

POLICY BRIEF NR.2 MAY 2015



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INTRODUCTION

The aim of DANCERS has been to develop new instruments and tools that will enhance environmental research and promote innovation in the Danube Region, including the Danube Delta and the Black Sea. The project has undertaken a critical analysis of what has been achieved so far in the Danube Region and builds upon results of achievements to date, to design innovative solutions to strengthen knowledge transfer in this area. This has been achieved by gathering top level representatives of the academic and business communities as well as decision makers, specialized in various sectors of integrated management of the Danube – Black Sea macrosystem. The project was structured on the three main pillars of Research and Innovation: i. Science and Innovation Agenda, ii. Research Infrastructures and iii. Human Capital – and their relation to the three principle categories of stakeholder: i. Policy and Decision Makers, ii. Business / Industry community and iii. Academia. The consortium successfully delivered the three main documents promised at the beginning of the project. Below are set out the most important policy-facing conclusions arising from them.



1. Strategic Research and Innovation Agenda in the Danube – Black Sea system

The overarching aim in producing a Strategic Agenda for Research and Innovation (SRIA) was to review and evaluate the outcomes and uptake of existing and ongoing research within regional, EU and international scientific projects and initiatives that concern riverine, delta and sea systems. Specifically, the gaps between

science and policy were critically reviewed, with a particular focus on how research at different scales (local, regional, nation state) or concerned with separate elements of river-delta-sea systems (e.g. river channel or delta or sea) is integrated and robustly informs society and policy at present. Additionally, a range of international projects that were designed to support and inform policy decisions in key industrial sectors such as aquaculture, fisheries, energy, navigation, coastal protection and aggregate extraction (e.g. CONSCIENCE (EU FP6), COEXIST, CORALFISH, MESMA (EU FP7) were more closely examined to determine their impact on policy-makers and the relevant industrial sector. The results of the analysis delivered a range of information concerning the experiences of both successful and unsuccessful attempts to engage industry and policy-makers with the products of science.

Scientifically coherent solutions for integrated river-basin-sea management require an interdisciplinary approach that is well communicated and able to simultaneously inform decisions of society, industry and governments. Only through such an approach can the necessary sustainable and innovative solutions can be developed to address the major societal challenges into the future. The EU Strategy for the Danube Region determined priorities that will both strengthen and connect the region while simultaneously increasing prosperity and protecting the environment.

The proposed SRIA (Strategic Research and Innovation Agenda) addresses these research priorities in the context of Pillars and Priority Areas of the EU Strategy for the Danube.

- 1. Restoring ecosystem continuity throughout the Danube River Danube Delta NW Black Sea system
- 2. Pathways of transport and accumulation of litter(plastic) and pollutants (including emerging pollutants (e.g. nanoparticles) in the Danube Black Sea system and their impacts on local ecosystems
- **3.** Ensuring safe and continuous navigation while restoring the Danube green corridors (with strengthened natural protection from floods)
- 4. Resource Recovery from Eutrophication in the Danube Black Sea interaction zone
- 5. Dealing with Eutrophication in the Danube Black Sea interaction zone by using algae as 2nd Generation Biofuels
- 6. Using and developing latest Earth observation (EO) technologies coupled with in situ measurements for an upgraded Danube Black Sea environmental monitoring system
- 7. Developing sustainable agricultural practices (crops, husbandry) while obtaining good water quality in the Danube Black Sea system
- 8. Understanding river-sea interaction processes in the Danube Delta transitional environments
- 9. Managing dams and reservoir lakes as critical sediment traps and bottlenecks for river habitat continuity
- 10. Restoring natural habitats in the Danube floodplains Danube Delta and lagoon systems as support for fisheries revival
- 11. Understanding Climate change impacts on the Danube Black Sea System by applying the latest generation of models
- 12. Managing water resources for human use by implementing new technologies for water abstraction, purification, distribution, collection, treatment, and reuse
- 13. Harmonising scientific data and monitoring protocols in the Danube River Danube Delta Black Sea continuum
- 14. Unfolding the cultural heritage potential of the Danube Black Sea system by using scientific tools
- 15. Reducing future risks of invasive species in the Danube River- Danube Delta Black Sea system
- 16. Interdisciplinary scientific support for the successful implementation of the Sturgeon 2020 Flagship Project
- 17. A new Danube River- Danube Delta Black Sea Atlas

