providing information, practical advice and research results to water actors and to society is of main importance. The tasks proposed are as follows:

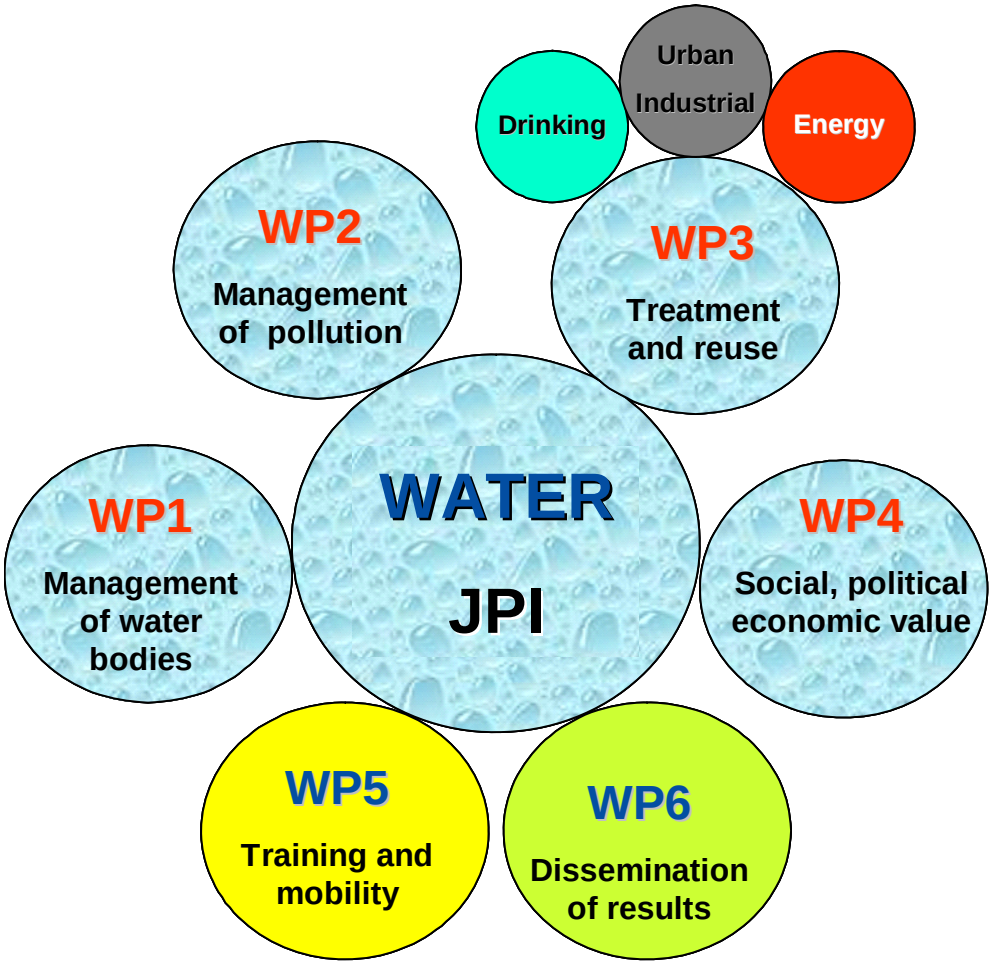
- **e-Bulletin**: periodic newsletter showing the latest water issues information (events, news, technologies and results).
- **Publicity**: including leaflets, brochures and posters showing the mission, objectives, activities and any information related to the JPI interest.
- **Media**: allowing the interaction with a large public via Internet, newspapers and radio.
- **Research information transfer**: supporting groups from both companies and institutions to disseminate their projects results and new technologies, involving them in different events as forums, conferences, workshops and congresses.
- **Technology Transfer**: supporting companies, end-users and researchers on interacting in water technology fairs or in brokerage events with the objective of solving technological problems, giving answers or establishing cooperation.
- **Documents**: preparing reports and summaries on topics of interest for companies, policy makers and researchers.
- **Website**: developing a website with a public and private interface, being user-friendly and showing clear information.

