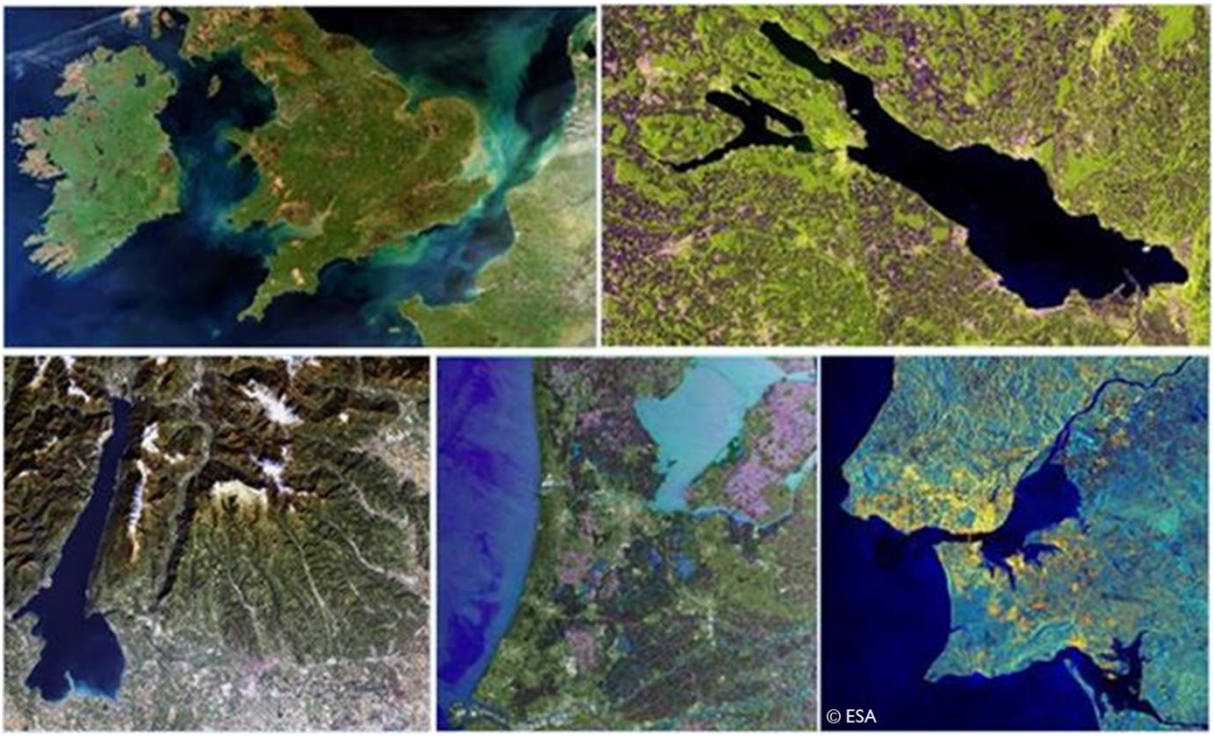

Mapping Water RDI in Europe

December, 2014

Disclaimer

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This publication contains Annexes that, due to their size, are not included in this manuscript. Access to the main report and the Annexes 1, 2 and 3 will be available in the Water JPI webpage through hyperlinks. Annexes 4, 5 and 6 will be available on the intranet of the Water JPI webpage. Annexes will be listed as follows: Annex 1, Country Fiches; Annex 2, Interviews; Annex 3, Methodology; Annex 4, Questionnaires and Questionnaire Tables; Annex 5, Questionnaires (Open Questions); Annex 6, Raw data source.

Acknowledgments

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Interviewees

- Laura Burke (Director-General of the Environmental Protection Agency (EPA));
- Durk Krol (Director of the WssTP - European Technology Platform for Water Research and Innovation);
- Seppo Rekolainen (Director Freshwater Centre of the Finish Environment Institute (SYKE));
- Robert Schroeder (Policy Officer at the European Commission, Directorate General for the Environment, Unit C.1 Protection of Water Resources and presents the European Innovation Partnership on Water);
- Jean-Philippe Torterotot (Deputy Director of Research, Development and Innovation of the Ministry of Ecology, Sustainable Development and Energy);
- Marina Villegas Gracia (General Director of Scientific and Technical Research Ministry of Economic Affairs and Competitiveness).

Respondents to the Questionnaires

- WasserCluster Lunz (AUSTRIA)
- Research Promotion Foundation (CYPRUS)
- Biology Centre ASCR - Institute of Hydrobiology (CZECH REPUBLIC)
- Aarhus University (DENMARK)
- Innovation Fund Denmark (DENMARK)
- Health Board (ESTONIA)
- Ministry of the Environment (ESTONIA)
- Aalto University (FINLAND)
- Academy of Finland (FINLAND)
- Alleco Oy (FINLAND)
- Geological Survey of Finland (FINLAND)
- Metla (FINLAND)
- Ministry of Employment and the Economy (FINLAND)
- RYM Oy (FINLAND)
- Tampere University of Technology (FINLAND)
- University of Tampere (FINLAND)
- University of Oulu (FINLAND)
- Vaisala Oyj (FINLAND)
- CEFREM - Centre de Formation et de Recherche sur les Environnements Méditerranéens, Université de Perpignan, UMR 5110, CNRS (FRANCE)
- ECOBIO Rennes - Ecosystems, Biodiversity, Evolution, Université de Rennes 1, UMR 6553, CNRS (FRANCE)
- CEREMA - Centre d'études et d'expertise sur les risques, l'environnement, la mobilité et l'aménagement (FRANCE)
- Pacte - Politiques Publiques, Action Politique, Territoires, Université de Grenoble, UMR 5194, CNRS (FRANCE)
- CEPAM - Cultures–Environnements. Préhistoire, Antiquité, Moyen Âge, Université Nice Sophia Antipolis, UMR 7264, CNRS (FRANCE)
- CITERES - Cités Territoires Environnement et Sociétés, Université François-Rabelais de Tours, UMR 7324, CNRS (FRANCE)
- GEOLAB, UMR 6042, Université Blaise Pascal / Université de Limoges /CNRS (FRANCE)

- GEPEA - Laboratoire de Génie des rocédés Environnement et Agro-alimentaire, Université de Nantes / Ecole des Mines de Nantes /ONIRIS, UMR CNRS 6144 (FRANCE)
- LBE - Laboratoire de Biotechnologie de l'Environnement, INRA - Institut National de la Recherche Agronomique (FRANCE)
- Institut de Physique du Globe de Paris, Water geochemistry Research Department (FRANCE)
- Irstea - Institut national de recherche en sciences et technologies pour l'environnement et l'agriculture (FRANCE)
- Station Biologique de Roscoff, Université Pierre et Marie Curie, UMR 7144, CNRS (FRANCE)
- Leesu - Laboratoire Eau Environnement et Systèmes Urbains, École des Ponts ParisTech / Université Paris-Est Créteil / Université Paris-Est Marne-la-Vallée / AgroParisTech, UMR MA 102 (FRANCE)
- LEGOS - Laboratoire d'Etudes en Géophysique et Océanographie Spatiales (FRANCE)
- Météo France, CNRM-GAME - Centre National de Recherches Météorologiques. Groupe d'études de l'Atmosphère Météorologique, UMR 3589, CNRS (FRANCE)
- Centre de Géosciences, MINES ParisTech / ARMINES (FRANCE)
- ONEMA - Office national de l'eau et des milieux aquatiques (FRANCE)
- Fondation de Coopération Scientifique Rovaltain (FRANCE)
- LEHNA - Laboratoire d'Ecologie des Hydrosystèmes Naturels et Anthropisés, Université Claude Bernard
- Lyon I / ENTPE - Ecole Nationale des Travaux Publics de l'Etat, UMR 5023, CNRS (FRANCE)
- LCME - Laboratory of Molecular Chemistry and Environment - University of Savoie (FRANCE)
- Central Solutions Ltd (IRELAND)
- Department of Agriculture, Food and the Marine (IRELAND)
- Department of Environment, Community and Local Government (IRELAND)
- Dublin City University (IRELAND)
- Dublin Institute of Technology (IRELAND)
- Enterprise Ireland (IRELAND)
- Environmental Protection Agency (IRELAND)
- Inland Fisheries Ireland (IRELAND)
- Irish Research Council (IRELAND)
- Marine Institute (IRELAND)
- National University of Ireland Maynooth (IRELAND)
- RainSafe™ Water (IRELAND)
- Ryan Institute - National University of Ireland (IRELAND)
- The Office of Public Works (IRELAND)
- Trinity College Dublin (IRELAND)
- University College Cork (IRELAND)
- University College Dublin (UCD) Earth Institute (IRELAND)
- Water Technology Research Group - Trinity College Dublin (IRELAND)
- ARPA Valle d'Aosta (ITALY)
- ARPAV - Regional Department for Land Safety (ITALY)
- Autorità di bacino del fiume Po (ITALY)
- Enea (ITALY)
- IDPA-CNR (ITALY)
- Institute for the Dynamics of Environmental Processes - CNR (ITALY)
- ISPRA - Institute for Environmental Protection and Research (ITALY)
- MIUR - Ministry of Education, Research and University (ITALY)
- NRD - Desertification Research Centre - University of Sassari (ITALY)
- Regione Autonoma Valle d'Aosta - Dipartimento programmazione, difesa del suolo e risorse idriche (ITALY)
- SMAT - Società Metropolitana Acque Torino S.p.A. (ITALY)
- Università Ca' Foscari di Venezia (ITALY)
- University of Bologna (ITALY)
- University of Trento (ITALY)
- Geological Survey of Norway (NORWAY)
- Ministry of Petroleum and Energy (NORWAY)
- Nofima AS (NORWAY)