- 18. Innovative means to harness water energy
- 19. Promoting Cross Border Environmental Stewardship through Citizen Science
- 20. Dynamics of Dissolved Organic Matter in the Danube River Danube Delta Black Sea System
- 21. Cross-cutting SRIA activities in the Danube River Danube Delta Black Sea System

2. Detailed plans and concepts for a new regional research infrastructure in the field of integrated river- delta – sea management in the Danube – Black Sea area

This is an opportune time to address the challenges, identified above, by a cross- disciplinary distributed Research Infrastructure (RI) on freshwater – marine systems. The RI can potentially build upon the world-leading capabilities of the European environmental science community to deliver the necessary step-change in our understanding. This includes: (i) Earth Observation and the development of linked in-situ technologies through EC Framework Programmes and ESA funding, building on ESA's Copernicus Programme; (ii) near real-time processing and management of spatially distributed Big Data from smart networks; (iii) advanced geo- and biochemical analytical platforms, the latter describing genotypic and phenotypic diversity in increasing detail.

The initiative to develop a RI in the Danube River Basin and Black Sea is further enhanced by the coincidence of the following factors:

- i. Political framework including EUSDR and ESFRI.
- ii. Timeliness of technical advances (analytical capabilities eg. mass spectrometry, DNA e-sequencing, satellites sensors, mesocosms, numerical modelling, smart sensor networks)
- iii. Resource exploitation
- iv. European e-infrastructures initiatives (Geant & PRACE)
- v. Existence of the GEOSS and the COPERNICUS programmes

It is important to look forward and consider the degree to which the research needs identified in Section 2 (SWOT analysis and conclusions from DANCERS workshops) and the opportunities summarised in Section 3, can be addressed by the two new EUSDR flagship research initiatives in the Danube – Black Sea system (River, Delta and Sea). Together these initiatives (DREAM and DANUBIUS-RI) have the potential to provide world-leading facilities that will facilitate inter-disciplinary research in the Danube – Black Sea system. Both projects will build capacity and will benefit from active engagement with the European research community.

DANUBIUS-RI (International Centre for Advanced Studies on River-Sea Systems)

DANUBIUS-RI seeks to provide a world-leading RI to enable interdisciplinary research on freshwater – marine systems. In so doing it aims to identify and implement solutions to reconcile conflicting human uses within several river-sea systems in Europe, comprising the Danube - Black Sea. These solutions require a

holistic basin approach (from source to the sea), that spans the Danube - Black Sea system.

The RI will comprise a Hub, Supersites, Nodes, a Data Centre and Technology Transfer Office. Project co-ordination will be the responsibility of the Hub, situated in the Danube Delta, Romania. The infrastructure will be linked by the DANUBIUS Commons: a set of harmonized methods, protocols, instruments data acquisition and management to ensure quality assured and comparable data acquired across DANUBIUS-RI, to guarantee the consistency and quality of scientific output.

Supersites (field laboratories) are planned for the Danube River – Black Sea system at: (i) the Danube Delta (Romania); (ii) the Danube River at Szigetköz (Hungary) investigating surface-groundwater interactions; and (iii) Lake Lunz (Austria) focusing on the effects of climate change on aquatic ecosystems.



DANUBIUS-RI pan-European distributed infrastructure architecture. Map showing the location of the Supersites, the Hub, Nodes, key partners and the Technology Transfer Office. (situation – March 2015)

Nodes are key thematic facilities based on institutions with world-leading facilities and expertise, will ensure disciplinary rigour. Although located outside the Danube Region (Observation: Plymouth Marine Laboratory, UK; Analysis: BfG, Germany; Modelling: ISMAR, Italy; Social/Economic: Deltares, Netherlands), they will work to build capability and capacity across Europe including the Danube Region. They will do this by appointing other laboratories (Accredited Service Providers) in the Danube Basin that conform to the DANU-BIUS Commons and meet a need in the provision of facilities and services.

DANUBIUS-RI provides a unique opportunity to bring together European expertise and facilities with an internationally leading focus on understanding, characterising and managing freshwater and marine systems globally. Opportunities provided by research in the natural laboratory of the Danube – Black Sea system, will be maximised by building capacity with a new RI with wider engagement from European researchers and institutions. This exemplar will provide research outputs that will be transferrable to other river – sea systems globally.

