DANube macroregion: Capacity building and Excellence in River Systems (basin, delta and sea)

- DANCERS -

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1 Introduction to the DANCERS Knowledge Matrix

FP7 DANCERS main aim is to assess the development of research and innovation projects in the field of water research (river-delta-sea approach) in the Danube Region in the last 20 years and, based on this, to develop a toolbox of instruments that will support further development of the research in the field of integrated river-delta-sea management in the Region. In this respect, several categories of stakeholders were consulted, as well as communities directly involved in this process via direct (workshops) and indirect (web) consultations.

During the three workshops (with scientists, business representatives, decision makers), the weak and strong points of the region, as well as proposals for future major topics of research and regarding Research and Innovation were discussed. Each of these workshops hosted a prioritization process regarding the strategic needs of R&I, in accordance with the Horizon 2020 Societal Challenges, which reflect the policy priorities of the Europe 2020 Strategy. These outcomes (presented in D2.1 – D2.3 of FP7 DANCERS) identified during the workshops were the starting point for discussions during the Dialogue Conference. Here, the joint discussions of the representatives of the three main categories of stakeholders (selected active participants at the previous workshops) helped to crystallise conclusions regarding the present state of the three pillars for research and innovation in the Danube Region (Science & Innovation Agenda, Research Infrastructures and Human Potential).

Consensus was obtained between participants at the Conference regarding the strong and weak (internal) points, as well as the threats and opportunities (external) for the development of research and innovation in the field of integrated river-delta-sea management in the Danube Region.

The Knowledge Matrix has been developed by considering the three main pillars of R&I: Science & Innovation Agenda, Research Infrastructures and Human Potential, originating from the SWOT Analysis.

Besides the analysis of what is good and what is missing, what is significant, and what needs to be strengthened in this field, the Knowledge Matrix incorporates several important suggestions regarding the future developments in the Danube Region. These suggestions are the initial contributions for the detailed materials that will constitute the toolbox of instruments, which is one of the final deliverables of the project.

This Knowledge Matrix may further evolve and will be used in definition of a new research infrastructure that may be built in the Danube Region.

2 The SWOT Analysis

	Human Resources	Research Infrastructures	Strategic Research and Innovation Agenda
Strengths	• Existing expertise and education competencies at all levels • Education is recognised as one of the top societal priorities in Danube Region. It is Priority Area 9 "Education and skills" in EUSDR • Some Education programmes comprise involvement in research activities • Community exists (Universities, Professors, Associations – such as the Danube Region Academies or the Danube Rectors Conference, institutional networks) • Significant cultural diversity in the Danube Region, from the Upper Danube to the Black Sea	• Existing "natural cross-national laboratory" (the Danube River – Danube Delta – Black Sea System) • Some existing national infrastructures with different focus of action (from analytic facilities – laboratories to research vessels) Experience from Flagship Projects for Research infrastructure like AT with DREAM and Romania with DANUBIUS-RI • Experiences with the use of the Structural funds eg for CBC or in other sectors • A significant amount of data collected during the decades in various research projects (either by individual countries or by the ICPDR cruises) exist; e-infrastructures (ex. metadatabase and computing facilities) exist	• Common understanding of existing environmental problems within the Danube Region – among research communities in Danube Region countries • National Funding (to find solutions for national problems) • Existing international cooperation (i.e. in the FPs, SEE TCP, CBC, bilateral programmes, involvement of Researchers in EU or global research initiatives, even if partly focused on river or sea research) • Existing inter- and multidisciplinary studies (even if so far with limited geographical focus, not covering the whole River Basin including the connected sea, or focused on specific topics) • Researchers cooperate with Administrations (successful pilot actions exist and were acknowledged by some representatives of the administrations) • Champions with excellent initiatives exist with business, administrations and the public • Research assistance to water management at national level • Established Messages (like the "Sturgeon 2020" Flagship Project within EUSDR)