- Norsk Institutt for Vannforskning (NORWAY)
- Norwegian Agriculture Agency (NORWAY)
- Norwegian Environmental Agency (NORWAY)
- Norwegian Institute for Nature Research (NINA) (NORWAY)
- Norwegian University of Science and Technology (NORWAY)
- NTNU-Trondheim - Norwegian University of Science and Technology (NORWAY)
- SINTEF Energy Research (NORWAY)
- Sogn og Fjordane University College (NORWAY)
- The Norwegian Environmental Agency (NORWAY)
- The Research Council of Norway (NORWAY)
- Adventech, Lda (PORTUGAL)
- Foundation for Science and Technology (FCT) (PORTUGAL)
- Grove Advanced Chemicals SA (PORTUGAL)
- Polytechnic Institute of Leiria (PORTUGAL)
- AQUALOGY (SPAIN)
- CDTI - Centre for Industrial Technological Development (SPAIN)
- CETAQUA (SPAIN)
- FCC AQUALIA (SPAIN)
- Fundació Institut Català de Recerca de l'Aigua (ICRA) (SPAIN)
- INIA (SPAIN)
- Institute of Water Research, University of Granada (SPAIN)
- MINECO - Ministry of Economy and Competitiveness - State Secretariat for Research, Development and Innovation (SPAIN)
- MAGRAMA - Ministerio de Agricultura, Alimentación y Medio Ambiente - Subdirección General de Regadíos y Economía del Agua (SPAIN)
- University of Cordoba (SPAIN)
- IVL Swedish Environmental Research Institute (SWEDEN)
- Stockholm Environment Institute (SWEDEN)
- Svenskt Vatten (SWEDEN)
- Swedish Meteorological and Hydrological Institute (SWEDEN)
- FORMAS - The Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning (SWEDEN)
- KVU - Konferenz der Vorsteher der Umweltschutzämter (SWITZERLAND)
- SISKA - Swiss Institute for Speleology and Karst-Studies (SWITZERLAND)
- Swiss National Science Foundation (SWITZERLAND)
- WASH Competence Centre, Dipartimento Ambiente Costruzioni e Design - SUPSI - Scuola Universitaria Professionale della Svizzera Italiana (SWITZERLAND)
- Marmara University, Faculty of Engineering, Environmental Engineering Department (TURKEY)
- EPSRC - Engineering and Physical Sciences Research Council (UNITED KINGDOM).

Table of Contents

List of Abbreviations

DoW	Description of Work
EIP on Water	European Innovation Partnership on Water
ERA-NET	European Research Area Network
ESFRI	European Strategy Form on Research Infrastructures
EU	European Union
EUROSTATS	Statistical Office of the European Union
EU40	Europe: Member States and Associated Countries
FP7	7th Framework Programme for Research and Technological Development
GDP	Gross domestic product
JPI	Joint Programming Initiative
PCT	The Patent Cooperation Treaty
RDI	Research, Development and Innovation
SRIA	Strategic Research and Innovation Agenda
Water JPI	Water Joint Programming Initiative
WatEUr CSA	Tackling European Water Challenges. FP7 Coordination and Support Action
WIPO	World Intellectual Property Organisation
WOS	Web Of Science™
WP	Work Package
WssTP	European Technology Platform for Water Research and Innovation

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Executive Summary

The Water Joint Programming Initiative (Water JPI), which currently counts on nineteen partner and five observer countries, aims at achieving sustainable water systems for a sustainable economy in Europe and beyond. The WatEUr Coordination and Support Action (WatEUr CSA) has been supporting the development and implementation of the Water JPI and contributing to the realisation of its objectives.

The Work Package 2 (WP2) of the WatEUr CSA includes a mapping exercise aiming at the acquisition of a solid knowledge of the Water RDI sector across European nations. Portugal, through Foundation for Science and Technology (FCT) and Norway, through the Environmental Agency (NEA) are the leader and co-leader of this WP, respectively, and they have counted on the valuable contribution from the Ministry of Economy and Competitiveness (MINECO, Spain).

This Mapping Report is put into frame in the context of the Water JPI and the WatEUr CSA (Chapter 1). A description of the Water JPI and WatEUr CSA objectives is provided. This WP is at the core of the WatEUr CSA, and this manuscript makes use of varied instruments (questionnaires, desk research and interviews), which are detailed in this section.

Chapter 2 deals with the methodology used to build this Mapping Report. The design of the questionnaires, the procedures and overall objectives are described, as well as how the interviews were outlined and how the interviewees were selected and invited. The criteria used in the desk research that was conducted by MINECO is also addressed, with detailed information on how the data relative to Europe's scientific production and seven other countries, representing developed and emerging nations, was acquired.

Chapter 3 describes the analysis of the results and discussion of the data, in a close relationship with the information gathered from the interviews. Data was used to characterise research strategies, policies and programmes, as well as research projects, infrastructures and mobility schemes from the participating organisations from the different member states. In addition, a bibliometric analysis provided information on the number of publications, patents, and increasing rates of productivity. Europe's profile on Water RDI was compared to the rest of the World. Additional information was gathered regarding coordination activities in Europe, and data was collected that allowed to understand current strengths and weaknesses.

The last part of this manuscript, Chapter 4, deals with the conclusions and future directions.

The participation of 108 organisations that contributed to the questionnaires must be highlighted, and the separation of the questionnaires by different types of actors and themes is of greater efficiency, but there is still room for improvement.

Also of great relevance is to develop mechanisms to increase the number of participating organisations and the countries involved. Interestingly, the interviews were a great asset to this Mapping Report and it is remarkable that the information collected from the questionnaires and desk research is so inextricably linked to the answers provided by the interviewees.

The desk research confirmed Europe's leadership in Water RDI, and how a shift towards tackling present water-related challenges is being seriously undertaken by all types of European institutions and actors.

Overall, the progress that has been made since the beginning of the Water JPI is notorious, and the efforts made by the organisations towards a unified European strategy is clearly visible throughout this document.

1. Introduction

1.1. Framing the mapping exercise within Water Joint Programming Initiative and WatEUr Coordination Support Action (WatEUr CSA): background, connections and objectives

Water availability in sufficient quantities and adequate quality is an issue of highest priority and represents a pan-European and global societal challenge. However, Water challenges cannot be successfully tackled through the isolated effort of individual national research and innovation programmes.