DREAM (Danube River Research and Management)

DREAM aims to improve research infrastructure in the Danube basin in order to develop measures to improve the actual situation in river engineering, flood risk management, hydropower, navigation and protecting the Danube River ecosystems. It envisages the construction of two new laboratories in Romania and Austria, the upgrade of existing laboratories throughout the DRB, the development of a network that spans the joint usage (and application) of numerical models, the installation and running of field study sites, and the construction of a research vessel. DREAM furthermore seeks to foster improved cooperation between research organisations in the Danube basin as well as research groups based outside the region.

There is an urgent need to integrate use and protection of the Danube River in a sustainable way. Research is of fundamental importance to derive monitoring strategies, modelling and engineering solutions to improve measures suited to reach a win-win situation between economic use and environmental protection of the Danube River. This will be strongly related to the Danube River Basin Management Plan.



DREAM EUSDR Research Infrastructure proposed architecture. Map showing the location of the proposed new facilities to be developed (situation September 2014).

DREAM will provide an improvement of research infrastructure and cooperation between research institutions in the Danube basin. The two new laboratories combined with existing ones offer unique possibility for large-scale physical laboratory investigation allowing fundamental and applied research. One is situated in the Upper Danube in Vienna. It uses the water level difference between the Danube and the Danube Canal of 3 m to reach a laboratory providing free flowing discharge of up to 10 m³/s. This will be a unique facility in Europe. The focus of research will be steeper slope reaches, coarse sediment transport interacting with flood risk management, hydropower, navigation and ecology, thus the Upper and Middle Danube are mainly investigated there. The Romanian new Laboratory will concentrate on low slope and fine grained sediment transport, including the Deltaic and estuarine conditions.

DREAM provides an umbrella and the infrastructure for a set of research topics. These topics are interconnected and cover several disciplines, from basic research, to be represented by advanced hydraulic laboratories and sophisticated 3D models on high computational technology, to applied research, providing field data to mitigate hydrological extremes and to improve existing situations in water regimes, sediment regime, flood risk, drought problems, hydropower, revision of bio-engineering measures, restoration of streams and flood plains, etc.

The DREAM partnership includes all Danube River Basin Countries and further research institutions outside the basin.

Proposed partnership

The partnership between the two flagship projects aims to fulfil the needs of the region. DANUBIUS-RI and DREAM are complementary RI projects: while they have different objectives, there are areas of interface, and potential synergy, between the two flagship projects. DREAM focusses on hydrodynamics, sediment transport, river morphodynamics, flood risk management and engineering in the Danube River basin. DANUBIUS-RI has a wide disciplinary scope (physical, chemical, biological, social and economic sciences) and covers not only the Danube - Black Sea macrosystem but other large European River-Sea systems. The two projects have a number of partner organisations in common across Europe. The opportunities for partnership include:

- collaboration and sharing of field sites (DREAM field study sites; DANUBIUS-RI Supersites and other field sites) in the Danube River basin;
- use of DANUBIUS-RI facilities in the Danube Delta, and elsewhere, for DREAM activities;
- use of DREAM facilities for DANUBIUS-RI activities;
- collection and sharing of data using the same protocols;
- facilities provided by both facilities to be used for research on the main common point of interest - dynamics of sediments in the Danube – Black Sea;
- DANUBIUS-RI Data Centre will provide support on request to DREAM;
- DREAM facility in Vienna has the potential to become a Node of DANUBIUS-RI on river hydraulics, or establish a clear agreement to cover this role; and
- DANUBIUS-RI Technological Transfer Office will support specific requests coming from the DREAM project.

Means of cooperation, data accessibility

It is important that DANUBIUS-RI and DREAM develop and maintain a close level of cooperation on all major topics, from strategic research directions to data sharing, joint projects, and agreements towards common use of several facilities. This cooperation is helped by several key participant institutions from Romania (GeoEcoMar – coordinating the ESFRI process of DANUBIUS-RI) and Austria (WCL, BOKU) being present in both RI initiatives.

Ongoing collaboration is ensured by DREAM representatives being invited to participate in the DANUBIUS-RI ESFRI Preparatory Phase (subsequent to the access on the 2016 ESFRI Roadmap). DANUBIUS-RI repreesentatives are participating in the DREAM project meetings. These joint actions will contribute to the final and detailed decision to strengthen the long lasting collaboration between the two RIs

Implementation strategy and funding sources

The implementation strategy for both projects is that all funding sources must be sought and used for the building of the various parts of the planned facilities.