	Human Resources	Research Infrastructures	Strategic Research and Innovation Agenda
Weakneses	• Many education programmes do not necessarily fit the present day requirements of economy (companies) and administrations • Education curricula respecting "traditional" domains and disciplines, not covering the river-delta-sea system as a continuum • incomplete picture of existing skills in Danube Region • lack of a quickly reacting-centralized system of education and training • Capacity building and training actions are limited (rarely provided to non academic actors like administrations, business community, etc) • Reduced credibility of the Higher Education system in several Danube Region countries due to some corruption cases • Lack of interdisciplinarity	• Current dispersion of existing research infrastructures and facilities and no coordination or clear information accessible • Missing systematic transnational (and sometimes even national) access to existing infrastructures • Lack of harmonization/ standardization of scientific data – either between domains or within the same field • Fragmentation of the overall picture of regional/national priorities for Research Infrastructures	• Stakeholder involvement in research coordination actions is insufficient • In some Danube Region countries there is a limited administrative capacity to absorb research, education and training funds (even though there are countries where almost 100% R&D funds have been committed and used) • Limited number of research providers, not fully exploiting the existing research potential (i.e. contracting always with the same research service providers on national level, not looking for competition) • Lack of an overall perspective of the entire Danube – Black Sea macrosystem leading to a non-alignment of research priorities taking into consideration the river basin-delta-sea system • Non-alignment of strategies and instruments /coordination • Lack of sustainable management of natural resources and ecosystems at the scale of the Danube River – Danube Delta – western Black Sea (taking into account of the entire macrobasin). • Not very effective communication of results from researchers to decision makers, administrations and the public. Communication between river basin and coastal – marine end users is limited. • Persistent lack of good intercalibration for WFD parameters in the entire river basin, including the coastal waters (despite the number of initiatives running) • Missing Harmonization of data in the entire basin (including the coastal sea) • Limited stakeholder involvement in many research projects • Limited number of basin – scale initiatives vs. national projects

	Human Resources	Research Infrastructures	Strategic Research and Innovation Agenda
Opportunities	• Development of Higher Education Institution (HEI) networks • Existing global educational trend towards a cross sectoral / interdisciplinary approach • Existing public awards for "water research" or "HEI+Administration cooperation" to showcase good experiences (best practice also in some Danube countries) • Twinning actions between HEIs to facilitate mutual learning • ERASMUS and other pan-European actions in the field of water • European legal framework for transferable credits between Higher Education Institutions • Existing European opportunities such as Marie Curie – for training at various research career stages • Already identified needs for highly skilled experts in future actions (ex. navigation) • Possibility to involve Industry/business funding of HEI training programmes, applied research and training activities • Promoting hands-on training in curricula • Framework exists to develop training certificates	• Proposed pan-European distributed RI in the field of river delta _ sea system (DANUBIUS-RI – its Danube component is EUSDR Flagship Project) • Proposed distributed RI: DREAM Danube River Research and Management – EUSDR Flagship Project • Existence of ESFRI and its roadmap • Existence of dedicated calls for Integrated Activities for Infrastructures at European level (H2020) • Coordination of existing national research infrastructures (national roadmaps) • Environmental and social research centres lining up to global initiatives, such as collection of long term data series • Existence of the GEOSS and COPERNICUS programmes	• Understanding of the full connected system river-delta-sea • Harmonisation of research goals and methodologies to support better research Programmes (Programme logic alignment and quality support, set up of better indicator sets for R&I programmes = structural support to stakeholders of national research and innovation programmes) • Setting the R&I Agenda relevant to EU 2020 Societal Challenges – also covering Horizon 2020 challenges (considering the Water EIP, Water, Climate and Ocean JPIs) • Acknowledged need to support the set up of the Danube River Basin Management Plan with the active involvement of researchers

	Human Resources	Research Infrastructures	Strategic Research and Innovation Agenda
Threats	• Inertia to changes when dealing with development of new research and professional communities • Lack of ability to involve in the capacity building process all the relevant actors/sectors • Limited access (eg. bureaucratic barriers) to field work for stakeholders that are not directly involved in water research	• Lack or uncertainties of funding • Subcritical funding and size endanger the visibility and significance in the region and globally • Focus on a very limited Research field • Limited funding for maintenance of regional and national infrastructures • Life cycle of infrastructure	• Complex administrative processes at national level endanger further alignment of international or coordinated research actions • Non availability and accessibility of best available technologies (cost factor, information, disclosure by industry) • Non timely response of actors - Urgency for action i.e. climate change • Possible rapid alterations suffered by the European natural habitats (eg. risk to lose the subject of research) • Segregation of the connected natural system driven by non coordinated interventions/isolated interventions in the system

3 Main proposals for a new toolbox of instruments to develop R&I in the field of Water research in the Danube Region, as resulting from the WP2 meetings and the SWOT Analysis

WHAT (Vision): The Danube River – Danube Delta – Black Sea system is a unique natural system with significant environmental assets with a range of competing pressures. The system is a natural laboratory, with a full range of interconnected river-delta-coastal-sea systems that are linked to economic, social and political structures. There is a critical need for adoption of sustainable and interconnected management of the systems that promote sustainable development that also preserves key assets and natural systems alongside economic development. To achieve this goal there is need for an overarching Strategic Research and Innovation Agenda (SRIA) that is dedicated to the Integrated Management of the Danube – Delta-Black Sea system. This SRIA requires promotion and implementation and development of a highly educated human resource that is trained within a "source – to – sea" philosophy that has the implementation of an integrated management of the river-delta-sea system at its core. Alongside this there is a need for development of a distributed research infrastructure within the implementation of the SRIA that exploits and facilitates development of human capital. This will allow for the improved, and sustainable, exploitation of the Danube Region and its resources within Europe. These activities will essentially "fill the gap" in water cycle research infrastructures (as requested in the EUSDR PA7 list) as well as strengthen the connectivity between fresh and marine water systems and their management.