Finally, it is important to note that this JPI can strongly interact with at least six large research areas in which rapidly emerging water-related technologies are likely to exert strong pressures on the supply, use and management of water resources:

- Environmental research and development,
- Renewable energy,
- Information and communications technology,
- Biotechnology,
- Bioenergy,
- Nanotechnology.

In this sense, it would be possible that some of the objectives and tasks of this JPI can overlap with those from other JPIs. Water management has effects on different research areas. Therefore, there may be a need to think about common call for proposals, chances for

cooperation between different JPIs in order to eliminate the overlapping of the research conducted. A preliminary and simplified scheme of the different work packages is shown below:



4 Research questions being addressed

The key research areas being addressed by the proposed JPI can be summarized as follows:

- Optimising management of "new water resources" like water saving, water reuse (including public acceptance), new and less energy demanding technologies for water desalting like capacitive deionization, etc.
- Energy-water relationship studies, including the energy intensity in the water cycle. Such studies help to identify opportunities for changing the pattern and magnitude of water

related energy consumption. The use of wastewater materials as an energy source is another target in this area.

- Development of water desalination technologies to facilitate the economical and ecological use of marine water as well as other continental water resources with a high salt content.
- Research and development in integrated water management, including surface and groundwater resources with DSS (decision support systems).
- Flood vulnerability and risks analysis to define the means and technologies to apply or develop, taking into account cost/benefit assessments.
- Studying the behaviour of emergent contaminants along the integral water cycle. The occurrence and concentration of emerging pollutants in influent and effluent at treatment plants, their behaviour in nature and the toxicological, ecotoxicological data on PPCP and nanomaterials are relevant subjects.
- Water quality assessment projects on treatment process issues, including the lifecycle of product waters, biological and chemical contaminants, tracking, the development of devices to monitor quality, and associated security issues.
- Industrial water and sewage treatments and processes research and development, including classical and advanced processes, with emphasis on using only the necessary amounts of water and avoiding waste.
- Research addressing concerns for health and aquatic life risks associated with pathogens, nutrients, and emerging contaminants exposures, either occurring separately or in combination.
- Protecting the quality and sustainability of water resources.
- Ensuring that treatment facilities are capable of controlling waterborne contaminants
- Understanding and managing health risks associated with public water supplies
- Preventing and mitigating the impacts of water distribution and storage systems on drinking water quality.
- Improving infrastructure reliability and sustainability
- Risk characterization studies providing methods, data, and tools to characterize drinking water sources, treatment efficacy, distribution and storage systems, and health risks associated with waterborne contaminants.
- Risk management: providing data, tools, models, and technologies to prevent, control, manage, and/or mitigate potential health risks associated with sources, treatment,

distribution, and use of drinking water and to promote the sustainability of water resources and the reliable delivery of safe drinking water.

- Research encompassing the hydrologic or water cycle with an emphasis on surface water and ground water sources that are used to supply drinking water and dependent ecosystems. Such research can be oriented to protecting drinking water sources and characterizing and managing health risks associated with exposure to waterborne contaminants.
- The treatment and monitoring projects focusing on water and wastewater treatment and management or on future directions for the development of community water supplies and wastewater systems.
- Social and economical studies related to the management of water, including criteria for water allocation in scarcity scenarios; flexibility of reallocation; control of externalities related to allocation and use or reallocation.
- Developing integrated assessment tools, within the Water Framework Directive objectives, to inform public and policy debate on the use of economic analysis tools and institutional analysis.

5 Added value, benefits and impact

Concerning the added value of Water JPI, the recent Workshop 'Water for Integration – Integration for Water' (Brussels, September 28, 2009) provided some interesting clues to support the need for an European integrated research action on water since "the actual practice of integrated water research still remains the exception rather than the rule". Thus, "it is rare to find adequate funding schemes or joint calls for integrated research". In this context the European Commission has emphasized that "integrated water research is needed to help people to think out of their box". One of the problems is "the traditional divisions between research communities and, in particular, the cultural rift between the natural, engineering and social sciences, a situation which is reflected in research policy and its implementation. This is shown by the lack of an intermediate platform between science, decision makers and stakeholders, which was one of the points addressed during the panel discussion". In agreement with the conclusions of this seminar an integrated research like that undertaken by the Water JPI can pose "a great challenge for policy makers, funding agencies, evaluators and the scientists themselves, despite being a vital source of knowledge for pressing political decisions and their sustainable implementation".