DANUBIUS-RI: After obtaining ESFRI status, DANUBIUS-RI will be eligible for Structural Funds. Romania dedicated a chapter for the building of the Hub from Structural Funds – the Competitiveness Operational Programme (for RIs) 2014 – 2020 – and part of the facilities to be developed in the Danube Delta as DREAM - Romania are eligible here. Structural funds and national funding in all European countries hosting parts of DANUBIUS-RI are available for construction, and such funds were already identified under adequate Smart Specialisation Strategies in each EU country where Nodes and Supersites are being developed. National funds and other sources are also sought where necessary to supplement the financial resources, both for construction and for operation.

DREAM: DREAM aims to use all funding opportunities in the Danube Region, from national to specific programmes and structural funds. The CBC (Cross Border Cooperation) Programmes existing between all the DREAM consortium countries are excellent opportunities to build most of the hard infrastructure required for the project.

The newly launched programme DANUBE is crucial for both projects and may become a major funding source to continue the already established collaboration.

Detailed explanations on each of the above mentioned RI can be found on www.dancers-fp7.eu.

3. Human capital development programme

The proposal for the education agenda is achieved through an analysis of the gaps and opportunities for an integrated approach towards a better alignment of international education and Human Resource development in the Danube Basin. Developments in the Danube – Black Sea system macro-region include a number of initiatives and activities from before and after the 1990s (the fall of the Iron Curtain). In this context, the document reflects on the challenges including access to education programmes, new developments (including the credit transfer system) and the language requirements necessary for more substantial international co-operation. The document reflects on stakeholder opinions and provides a general discussion of the existing programs in the field of higher education and professional training. Based on the presented challenges and opportunities with which the educational needs are faced, DANCERS proposes a model for a new Danube education programme has at its core a pyramid base and approach that aims to address different levels of education.



Proposed Model for a Danube Educational Programme

The main aim of such a programme is to build a network of institutions and to develop agreements and mechanisms to facilitate the exchange of experts, students and scientists at the following educational levels within the Danube Basin.

Technicians

One big challenge of the EUSDR is the difference in educational structure between individual countries, i.e. regarding professional education and chances on the job market (oead'news 1/94 p. 23). To facilitate exchange of personnel it is necessary to ensure a high level of quality in basic training; standardised methods; and promote exchange of know-how on an advanced level. Therefore, technicians should be encouraged to visit labs for short term hands on training courses, helping to foster technical cooperation between research centres and industries. Also, it is crucial to grant internationally recognised certificates for participants of the training courses.

Relevant course contents could include e.g. measuring water quantity (discharge, sediment transport) and water quality parameters (quality assurance/quality control practices), data acquisition, storage and preparation of samples, generation of regulatory data, calibration and maintenance of lab and field equipment, conducting data management including statistical analyses and field sampling etc.

It is important to note that technicians support all levels of education. Thus, a cooperation of technicians in the Danube Basin will improve the technical skills level for problem solving.

Undergraduate students

The international network should embolden bachelor students to spend one or two semesters, or to undertake research projects, at a partner institution in the Danube Black Sea system (academia and industry sector), to gain international experience.

On bachelor level, there is a large range of possibilities for international exchange in Danube – Black Sea system. What is missing is a clearly arranged platform that gives a complete overview.

There should also be a strengthening of a Danube Basin undergraduate student exchange programme and an offering of specific undergraduate Danube related special courses. These courses range e.g. from fundamental subjects like environmental science, geomorphology, hydraulics, hydrology, sediment transport, ecology,

social and political science courses to an integrated water and river management.

Postgraduate students (MSc)

Master Students exchange is of utmost importance to the future improvement of the Danube River Basin Management since many alumni will work later in governmental organisations like Ministries, Water Authorities, Consulting Companies (planning measures to improve the water management situation in the Basin) or the Private Sector (e.g. Hydropower Companies, Navigation sector). Thus there is a direct impact of the education improvement on water and river management.

By strengthening a Danube Basin postgraduate student exchange programme and offering of specific postgraduate Danube related special courses these goals should be reachable.