The Water Joint Programming Initiative (Water JPI), which currently counts on nineteen partner and five observer countries, aims at achieving sustainable water systems for a sustainable economy in Europe and beyond. The WatEUr CSA has been preparing and supporting the successful development and implementation of the Water JPI. This Coordination and Support Action has been mediating the structures of the Water JPI to impulse progress towards its objectives.

Joint activities are of crucial importance in making the Water JPI instrumental to the Research, Development and Innovation (RDI) community. In addition, joint efforts augment the effectiveness of addressing and tackling European water-related challenges. The current mapping of national and regional RDI institutions, their programmes, projects and funding schemes constitutes one of these instruments.

A coordinated and strategic approach to public and private national and regional research and innovation funding in Europe is conditioned by particular policies and very different scientific and technological national systems, including traditional RDI institutions and companies. Also, one should take into account the disparities in the available funds and all the idiosyncrasies inherent to each country. Therefore, it is understandable how critical a solid knowledge of the Water RDI sector across European nations is.

The mapping exercise included in the Work Package 2 (WP2) of WatEUr CSA aims at i) facilitating a better understanding of the European water-related RDI landscape, ii) deliver a targeted inventory of national and regional research strategies, policies and programs, iii) examine the funding of research projects, infrastructures and mobility schemes in Water RDI, iv) describe relevant multi-national coordination activities taking place in Europe, and v) provide a preliminary strategic analysis of the current water research strengths, weaknesses, gaps and barriers to cooperation.

This WP constitutes one of the core activities of the WatEUr CSA. The analysis of the results gathered is intended to contribute to feeding the Water JPI Strategic Research and Innovation Agenda (SRIA), and to bring exhaustive information, new perspectives and ideas that will complement and critically support the development of the SRIA throughout its implementation process (now progressing from version 1.0 to version 2.0).

Prior to the beginning of WatEUr CSA, Water JPI benefited from two previous mapping exercises. One was accomplished by the European Commission in October 2011, tracing the main lines and thematic funding between 2007 and 2011 for FP7 projects. The fact that Water was included in the Environmental sector diminished the impact of the data, and this exercise became more relevant for the overall framing than for the Water sector itself.

The second mapping exercise[1] was developed in 2011 by the Water JPI, under the leadership of Ireland (EPA). This mapping focused on water research and development, and particularly on competitive funding. A four-page document, only addressing public RDI funding, assessed the importance of SRIA topics for each respondent (43 in total), funding data for water projects and projects in general. In addition, information on international cooperation was included, and it covered the type of funding and foreign institutions able to receive funding. Efforts were also made to describe the role of each of the responding organisations, and to enhance other thematic fields beyond water.

The current mapping exercise intends to provide more in-depth information than its predecessors, in what concerns the mechanisms facilitating policies, strategies, funding schemes and performance in Water RDI.

[1] Water JPI Maturity Template (http://www.waterjpi.eu/images/documents/Water_JPI_Maturity_Template_20110420.pdf)

Efforts were developed at mapping all types of organisations in the public and private sector, governmental and funding organisations, universities and companies.

The higher-value contribution of this assembly of tasks is expected to prove essential in providing the desired critical mass on policies, programs, financing and performance of the scientific and technological sector. Ultimately, the challenges designed for the Water JPI will be met with success.

1.2. Selected instruments: questionnaires, interviews, desk research

The WatEUr CSA European mapping in Water RDI was based on three data collection instruments: questionnaires, interviews and desk research studies. The contents of these instruments were structured and approached under four main themes: Thematic Priorities, Governmental Strategies, Funding Schemes and Performing in Water RDI.

The Questionnaires are electronically available in the SURVS Platform (http://www.survs.com) and they comprise the core of this exercise. In what started as a single and extensive document, it was later divided into four separate questionnaires, each one addressing one of the aforementioned topics. The first version of the questionnaire, approved by the Governing Board (GB) on 14th May 2013, was filled out internally by the Water JPI and the WatEUr CSA partners in 2013. The final version of the document, split into four individual questionnaires, was opened to the Water RDI community in February 2014. These questionnaires can still be answered throughout the CSA lifetime and the information will be annually collected, analysed and reported in due time.

Another important part of the mapping exercise was to conduct a series of Interviews to leaders of European initiatives in the field of water and other relevant stakeholders in the private and public sectors. These interviews constituted a solid opportunity to convene the experience and personal thoughts of each interviewee on different challenges inspired by water management and needs. Their contribution allowed obtaining valuable information from experts, which complemented the rigidity of the questionnaires.

Desk research studies were conducted to collect data on water RDI, through a bibliometric analysis compiled from the Web of Science™. This included several key scientific productivity indexes, namely publications, and the most relevant research and funding institutions involved. The Patents analysis covered patents registered under The Patent Cooperation Treaty (PCT), obtained from WIPO database (World Intellectual Property Organisation) and downloaded from ESPACENET.

Thus, questionnaires, interviews and desk research studies are, by definition, complementary parts of a mapping exercise that has sought to balance the accuracy and diversity of information in a quantitative and qualitative approach, showing not only objective data but also bringing into the discussion critical issues and different points of view. A polyhedral perspective will was attempted, in order to effectively serve a common endeavour.

In this manuscript, it is outlined an introduction to the Water Joint Programming Initiative and the WatEUr Coordination Support Action (Chapter 1). On Chapter 2, it is described the Methodology employed in this Mapping Report, namely the questionnaires design, the interviews and the desk research. Chapter 3 deals with the results and the discussion of the data, in a close relationship with the information gathered from the interviews. The last part of this manuscript, Chapter 4, deals with the conclusions and future directions.

The various supplementary information in the form of Annex 1, Annex 2, Annex 3, Annex 4, Annex 5 and Annex 6 provides additional information on the methodology and procedure for the mapping exercise, copy of the questionnaires and documentation of support, the *Country Fiches* generated as well as the DoW components on the mapping.

1.3. Coordination

Portugal, through Foundation for Science and Technology (FCT) and Norway, through the Environmental Agency (NEA) are the leader and co-leader of WP2, respectively.

Other participant partners in this WP are: the Ministry of Economy and Competitiveness (MINECO, Spain), Natural Environment Research Council (NERC, United Kingdom), Institute for Environment Protection and Research (ISPRA, Italy), Academy of Finland (AKA, Finland), Environment Protection Agency (EPA, Ireland),

Executive Agency for Higher Education, Research, Development and Innovation Funding (UEFISCDI, Romania), Research Promotion Foundation (RPF, Cyprus) and Office National de l'Eau et des Milieux Aquatiques (ONEMA, France).

2. Methodology

WP2 objectives according to the WatEUr CSA Description of Work (DoW) were stated as follows:

"WP2 will build on the preliminary mapping survey developed by the Water JPI and the complete mapping performed by Commission Services on Water in the Framework Programme. The previous Water JPI mapping effort focused only on programs funding RDI projects. WatEUr will broaden the scope of mapping activities. WP2 has been designed to gather relevant information on water-related research, development and innovation, at the national and regional levels. Mapping will feed SRIA development (WP3). WP objectives include:

I. Facilitate better understanding of the European water-related RDI landscape;
II. Deliver a targeted inventory of national and regional research strategies, policies and programs, where they exist;
III. Examine funding of projects, research infrastructures and mobility schemes in support of water RDI, which are in place or in planning across Europe;
IV. Describe relevant multi-national coordination activities taking place in Europe; and
V. Provide a preliminary strategic analysis of the current water research strengths, weaknesses, gaps and barriers to cooperation as a key input to WP3.

A strong coordination is needed between WP2 and WP3, since WP2 will provide key information and meta-information for WP3 (developing the SRIA). Cooperation from all Water JPI partner countries will be particularly required for the success of this WP."

2.1. Questionnaire(s) design – Instrument, Methodology and Procedures

As aforementioned, the internet-based questionnaires comprised a key basis of the mapping exercise, representing a standardised instrument in order to facilitate the compilation and statistical analysis of the data.