The benefits and impact that the proposed JPI may bring to European citizens and

European competitiveness can be summarized as follows:

- Development of scientific, technological economical and social tools to foster efficiency in water management, internalization of externalities and sustainable management patterns of water uses.
- Improvement of information on water availability and demand, and its vulnerability to increased risk and uncertainty.
- Improvement of information on the effects that different activities have on water demand, water resources availability, use and quality.
- Improvement of the management of consumptive and nonconsumptive water uses.
- Extended water availability, resulting from the optimisation of water uses and water quality and the optimisation of treatment costs
- Enhanced health and better quality of life for European citizens.
- Lower drought, desertification and flooding risks; increased food security.
- Added protection for vast list of European industries depending on the sustainability of water resources.

Research will provide the expertise to develop criteria for protecting and restoring the biological, physical, and chemical integrity of water resources in Europe. The Water JPI will develop the knowledge to set criteria for protecting human health and aquatic life by maintaining the water quality that supports the associated designated uses.

The JPI Program will provide sound scientific approaches for protecting drinking water sources, producing and distributing safe drinking water, managing health risks associated with exposure to waterborne contaminants, and promoting the safety and sustainability of water resources and water infrastructure.

The program can also help policy makers to better understand the national development benefits that result from sustainable water management and provision of safe water. Investments in environmental sustainability and water management to prevent water related disasters can have large payoffs. There is also growing evidence of the macroeconomic returns to investments in water management and of the costs of failures to invest. Disasters such as droughts and floods resulting from rainfall exceeding the carrying capacity of channels are less destructive to the economies that are better prepared. Environmental degradation from water pollution and excessive withdrawals also has negative economic impacts. Industrial countries are learning the enormous costs associated with restoring essential ecosystems.

In the water sector the expansion of scientific knowledge and technological applications

is changing the way water is used, treated and reused to meet human, economic and environmental needs. Industries are investing in new technologies and processes that reduce water use and wastewater discharges. Water supplies are being enhanced in many countries through innovative wastewater treatment and reuse techniques. Breakthroughs continue in desalination, as advances in technologies and energy efficiency in the past decade have made it an economic option for water supplies in coastal cities.

6 Preliminary indications for success/performance indicators

The indicators should be in harmony with the evaluation systems of the Member States/associated countries and the EC. The values that guide this JPI include the following: i) Producing research that is of highest quality and responsive to international needs; ii) providing resources that are useful to decision-makers and the European citizens; iii) and promoting an environment of collegiality, integrity, and excellence.

The activities of the JPI are addressed to manage research, development and knowledge transfer in the water area. These objectives will be conducted for the benefit of the involved countries and implemented within the following values:

- **Excellence** - The JPI "Water Challenges" will pursue excellent research and innovation and support only the best people identified through a rigorous peer review process. This process will ensure that the highest standards of quality are met as determined by stringent peer reviews.
- **Participative** - The JPI will bring together stakeholders from public and private organizations that have proven capacity for research and innovation. These stakeholders may include industry leaders, companies, universities, institutes, government research organizations, research institutes, professional associations and civil society organizations.
- **Collaborative** - The JPI "Water Challenges" will enable mutually supportive collaborations between and among science and engineering researchers and innovators, water managers and decision makers, industry research and innovation leaders with a focus on the scope of the initiative. Success will be built on establishing and sustaining regional, national, and international research collaborations and developing effective partnerships.
- **Integrated and Focused** - The JPI will support research and innovation spanning the spectrum from knowledge creation to the translation of that knowledge into products, services, and public policies. The JPI will support excellent researchers and innovators at

all career levels, from bright and talented research trainees to world-class senior researchers; from early entrepreneurs to experienced business professionals with a goal to producing new discoveries, new technologies, and new knowledge to inform advanced decision making on the part of water managers. It will accelerate the synergy among industry partners to develop new water conservation processes, technologies, intellectual property and innovations that will help ensure the long term safety, health and sustainability of our water resources.