One element could be a newly developed Master's programme based on the following topics:

- Ecology and limnology, including assessment methods, restoration and management schemes, etc;
- Hydrology and hydraulics, from theory to practical application
- Sustainable water management, including e.g. sustainable flood protection, hydro-power, navigation, river preservation and restoration, sustainable water use for irrigation; and
- Socioeconomics, including ecotourism.

The programme should include an obligation for an internship/apprenticeship in a research institute or in industry. For the further development also see "Guidelines for Curriculum Development and Quality Assurance of Joint Master Programmes" (Euroleague for Life Sciences).

Postgraduate students (PhD)

A further goal is to facilitate an international exchange of Danube Basin PhDs, aiming at exchanging and assimilating know-how between countries/institutions and advancing knowledge by either taking specific, specialised modules or undertaking specific credit bearing research projects (e.g. PhD thesis, scientific projects) in a host institution or jointly. Also, the jointly use of research facilities would enhance exchange and knowledge transfer and could be an eligible development considering limited financial and material resources.

To meet these challenges and needs in education, we propose that CASEE, Danube Rectors' Conference (DRC), the European Academy of Science and the Black Sea Universities Network (BSUN) should be integrated to work on a Danube specific programme, to enhance the efforts and implement it. Also, it is proposed to seek pan-European funding and supervisors with key expertise distributed across the region to capitalise on the expertise available. CEEPUS (the "Central European Exchange Program for University Studies") could serve as a model programme.

Based on these models the establishment of a Danube Basin PhD programme should be initiated. Furthermore the development of a Danube education cooperation strategy should be initiated.

Scientists:

Finally, the proposed Danube education programme also includes the scientists, from PostDocs, junior to senior lecturers to full professors. In this field a joint teaching and research program and a scientist exchange strategy among the Danube – Black Sea system universities is envisaged. In order to reach these goals the following roadmap could be followed: In a conference scientists of the whole Danube – Black Sea system, dealing with water and river – delta – coastal sea research, could meet and discuss ways and strategies to establish a joint and fully complementary teaching and research program. The conference would establish working

groups that would be initiated with specific tasks that cover both strategic teaching and research areas. Within a period of two years a concrete strategy should be available as draft version, to be discussed and adopted in a final conference. In parallel, means to improve the flow and exchange of scientists and expertise between different Danube Region universities should be constructed. The DRC and BSUN should be involved so that there exist at the end direct implementation ideas that allow the realisation.

Lifelong learning

Across Europe the importance of providing lifelong learning is increasingly recognised and can take many forms: in academic institutions, in places of employment, at home (distance learning) and through leisure activities. At one level, lifelong learning can facilitate retraining of individuals, providing a more flexible labour force. It also enables individuals to develop their knowledge and technical expertise to adapt to changing requirements of the labour market and fulfil the requirement of continuous professional development. It is important to acknowledge that this also applies to administrators and managers (Table 5.5) as well as scientists.

In the UK (NIACE, 2009: www.niace.org.uk), a recent review of lifelong learning advocates a 4-stage model: i. up to 25; ii. 25–50; iii. 50–75, and iv. 75+. While people in the first stage may learn as 'young people, in the second stage, lifelong learning can sustain productivity and prosperity. Training and education opportunities are also important in stage 3, to facilitate retraining, but increasingly, stage 4 is becoming important in delivering an appropriate curriculum in later life.

A major request that came out during the DANCERS workshop with the managers and administrators in May 2014 regarded a stronger and more intensive lifelong learning system. All participants required to have systematic intensive training, during which to be instructed in the latest scientific updates / available tools.

Depending on the type of managers and administrators as well as the field of interest three professional training programmes are proposed:

- Specialised courses related to a certain field of expertise (e.g. river hydraulics, coastal dynamics, sediment transport, flood risk management)
- Summer schools consisting of a theoretical and practical part.
- Masters courses as programs that are run in parallel to the job

Specialised courses related to a certain field of expertise would be offered by a specific University covering a needed subject. Summer schools could be offered by several universities and be implemented at a special location, eventually close to the Danube River and the Danube Delta / Black Sea coast (depending also on the topic). There, theory and practical work should be included to allow an easier transfer from basic research to application.

A third suggestion is the development of a Masters course as a programme in parallel to employment, meaning that the courses would have to take place in the evening, on weekends or during job releases. It could be envisaged that this could be a special Danube - BlackSea Masters programme. These courses or schools should result in certified diplomas.



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