Each questionnaire was built to be accessible through an individual link that did not require personal access codes. The first page of each questionnaire contained information about the targeted respondents and instructions on how to fill out the survey. The design was meant simple, with the sharp goal of collecting objective information regarded as relevant and as accurate as possible. With this in mind, the majority of questions were close-ended (Yes/No, multiple-choice), limiting the open-ended questions to very specific cases. Respondents were required to identify themselves and (name, function, contacts) and provide the name of the organisation. Completion of the questionnaire was concluded by pressing the button "Submit". Submission is possible with questions unanswered but seals the report and validates the answers.

Four questionnaires focused on specific themes were developed, after identification of the information needed, the corresponding target organisations and all the variables of interest. According to their objectives, they were named:

- Questionnaire 1: Thematic Priorities;
- Questionnaire 2: Government Strategies;
- Questionnaire 3: Funding Schemes;
- Questionnaire 4: Performing Organizations.

The first questionnaire "Thematic Priorities" comprised 42 questions, and it was directed to all types of organisations: governmental, public, private, companies, NGOs, etc. Having as reference the SRIA priorities (including Ecological Engineering), respondents were asked to identify the thematic priorities of the organisation, and the corresponding level of priority (high or low, and short-, medium- or long-term). In addition, other high-priority topics not mentioned in the SRIA were also requested from respondents.

Finally, it was assessed each priority against the following criteria: investment return; contribution to improving the state of the European environment; contribution to tackling the societal challenges problems identified in Horizon 2020, and European contribution to tackling policy priorities.

The second questionnaire, "Governmental Strategies", was built with 38 questions, and it was specifically aimed at governmental organisations that could be directly involved in the definition of Water RDI strategies, namely Ministries, public institutions, municipalities and other regional authorities. The information requested was intended to explain the thematic on the basis of the strategic design in the Water area.

With this questionnaire it was possible to extract i) the main target areas in Water RDI, ii) scientific and strategic focus areas in Water RDI, iii) the main sources of data/information on which the organisations base their national Water RDI policy, iv) examples of relevant infrastructures for Water RDI, their type and the corresponding level of access, v) the organisations cooperation with stakeholders in Water RDI, and a description of the stakeholders, and vi) an overall evaluation of the cooperation between the organisations and the stakeholders and technology transfer.

"Funding Schemes", the third questionnaire, included 58 questions, and it was addressed to institutions, agencies and companies responsible for Water RDI funding. Disregarding their public or private nature, it was also aimed at understanding how each entity is distributing its investments in the Water sector, and how it compares to the global funding efforts in all the other scientific domains.

This questionnaire was also designed to accurately characterise the types of Water RDI funded activities, so it was necessary to include a quantitative component. Emphasis was given to competitive funding, as it represents the most common form of financial support, and the one that has been continuously sustaining the interface between funding agencies and the scientific and technological system. Nonetheless, "Funding Schemes" was performed to understand the procedures related to non-competitive funding and specific areas of research where it applies. Cooperation with companies/industries, international cooperation modalities and call procedures were also covered.

Finally, "Performing Organisations" included 49 questions, and it was meant to encompass diverse information and enlighten thematic priorities and procedures in Water RDI performing organisations. As previously mentioned, thematic priorities are deployed in a specific questionnaire, while this was sought to particularise the environment in which the performance is undertaken.

In addition to some information covered by "Thematic Priorities", other key areas on Water RDI were also included in the set of questions, namely scientific programs, infrastructures, fellowships/mobility schemes, and other actions. It was also emphasised the dimension of competitive funding compared to non-competitive, the type of expenditure executed and the source of the funding rules applicable to the performing organisations. The questionnaire includes questions on self-funding and external funding, and how they are compared.

The data sought in the questionnaires comprehended a period spanning from 2007 to the end of 2013, in order to cover most of the 7th Framework Programme (FP7). The survey started in February 2014 and the final deadline considered for submission of responses was the 30th September 2014, though efforts were made and the period was extended until the end of October 2014. The identity of respondents was protected. The information provided through these questionnaires was published aggregated. No results were meant to be published linking the name of the organisations to their answers. More detailed information on the methodology can be found in Annex 3, and regarding the Questionnaires, in Annex 4 and Annex 5.

2.2. The design of the interviews: instrument, methodology and procedures

It was established that interviews would be conducted as an integral part of Mapping Report, and efforts were made to harmonise the resulting information with the questionnaires and desk research studies. The target respondents were selected in accordance with the DoW, namely "stakeholders and leaders of relevant initiatives" in Water RDI in Europe, both at a national and international level.

In general, the thematic basis for the interviews followed the mapping components, but it was also given an important emphasis to the information contained in the questionnaires. This allowed acquiring a different

approach relative to the governmental strategies, funding schemes and performing organisations in Water RDI, including the set priorities in each of these levels. Nonetheless, the interviews were customised to the interviewee's profile in order to make them unique, personal and distinct from the standardised instruments. Following these considerations, the interviews were performed by email, in which it was included a brief introduction on the purpose and goals of this initiative, and it was stressed how the interviewees contribution would be relevant for the sustained growth of Water RDI in Europe.

This method ensured an accurate registration of the answers and the interviewers were provided with an opportunity to augment the quality and effectiveness of the information extracted.

Each interview was composed by a set of 6/7 predetermined open questions, driven by the general profile of the interviewees, their achievements, and the corresponding area(s) of intervention, all in accordance to the objectives of the current Mapping Report. Each set of questions allowed reaching different points of view, opinions and even realities insufficiently captured or undetected through the use of questionnaires and desk studies. More than an additional source of information, these interviews promoted the enlargement of the mapping focus, highlighted several problems, barriers and expectations, and consequently contributed substantially to an enrichment of the material contained in this study.

Interviewees were informed that their interviews would be published in the 2014 Mapping Report. More detailed information on the methodology can be found in Annex 3, and the full interviews, in Annex 2.

2.3. Desk research design – Instrument, Methodology and Procedures

Desk research was performed in an iterative way with Water JPI partners. The methodology and results of desk research was discussed in meetings' presentations and through data review requests to partners through email. Partners' inputs greatly improved the quality of the mapping exercise. A key hypothesis was made to produce this report: publication counts are a proxy for research, while patent counts are a proxy for innovation. The validity of this hypothesis determines the accuracy of the discussions below.

2.3.1. Bibliometric analysis of Water Research

Bibliometric analysis is based on the number of publications and the identification of key production issues, particularly Institutions, Funding Agencies, and Scientists / Towns. The number of publications was compiled from the Web of Science™ Core Collection (hereinafter WOS) including five basic Citation Indexes:

- Science Citation Index Expanded (SCI-EXPANDED); 1900-present,
- Social Sciences Citation Index (SSCI); 1956-present,
- Arts & Humanities Citation Index (A&HCI); 1975-present,
- Conference Proceedings Citation Index- Science (CPCI-S); 1990-present, and
- Conference Proceedings Citation Index- Social Science & Humanities (CPCI-SSH); 1990-present.

Searches in these databases were performed using three criteria (Topic, Timespan and Country) which are detailed in the following sections.

Thematic priorities of SRIA

The five thematic priorities expressed in the Water JPI Strategic Research and Innovation Agenda (SRIA 1.0) plus a general water question "all water issues" were introduced in the Web of Science as "Topic" for each country and timespan. These six questions were formulated in terms of Web of Science search strings indicated in Table 1.

Timespan

The main period analysed for each SRIA thematic priority is the nearest period of 15 years: 1999-2013. In order to analyse time evolution, the three consecutive 5-year periods were independently analysed: 1999-2003, 2004-2008, and 2009-2013.

Target territory

Bibliometric research focused on a total of 40 European and 7 non-European countries. In this context European countries include those eligible to receive funding from Horizon 2020[1]: EU Member States and Associated Countries to Horizon 2020. In this report the group of 40 countries is denoted as "Europe" or "EU40". The group of Member States is denoted as "EU MS". In order to place the European Union in an international context, additional non-European countries were analysed, including large developed countries and emerging countries (Table 2).