- **Policy Development** - The JPI will contribute to the creation of novel public policies and practices that are informed and supported by world-class research.

Summary of Key Performance Indicators

- Number of research, management and development collaborations.
- Number of water research publications and their impact.
- Number of technologies developed or adapted for specific use.
- Access and use of new knowledge by water managers and citizens.
- Number of water researchers and related professionals involved in the JPI projects.
- Number of novel policies and their impacts.

7 Preliminary estimate of human resources involved & scientific and technical requirements

State human, scientific and technical resources required to carry out the proposed JPI (number of researchers, requirement on the research infrastructure, industry cooperation etc.).

At the present stage it is very difficult to anticipate the number of human resources that can be involved in this JPI, since it will depend of the number of participant agencies and countries. We anticipate that the cooperation with the industries will be essential for the development of this JPI, since apart for their contributions at research level, the implementation of the results through technology transfer will require the participations of small, medium and large companies.

7.1 Participation of relevant regional, national, international and European stakeholders, including, where appropriate, the private sector

Apart from the European member States and Associate Countries that have demonstrated the initial interest in this JPI, it is open to all European members and associated States, which will be actively encouraged to participate. It is assumable that once approved, the JPI will mobilize the interest of other countries and stakeholders including the private sector. Then, the

objectives of the JPI will be remodelled to accommodate all these novel interests and initiatives.

7.2 Human, scientific and technical resources made available by participants

Europe has the required competences and basic infrastructures to set up this JPI: this instrument offers the possibility to coordinate these capacities in relation to the assigned objectives, and to use synergies to multiply the benefits in terms of knowledge production and improvements of life standards.

The ERANet projects have already created national networks of experts. This JPI proposal is largely based on ongoing and future ERANets. A future generation of scientists needs to be trained and thus, the JPI must allow for appropriate initiatives concerning to training.

7.3 Available infrastructure and new infrastructure required to carry out the proposed JPI

This JPI will offer the opportunity to European Member States of networking existing large infrastructures and facilities. A comprehensive list of the exiting infrastructures and facilities in the participant countries will be created just at the start of this JPI. It is also possible to envision that new infrastructures could be created during the development of the JPI.

7.4 Indicative overall budget and indicative contributions from the different participants.

It is assumed that the overall budget of this JPI should be at least of 100 M€ per year, but this amount can be increased depending of the number of partners of the JPI.

7.5 Duration of the research activities.

The JPI will be sustained for at least 5 years, but it will be possible to envision an extended scenario to keep further this cooperation.

7.6 International Cooperation

It is evident that the management of water resources is a matter of interest for many countries all over the world. According to The United Nations World Water Development Report, it is clear that urgent action is needed if we are to avoid a global water crisis. Therefore, this Water JPI will include within their targets its international projection. In this sense, the Work Packages devoted to training and mobility and dissemination would play a fundamental role if open to developing countries. Impediments to the dissemination of technology will be overcome for developing countries to benefit from innovations developed in this JPI. The Water JPI will provide a critical mass of researchers to favour the visibility of Europe in this field and thus, we will be able not only to contribute but also to lead the development of other international

research programs of water.

8 Research programmes on water. Preliminary suggestions concerning the governance and implementation of JPI

The need to choose the JPI approach, rather than any other existing European mechanisms, as the most appropriate means to facilitate collaboration at European level is unequivocal. Optimisation and synergies expected performing cooperative trans-European research justify the necessity of establishing a mechanism in which collaboration will have an added value. This Water JPI will bring great added value to current research financed from national and Community public funds, greatly increasing the efficiency and impact of public R&D financing.

The existing ERA-NETS related to water management and flooding risks management have created a research net where European researchers have performed coordinated research projects, preparing ground for this JPI, overcoming most of the legal and practical barriers, and setting up common proposal and evaluation procedures. The ERANETs will be very useful not only to settle the bases of efficient governance but also for foresight the frontier research activities of the water field. In this sense it is also worth to mention that the CRUE Flooding ERANET has recently finished and thus, the JPI could take advantage of its results in order to continue its works.