HOW:

- use of existing National and European instruments (dedicated collaborative R&I programmes of the Funding bodies from the Danube Region, Article 185, Water and Ocean JPIs, ERA Nets in the fields of water resources), structural funds for financial support of the SRIA
- adjust the SRIA to strategic agendas/roadmaps of European networks (EUSDR, ICPDR, river commissions…)
- interaction with other international and European agencies / directorates

WHEN: The Vision should be implemented over longer than a decade. This requires enhancement of collaboration between the Research funding agencies, ministries and Academies of science. There is thus a Need for a Basin-wide (covering the coastal sea) Strategic Programme jointly developed by the countries within the Region. The results should be used and implemented in order to implement the EUSDR into reality.

Extra support: ESFRI agenda, H2020 agendas, and Urgency for actions in the context of Climate Change

With WHAT:

- appropriate research thematics, defined according to societal challenges and oriented towards ecosystem based approaches.
- Use of existing material (metadatabase, surveys, policy reports…) to define and forecast needs in the region in education, training, research
- use the outputs from international and national conferences for scientific implementation of the SRIA

Outreach:

- **Coordination of regional efforts**, in research, education to improve the environmental management of a whole macrosystem
- clarify the interface and improve the communication between the research community and decision makers, and business
- Encourage Communities of practices networking (best practices) and citizen sciences
- Long term perspectives with business and stakeholders involvement from the beginning

3.1 The Strategic Research and Innovation Agenda (SRIA)

Defining a SRIA that will improve the institutional and infrastructural framework conditions and policy instruments for R&I. The SRIA will be closely linked with the needs in education, and will foster innovative learning systems to increase competencies of employees in all working sectors, and will strengthen entrepreneurial culture in the field of environment.

The SRIA will be supported by existing and new research infrastructures centered around a unique natural laboratory allowing a connected approach “from source to sink”. This will be organized in a unique structure designed for encompassing needs for integration in the Danube Region (global interest as an umbrella over local ones), a distributed structure containing a Central Hub and thematic and/or regional Nodes. As 2 major initiatives already exist and have the status of Flagship Projects in the EU Strategy for the Danube Region (Priority Action 7), a major possibility would be to propose a cluster of the 2 distributed RI`s, each with its own scope, agenda and responsibilities.

3.2 Outcomes on new ideas for the development of a successful Strategic Research and Innovation Agenda in the Danube – Black Sea Region

Research Thematic Priorities:

A) Related to **H2020 Societal Challenges**: Strong Relevance to most categories. *Special emphasis on:*

SC2 Food Security, sustainable agriculture, marine and maritime research and the bio-economy

2.1 Sustainable agriculture and forestry

2.3 Unlocking the potential of aquatic living resources

SC3 Secure, clean and efficient energy

3.5 New knowledge and technologies

3.6 Robust decision making and public engagement

SC5 Climate action, resource efficiency and raw materials

4.1 Fighting and adapting to climate change

4.2 Sustainably managing natural resources and ecosystems.

4.5 Developing comprehensive and sustained global environmental observation and information system.

B) Related to the **Danube ecosystem and ecosystem services**: Strong relevance to most categories. Special emphasis to the following categories:

Provisioning Ecosystem Services

Food and fibre

Freshwater

Regulating Ecosystem Services

Water regulation

Erosion control

Water purification and waste treatment

Regulating Ecosystem Services

Cultural diversity

Educational values

Cultural heritage values

Supporting Ecosystem Services

Nutrient Cycling

Water cycling

Provisioning of habitat

C) Related to **Human Modifications** to the Danube River-Delta-Sea Ecosystems

Recurring themes are:

- Fisheries collapse
- Species introductions and losses
- Regional climate change
- Pollution (nutrient/eutrophication and hypoxia, genetic, emerging contaminants)
- Habitat modification (coastal zone, connectivity, pressures from agriculture)
- Water and Sediment management related to hydropower and navigation, ecological restoration and conservation, protection from natural hazards
- Global climate change and sea level rise impacts on coastal and delta region
- Tourism, Recreation and cultural heritage valorisation
- Management of environmental risk (wetland and floodplain restoration for flood protection, flood warning systems)

D) Related to **Water issues** in the Danube River-Delta-Sea system.