Table 1. Formulation of the SRIA thematic priorities as Web Of Science strings

SRIA Code[2]	SRIA Question	WOS Search String
Q1	Maintaining Ecosystem Sustainability	water AND (ecosystem OR ecohydrology OR "ecological engineering" OR flood OR drought OR "early warning" OR "ecosystem service")
Q2	Developing safe water systems for the citizens	water AND (urban OR "emerging pollutants" OR "flood" OR "drinking water" OR "water treatment" OR "water distribution" OR "water storage")
Q3	Promoting competitiveness in the water industry	water AND (industry OR distribution OR measurement OR telemetry OR "remote control" OR reuse OR desalination OR sewage OR sludge OR "economic instrument" OR governance OR regulatory)
Q4	Implementing a water-wise bio-based economy	water AND (bio-based OR bio-economy OR bioeconomy OR agriculture OR (irrigation NOT clinical) OR forestry OR (non-point AND pollution))
Q5	Closing the water cycle gap	water AND ("water supply" OR "water demand" OR "water deficit" OR transboundary OR "sustainable" OR (hydrolog* AND model*) OR ("managed aquifer recharge") OR ("soil-aquifer treatment") OR (socio* AND econom*) OR "decision support system")
Q6	All Water Issues	hydrology OR (Water AND agriculture) OR (irrigation NOT clinical) OR (river AND basin) OR watershed OR flood OR drought OR ((urban OR municipal OR residential OR treatment) AND water) OR ((industry OR industrial) AND water)

Table 2. Countries analysed by desk research

Territory	Number of countries	Countries[3]
Member States of European Union (MS)	28	Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, The Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, United Kingdom
Associated Countries to H2020 (AC)	12	Albania, Bosnia, Faroe Islands, FYROM, Iceland, Israel, Moldova, Montenegro, Norway, Serbia, Switzerland, Turkey
Developed countries	4	Australia, Canada, Japan, USA
Emerging countries	3	Brazil, China, India

[1] Signed an agreement with the Union as identified in Article 7 of the Horizon 2020 Regulation. http://ec.europa.eu/research/participants/data/ref/h2020/grants_manual/hi/3cpart/h2020-hi-list-ac_en.pdf.

[2] Abbreviations to describe Q1-Q6 throughout the document are used. Q1-*Sustainable Ecosystems*, Q2-*Safe Water for Citizens*, Q3-*Water Industry*, Q4-*Water-wise Bio-economy*, Q5-*Water Cycle Gap*, and Q6-*All Water issues*

[3] In the WOS search string UK was set as "England OR Wales OR Scotland OR Northern Ireland"; FYROM was set as "FYROM OR (Macedonia NOT Greece)"; and Ireland was set as "Ireland NOT North".

2.3.2. Keys identified in Water scientific production

For each of the 40 EU countries we identified the most prevalent Funding Agencies and Performing Institutions. We extracted this information by applying the *Analysis* function of the Web of Science on the set of publications retrieved from the SRIA questions. This functionality generates lists ranked by record count (absolute number and percentage) based on the search query. Text files with the top 25 funding agencies, and 50 performing organizations were downloaded.

The data sets downloaded were consolidated in final ranked lists by the following three steps:

1. **Verification** of each item in its web site. Names were homogenised, in English, to generate consolidated ranked lists.
2. Selection of only the top funding and performing Institutions with the highest **intensity of citations.** The intensity of citations was calculated as the record counts value referred to the maximum value in the list. Only Institutions with intensity of citations ≥ 10 were retained in the country report.
3. Selection of a balanced number of **items per country**, from 1 to 5 according to the volume of scientific production in each country. Final ranked lists of Funding Agencies, Performing Organisations and Authors for each country only include a minimum of 1 item and a maximum of 5 items per query. For this purpose, countries were grouped by their scientific production (number of publications) into five classes (Table 3) obtained by automatic classification of the data (Section #5).

Table 3. Countries classified by their volume of scientific production into five classes, equivalent to the number of funders /performers /authors of the final ranked lists.

Class	Number of publications	Countries
1	2 to 500	Albania, Bosnia, Cyprus, Estonia, Faroe Island, Iceland, Lithuania, Luxembourg, Latvia, Moldova, Montenegro, FYROM, Malta
2	501 to 1,908	Bulgaria, Croatia, Hungary, Ireland, Romania, Serbia, Slovenia, Slovakia
3	1,909 to 3,855	Austria, Czech Republic, Denmark, Finland, Greece, Israel, Norway, Portugal
4	3,856 to 8,861	Belgium, The Netherlands, Poland, Switzerland, Sweden, Turkey
5	8,862 to 24,143	Spain, France, UK, Italy, Germany

Due to international collaboration, the same publication can be computed in different countries. In this sense, a maximum overlapping < 4% has been estimated in the number of publications per country. As an example, Spain shares a percentage of Q1 publications of 3.3% with France, 2.4% with Germany, 3.3% with Italy and 1.6% with the United States.

The intrinsic advantage of this methodology is that these data can be produced for any country using the same tools and filters applied in this report. Additionally, the analysis is completely repeatable.

2.3.3. Patents analysis

Patents were obtained in June 2014 from the ESPACENET WIPO database and extracted in a similar fashion to the bibliometric analysis. Detailed information about the query strings used can be found in Annex 3.

The raw data sets downloaded from the database were consolidated using following two steps:

1. **Verification** of the sound classification of the patents. After checking their abstracts in an arbitrary subset of patents per query, a number of the revised patents was discarded (Table 4). The rest were retained as patents relevant to the topics.
2. Correction of the number of patents applying a **goodness coefficient** per query (Table 4). The goodness coefficient was calculated as the percentage of relevant patents per analysed subset.

Table 4. Goodness coefficient applied to the patents dataset per Water JPI SRIA theme.

SRIA theme	No. Patents WIPO	No. Patents in the subset	No. Patents discarded	Goodness coefficient (%)
Q1-Sustainable Ecosystems	195	195	36	81.5
Q2-Safe Water for Citizens	3593	50	13	74.0
Q3- Water Industry	6489	217	139	35.9
Q4-Water-wise Bio-economy	635	60	12	80.0
Q5-Water Cycle Gap	2475	81	43	46.9
Q6-All water issues	10820	100	38	62.0

2.3.4. Indexes calculated per each country

Standardised Publications and Patents on Water

The number of publications and patents compiled per country were normalised per population and per Gross Domestic Product (GDP), so as to produce comparable indicators between countries of different sizes from the points of view of population and economic strength. The same indicators were produced for Europe as a whole (EU40).

The ISO 3166-1 alpha-2 – two-letter country official codes used in all the tables and maps, together with the Gross Domestic Product obtained from the List by the United Nations (2012) and Population data (inhabitants per country) can be found in Annex 6.

Increase rate of Publications and Patents on Water

The increasing rate of publications and patents on Water was calculated as the number of publications and patents from the last five years (2009-2013) divided by that of the five first years (1999-2003) of the analysed period. This rate was calculated for each country as:

1. **Absolute increasing rate** (INC_RATE): the number of publications (PUB) or patents (PAT) from the five last years of the analysed period divided by that of the five first years:

   INC_RATE_PUB= PUB_2009-2013[1] / PUB_1999-2003

   INC_RATE_PAT= PAT_2009-2013 / PAT_1999-2003

2. **Relative increasing rate** (%EU_INC_RATE): the absolute increase rate of the country divided by the same absolute value applied to Europe (EU40, MS+AC), expressed in percentage. This index expresses how fast water publications are increasing in time in the individual countries relative to Europe (MS+AC):

   %EU_INC_RATE = 100 x INC_RATE / EU_INC_RATE

Relationship between Research and Innovation on Water

The balance between research and innovation on Water was quantified by calculating the number of patents per 1,000 publications for each country.

2.3.5. Political Maps on Water Research (publications) and Innovation (patents)

Raw and standardised data and related indexes were mapped (political maps) using ArcGis® and edited using Adobe Illustrator CS5. All the data has been compiled in tables and relevant or selected information will be published on the Water JPI website.

[1] When PUB_Q1_1999-2003 = 0, the increasing rate is not determined.

All maps were obtained using the Jenks classification algorithm implemented in the ArcGis® software. This data clustering method is designed to determine the best arrangement of values into "natural" classes[1].