The European Technology Platform for Water (Water supply and sanitation Technology Platform, WssTP) was initiated by the European Commission in 2004 to promote coordination and collaboration of research and technology development in the water industry. The platform has developed a Strategic Research Agenda (SRA) that is highly compatible with the research objectives of the Water JPI. Other mirror national technology platforms have been also created in Europe like for instance the Spanish Technology Platform for Water and Irrigation or the Slovenian Water Technology Platform.

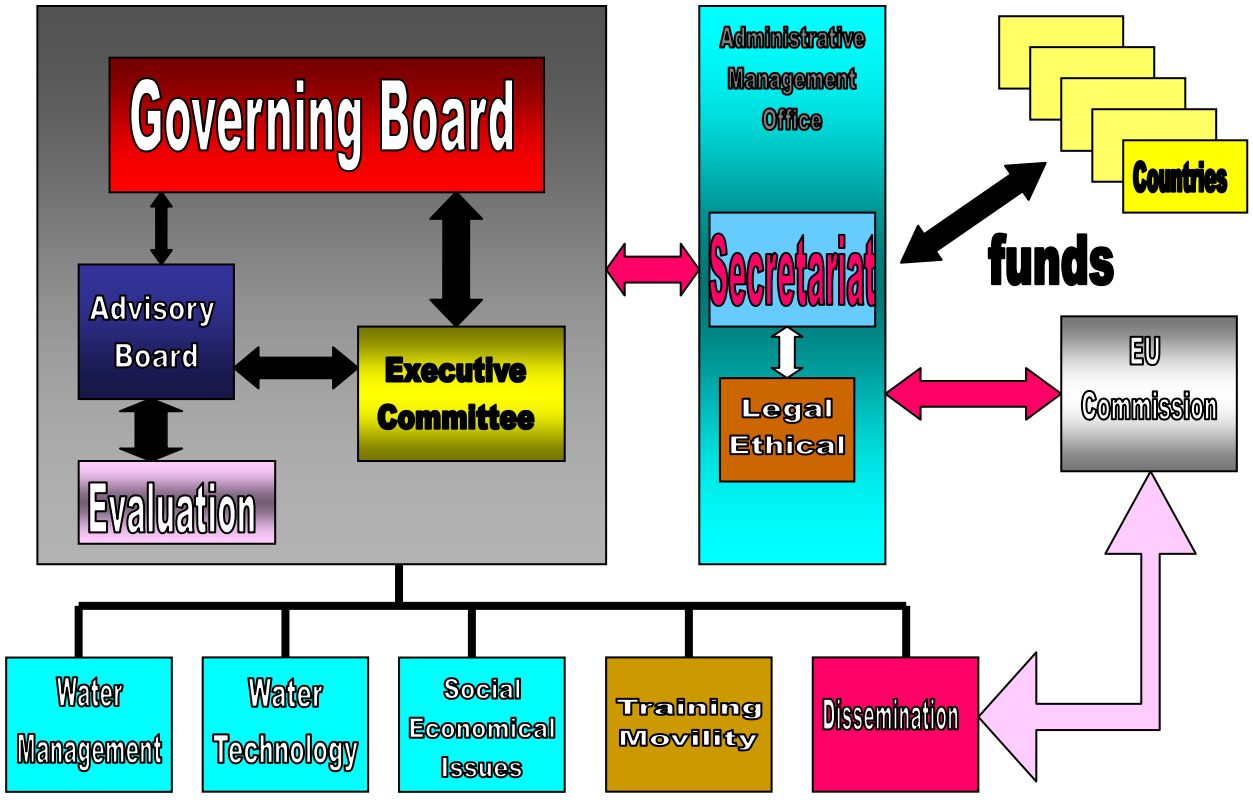
How the Technology Platforms could be integrated in the Joint Programming Initiatives is something that should be determined by the Commission. Nevertheless, as it will be commented below, the interests of these platforms will be taken into consideration by the governance structure.