Main research themes are:

- Maintaining ecosystem sustainability
- Developing safe water systems for citizens
- Promoting competitiveness in the water industry
- Implementing a water-wise bio-based economy
- Closing the water cycle gap
- River continuity and lateral connectivity and their effects on water ecology, sediment supply and transport
- Disaster risk reduction strategy for increasing communities resilience
- Natural Hazards associated with climate change and exceptional events
- Climate change effects on food webs and fluvial dynamics
- Climate Change adaptation Synergies (win-win) management scenarios for hydropower, navigation & ecological (WFD) requirements

- Optimization of water treatment technologies
- Risk assessment in drinking water quality
- Health
- Pollution- bioaccumulation - Toxicity
- Development of new aggregate environmental indicators to be used by administrators
- River-Sea Interactions in delta areas
- Interdisciplinary approach to research - Combine social and economic aspects (cost/benefit) with pure research
- Cultural heritage

3.3 Outcomes on new ideas for the development of new Distributed Research Infrastructure in the Danube – Black Sea Region

Main Activity Fields of a new Distributed Research Infrastructure:

- Advising on Policy/Regulation
- Basic and Applied Research/Innovation/ Technology
- Monitoring/ Data gathering and archiving
- Platform for Education Expert Analysis/Consultation
- Coordination/Collaboration with other global river/delta/sea infrastructures.

Existing Scientific expertise in the Danube Area:

- Hydrological monitoring
- Monitoring Technology for Sediment Mobilization/Transport/Accumulation
- Biodiversity/ Ecological status
- Research and development on biomarkers and other indices related to water quality

Topics in need of further development (could be addressed by a new distributed Research Infrastructure)

- Heavy metal impacts on water quality/ecosystem
- Emerging pollutant impacts on water quality

- Genetic biodiversity
- Biogeochemical Cycles/ Ecosystem Metabolism
- Remote Sensing Technology with applications to ecosystem monitoring
- Development of Field Sensor Technologies/ Independent in-situ multiparameter observatories
- Laboratory facilities for physical simulations of rivers, lakes and the coastal zone
- Database host/facilities for simulation software (e.g. for sediments, macroregional simulation of climate impact)
- Coordinated approach in data acquisition and preparation to connect with the European and Global system following the INSPIRE Directive
- Operational modelling and scenario development facilities
- Solutions to optimised and safe navigation
- Social and economic input
- Integrated catchment approach (including governance aspects)
- Impacts of changing land management practices on society and environment
- Framework for citizen science
- Development of a transnational Danube observatory that facilitates the implementation of the Research and innovation agenda ; promote plans from EU Strategy for the Danube Region
- Flooding modelling and forecast (early warnoing systems)
- Cultural heritage protection and valorisation

3.4 Challenges/Risks in the planning and operation of a new research infrastructure in the Danube region

- Financial Security/Funding
- Organization Structure
- Clarity of Scope/ Direction
- Quality of Staff-Facilities/ Appeal to targeted end-users
- Appropriate Thematic Area selection

- Obtaining continuous support/endorsement from regional national/international stakeholders
- Interconnection with European and global research communities
- Harmonization with existing infrastructures
- Linkages to industry – PPP (Public Private Partnerships) (Applications and links to practical outcomes)

3.5 Outcomes on new ideas for the development new ideas for the development of an Education Agenda in the Danube – Black Sea Region

Types of Educational Activities:

- Formal or informal exchange programs for students
- Erasmus / inter-institutional for teachers
- Targeted professional training leading to certificate
- Commercial courses
- Short courses (summer/winter schools)
- Online / online accredited educational programs
- Multidisciplinary/interdisciplinary courses
- Science-Policy-Industry collective workshops

Career prospects of potential students:

- Pure/Applied Research
- Environmental / Ecosystem/ Natural Resource Management
- Government / International Organizations
- Industry
- Environmental planning
- Law and Policy Regulation

3.6 Emerging Cross-cutting themes

Communication

- Better understanding by researchers of public needs
- Better communication of research findings to administration, businesses and public for efficient exploitation of results
- Support for continuous public information and increased awareness; (means and methods of communication)
- Citizen science must be developed in the region
- The set-up of new “catchy messages” to the public (highlighting cases such as “Sturgeon 2020”)

Interdisciplinarity

- Between research disciplines.
- Between research, social and economic disciplines (e.g research conducted with an eye to social and economic aspects).
- Interdisciplinary education should address and combine research, social and economic aspects.
- Education agenda /Infrastructure should facilitate the exchange of knowledge across sectors (science, business, administration).