All maps display **five** classes in order to have an accurate and simple representation of spatial data by means of monochromatic shaded maps.

2.3.6. Estimates on Water RDI in Europe

The information about Water RDI funding in Europe was based on data declared by Water JPI partners through current and previous[2] surveys. Water RDI estimations were based on EUROSTAT data[3] about the Gross Domestic Product expenditure on R&D activities, published in November 2014, and on recent GDP estimates[4] for EU Member States. More detailed information can be found in tables of Annex 6. Country Fiches can be found in Annex 1, and they will be published on the Water JPI website.

[1] Jenks, G. F. 1967. "The Data Model Concept in Statistical Mapping", International Yearbook of Cartography 7: 186-190.

[2] Water JPI Maturity Template (http://www.waterjpi.eu/images/documents/Water_JPI_Maturity_Template_20110420.pdf)

[3] First estimates of Research & Development in 2013 (http://epp.eurostat.ec.europa.eu/cache/ITY_PUBLIC/9-17112014-BP/EN/9-17112014-BP-EN.PDF)

[4] First estimation of European aggregates based on ESA 2010 http://epp.eurostat.ec.europa.eu/cache/ITY_PUBLIC/2-17102014-BP/EN/2-17102014-BP-EN.PDF

3. Results and Analysis of Data

3.1. Questionnaires and Interviews

3.1.1. General Overview

During the year of 2014, it was ensured the participation of 110 respondents in the mapping exercise, representing 16 European countries (Figure 1). A total of 13 Water JPI/ WatEUr CSA partners (68.4%) participated in this mapping exercise. Within Water JPI Observers, only one country participated (Sweden), which corresponds to 20% of the group. Regarding the non-member European countries of the Water JPI (EU Member States, other associated countries and non-EU countries), two countries participated (11.8%, Czech Republic and Switzerland). France, Ireland, Italy, Norway, Spain and Finland had a survey response rate between 10% and19%.

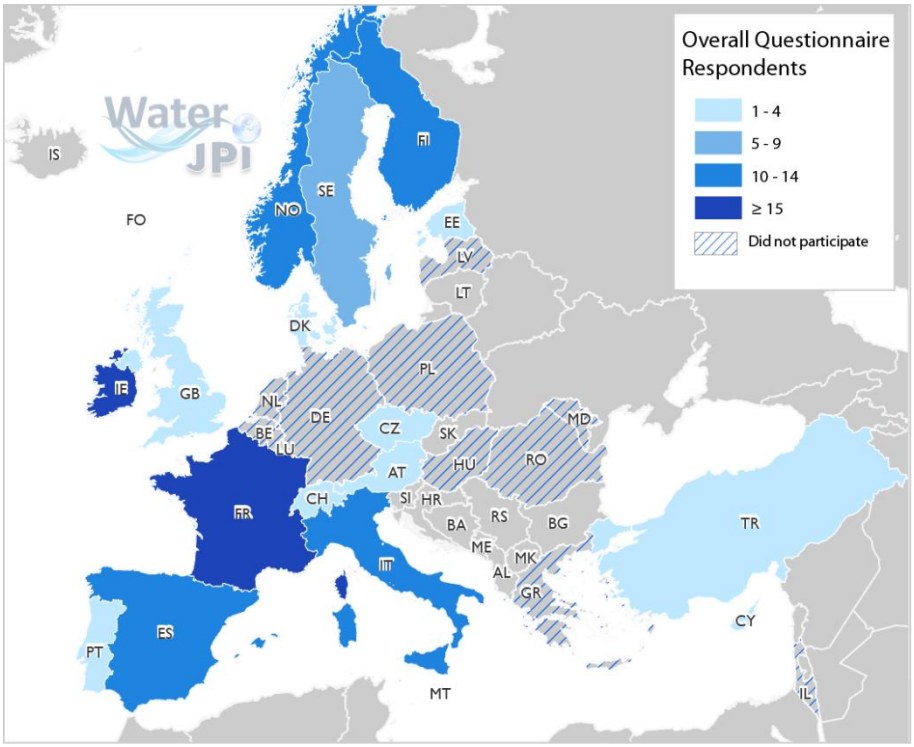

Figure 1. Distribution of respondents to the questionnaires per country. The colour intensities describe the level of participation, whereas the line-filled coloured countries are part of the Water JPI, but did not participate in this exercise.

The 110 respondents represent 108 organisations/institutes. The characterisation of the respondents is summarised in Table 5, where it is included the type of organisation and the number of organisations assigned to each category.

Circa 15% of the respondents were defined as *Unknown* because they did not reply to the "Thematic Priorities" questionnaire. As aforementioned, the latter questionnaire was meant to be answered by all participating organisations. Also, 7% of the respondents stated that their organisation did not fit in any of the suggested typologies, and consequently the option *Other* was selected. However, they subsequently failed to specify the proper typology or gave an incomplete/inaccurate characterisation. It is noteworthy that about 45% of respondents are from research organisations.

Depending on the organisation's role in the water sector, the respondents needed to address two or more of the four Questionnaires available (Figure 2), being the "Thematic Priorities" questionnaire mandatory for all respondents. Despite the instructions in the dissemination message and in the online questionnaires, among the 110 respondent organisations/institutions, only 93 responded to the "Thematic Priorities" questionnaire (85%). Also, it was noted that around 18% of the respondents did not answer any of the

three questionnaires directed to organisations according to their role – Governmental organisations responsible for the definition of strategies in water RDI, funding organisations and performing organisations.

Table 5. Number of respondents per type of organisation.

Type of Organisation	Total of Respondents	Percentage
Unknown	17	15
Departmental Authority	2	2
Governmental National Agency	17	15
Governmental Regional Agency	2	2
Non-profit Private Organisation	4	4
Non-profit Public Organisation	1	1
Private Company	7	6
Private Research Organisation	2	2
Private University/Research Unit	2	2
Public Company	2	2
Public Laboratory	1	1
Public Research Organisation	16	15
Public University/Research Unit	28	25
Regional Authority	1	1
Other, please specify	8	7
TOTAL	**110**	100

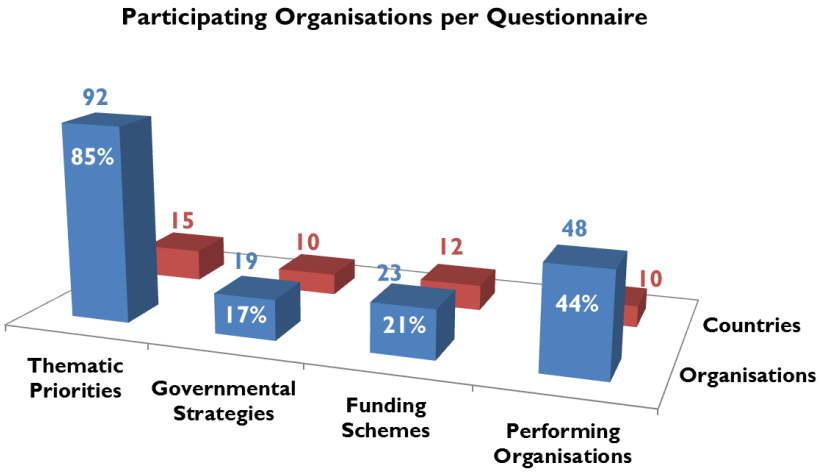

Figure 2. Distribution of respondents per questionnaire (blue). The figure inset includes the percentages (white) versus the total of 108 organisations that were considered among 16 countries (red).

3.1.2. Thematic Priorities in Water RDI

A total of 92 organisations corresponding to 15 countries have responded to the "Thematic Priorities" questionnaire, which correspond to 85% of all participating organisations and 94% of the countries involved (Figure 3). As aforementioned, this questionnaire was applicable to all participating organisations, so 15% failed to meet this goal.