8.1 Governance structure

A preliminary and simplified scheme of the governance structure is shown below:

8.1.1 Governing Board

The Governing Board (GB) will coordinate all activities of the JPI. The GB will take care of the administrative and political issues as well as of the strategic research agenda of the JPI. Therefore, the GB will coordinate the activities of the other administrative and governing bodies of the JPI, the foresight activities, the programme research activities (calls for proposals), the evaluation of projects, the assessment of JPI impact, the training activities, the dissemination of results, the observation of the legal, gender and ethical issues, etc. The GB will survey the evolution of the context and circumstances in which the JPI is developed (scientific novelties, environmental aspect, legal, social, and economic issues, etc.) in order to reorient the objectives of the JPI if necessary.



The GB will be composed by one representative of each funding member of the JPI plus a delegate of the European Commission. The GB will be steered by a President (the representative of the Coordinator partner) and two Vice-Presidents elected among the partners. The secretariat of the GB will be provided by the Administrative Managing Office. Each

member of the GB will have one vote for decision making but this vote will be weighted according to the funds provided to the JPI by the member. Then, the GB will take decisions upon simple majority. In addition, the General Secretary of the Executive Committee will attend the meetings without vote. The GB will meet at least twice a year, unless the governance of JPI might require additional meetings. The GB will be advised by the Executive Committee and the Advisory Board.

8.1.2 Executive Committee

The Executive Committee (EC) will be in charge of operational issues related to day to day management of the JPI research activities. The tasks of the EC will be specified by the GB. The EC will support the GB in all aspects concerning the preparation and implementation of decisions. The EC will take care of the programmed activities, and make proposals to the GB on the budget allocations among the calls for proposals and activities. The EC will provide progress reports to the GB about the results of the subprograms and activities supported by the JPI. The EC will be in charge of collecting and integrating recommendations from the Advisory Board. The EC will take care of the calls for proposals end the evaluations of the projects advised by the Scientific Committee of the Advisory Board.

The EC will be constituted by a General Secretary and the chair persons responsible for each of the Subprograms of the JPI. The members of the EC will be nominated by the GB. The secretariat of the EC will be provided by the Administrative Managing Office. Each member of the EC will have one vote for decision making. The EC will take decisions upon simple majority. Meetings of the EC will be held as many times a year as required.

8.1.3 Advisory Board

The Advisory Board (AB) will assist the EC and GB in establishing the Strategic Research Agenda, and propose scientific priorities. The AB will advise the GB and EC over the scientific direction, approach and implementation of the JPI.

The AB will be made up of two main components, a Scientific Advisory Board (SAB) and a Stakeholder Advisory Committee (SAC).

The SAB will be directed by a chair person and will be composed by scientists with demonstrated experience in the field of the JPI. The SAB will particularly help EC to evaluate the research projects and the other JPI activities.

The SAC will be directed by a chair person and will be composed by the representatives of the ERANets and European organisations involved in activities closely related to the JPI. The

research network created within ERANet can provide the basis on with the governance of this JPI will be structured.

In this context, it is also worth to mention that the European industrial platforms closely related to the JPI, like the European Technology Platform for Water (Water supply and sanitation Technology Platform, WssTP) will be also invited to form part of this board. Whether this or other private platforms would also support the JPI by funding specific research activities is a possibility that could be discussed later, providing that such contributions are allowed within the context of JPI funding rules.

The composition of the AB will be designed by the GB. The activities and meeting of AB will be programmed and coordinated by the EC and the secretariat will be provided by the Administrative Managing Office.

8.1.4 Administrative Management Office

The GB, EC and AD bodies will be assisted by the JPI Administrative Management Office (AMO) in charge of secretariat, daily management work and logistics. Therefore, AMO will be made up of administrators, experienced project managers, and other experts in charge of web site and other specific activities.

The AMO will be responsible for management of financial and payment issues, help desk for project applicants, and communication facilities. Thus, AMO will be responsible of administrative management of calls for proposals (*e. g.*, publication of scientific calls for proposals, Consortium Agreements, project operations, payments and justifications).

The AMO management activities will also include the assessment for legal and ethical issues. Then, AMO will include lawyers and IPR specialists for dissemination and valorisation of results and technology transfer.

To ensure success, the JPI will require a transparent and open agreement between all members to allow for the rapid transfer of knowledge between sectors.