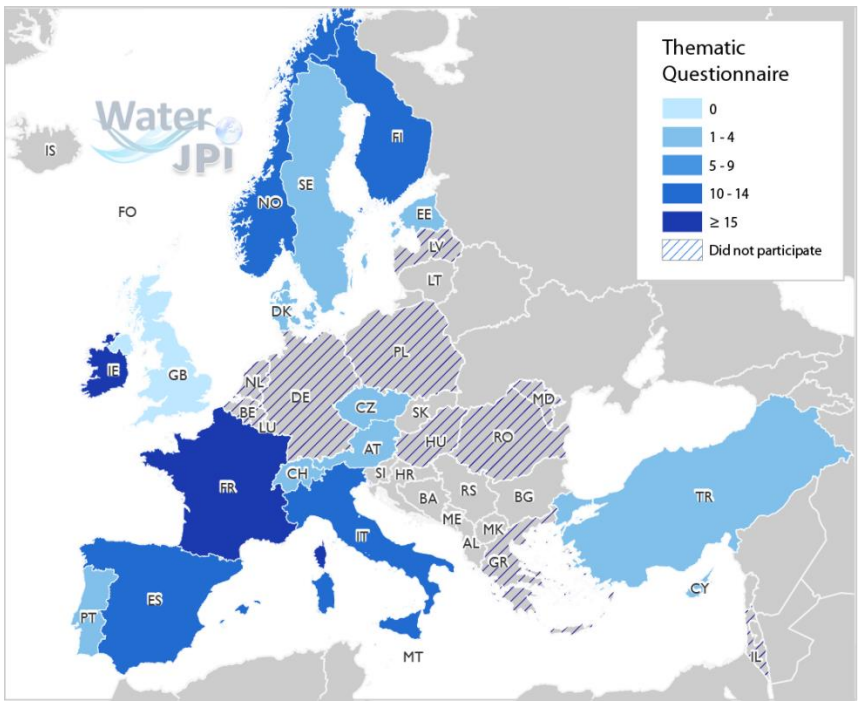

Figure 3. Distribution of respondents to the questionnaire "Thematic Priorities". The colour intensities describe the level of participation, whereas the line-filled coloured countries are part of the Water JPI, but did not participate in this exercise.

The public sector aggregated the majority of results with 74% of the answers, whereas the private sector contributed with 15% of the results. In terms of the roles of the organisations and the number of countries involved, the majority is related to performing Water RDI at 74% (68 organisations among 13 countries), with 26% assuming to fund Water RDI (24 organisations, 10 countries) and only 15% related to setting up governmental strategies (14 organisations, 8 countries).

Out of the 92 participating organisations, 78% admitted having strategic priorities for Water RDI (72 organisations in 12 countries). To these organisations it was outlined a series of questions regarding the corresponding research themes and specific interests. The Water JPI has five RDI themes, constituting the core of the SRIA (Table 1).

The first theme, *Q1-Sustainable Ecosystems*, gathers the interest of all the 12 countries, with an average of 54% of organisations invoking various research topics of relevant interest, as shown in Figure 4, namely *Ecological Engineering*, *Ecohydrology*, *Hydro Climatic Extremes* and *Ecosystem Service Approaches*. The themes Q2-*Safe Water for Citizens* – with the research topics *Emerging Pollutants* and *Risks and Natural Hazards* - and Q5-*Water-Cycle Gap* – with research topics *Water Management* and *Socio-Economic Approaches* – share the same level of relevance from the participating organisations. The themes Q3-*Water Industry* and Q4-*Water-Wise Bio-Economy* showed lower levels of interest with the most common research topic on each case (*Market Oriented Solutions* and *Reducing Pollution*, respectively) associated to less than 50% of the organisations (Figure 4).

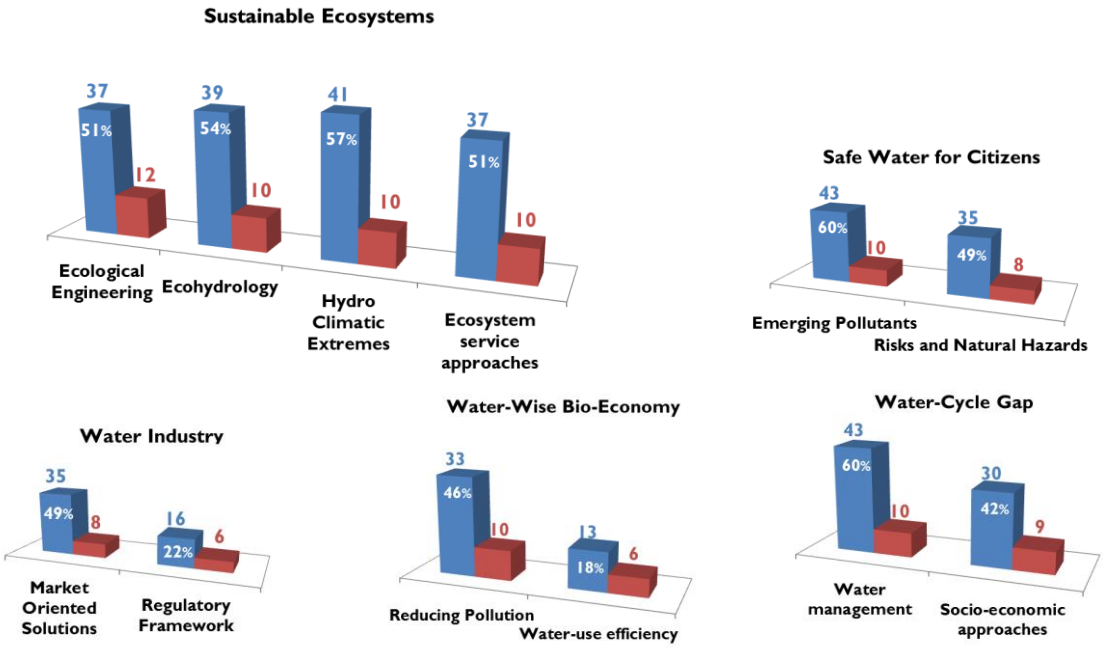

Figure 4. Strategic priorities in Water RDI. Number of organisations (blue) and the corresponding number of countries (red) interested in the five main research topics, namely Q1- Sustainable Ecosystems, Q2-Safe Water Citizens, Q3-Water Industry, Q4-Water-wise Bio-economy, Q5-Water Cycle Gap. Only the two main topics, or alternatively the topics assigned to more than 20 organisations are displayed. The figure inset includes the percentages relative to the total of 72 organisations that stated to have strategic priorities in Water RDI.

Figure 5 describes the most relevant research topics and themes provided by the organisations that have strategic priorities in Water RDI. In line to what was aforementioned in Figure 4, the ecosystem sustainability (Q1) represents a major concern for the organisations with *Environment* (67%, 48 organisations) and *Climate Change* (49%, 35 organisations) as the most common topics, in the context of *Water Use* and *Water Availability*, respectively. In the latter theme, it is important to highlight *Water Scarcity and Drought* at 32% (23 organisations), and in the context of *Water Quality/Ecology*, *Ecological Status* and *Indicators and Monitoring* share a similar level of interest at 36% (26 organisations) and 31% (21 organisations), respectively. Detailed analysis of Figure 5 will provide a broader view of the most common research topics highlighted by the organisations.

In Annex 5: Questionnaires (Open Questions), it was compiled a list of research topics specifically mentioned by the participating organisations. Although the SRIA generally covers these topics, emphasis was put on particular environments (glaciers, karst, lakes, etc.), relationships (water-energy nexus) and horizontal issues (smart technologies, open data, socio-economic aspects, etc.).

Again, Figure 6 reflects the higher weight that is placed on Q1-*Sustainable Ecosystems* and Q2-*Safe Water for Citizens*, consistent with the data shown in Figures 4 and 5. These are the two RDI themes in which the organisations allocate a higher priority (58% and 38% of the organisations consider the two themes at a high priority). The gap between low priority and high priority is enormous, as only less than 6% of the organisations considered the two themes at a low priority level. The remaining three themes (Q3-*Water Industry*, Q4-*Water-Wise Bio-Economy* and Q5-*Water-Cycle Gap*) have a very balanced distribution in terms of priority levels oscillating between 22% and 13% for high, medium and low priority.

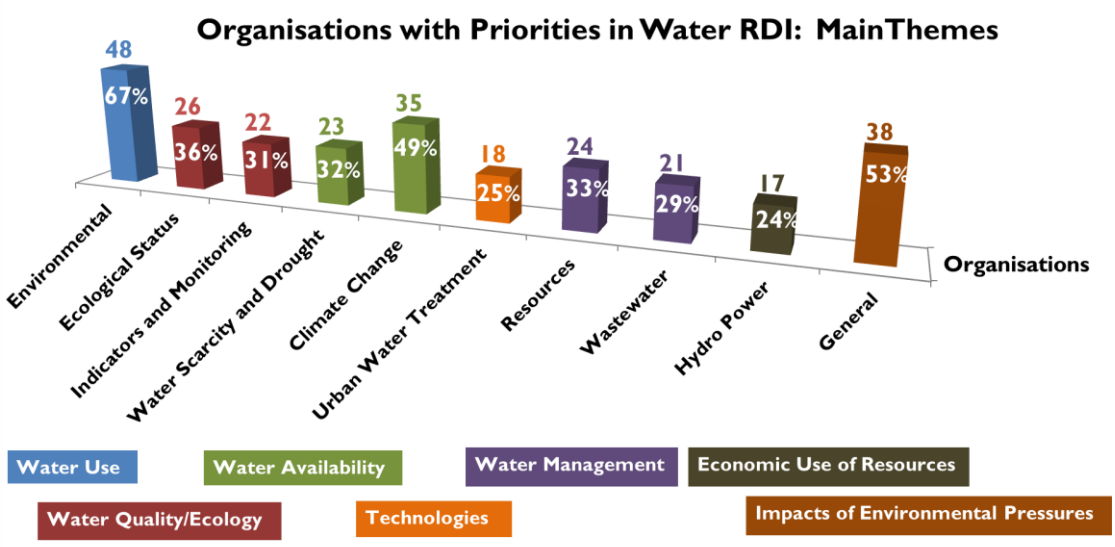

Figure 5. Most relevant topics and themes provided by the organisations that have strategic priorities in Water RDI. Number of organisations highlighted in different colours according to themes, namely Water Use, Water Quality/Ecology, Water Availability, Technologies, Water Management, Economic Use of Resources, Impacts of Environmental Pressures. Only the two main topics, or alternatively the topics assigned to more than 20 organisations are displayed. The relative percentages relative to the total of 72 organisations with strategic priorities in Water RDI are included in the figure inset.

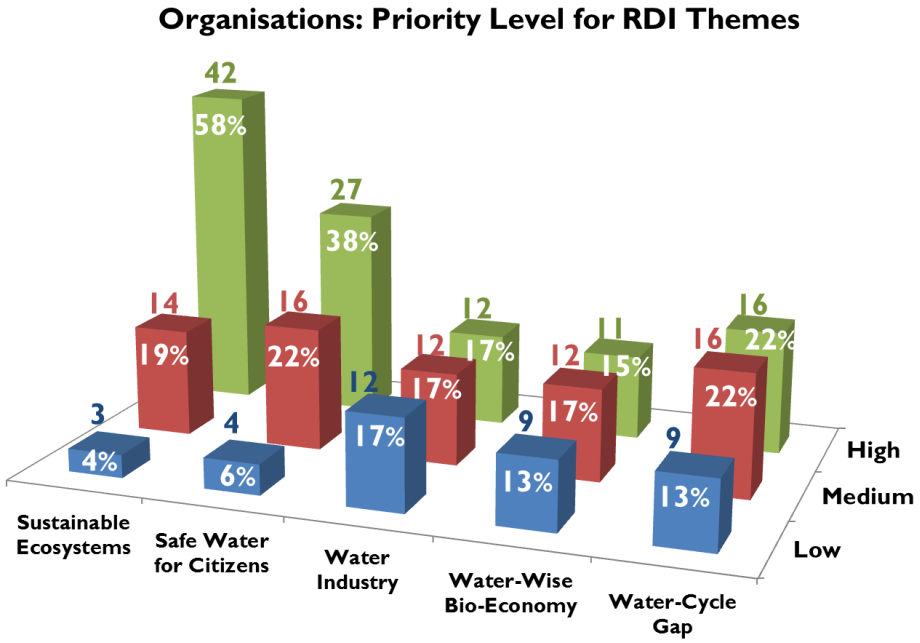

Figure 6. SRIA main research themes and the organisations that have strategic priorities in Water RDI (numbers and percentages relative to a total of 72 organisations) and the corresponding level of priority. Number of organisations highlighted in different colours according to the priority level, high, medium and low (green, red and blue, respectively) and the five SRIA themes: Q1-Sustainable Ecosystems, Q2-Safe Water for Citizens, Q3-Water Industry, Q4-Water-Wise Bio-Economy, Q5-Water-Cycle Gap.

Interestingly, while a vast majority of the organisations showed an apparent reluctance in putting any of the five SRIA themes as a low priority, as demonstrated by Figures 4 and 5, this was not accompanied by the priority timeline status for the different themes. As described by Figure 7, the organisations are apparently more focused in medium and long term goals, and Q2-*Safe Water for Citizens* overcomes Q1-*Sustainable Ecosystems* in the number of organisations that named it as a short term goal to be achieved.

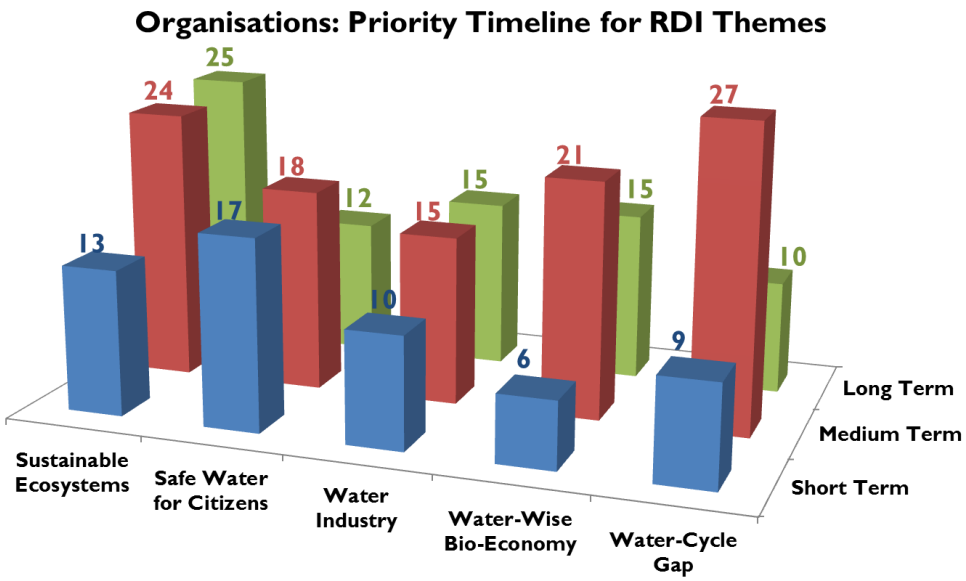

Figure 7. SRIA main research themes and the organisations that have strategic priorities in Water RDI (numbers and percentages relative to a total of 72 organisations) and the corresponding priority timeline. Number of organisations highlighted in different colours according to the priority timeline, short-term, medium-term and low-term (green, red and blue, respectively). SRIA themes: Q1-Sustainable Ecosystems, Q2-Safe Water for Citizens, Q3-Water Industry, Q4-Water-Wise Bio-Economy, Q5-Water-Cycle Gap.

Additional information on other priority research themes identified by the responding organisations is presented in Annex 5: Questionnaires (Open Questions), together with their respective level of priority and timelines.

In Table 6 are displayed the type of objectives and the corresponding relevance relatively to the organisations that have specific priorities in Water RDI (72 organisations). A colour code was adopted to facilitate the analysis of a vast amount of information. Consistently with the aforementioned data on this section, Q1-*Sustainable Ecosystems* and Q2-*Safe Water for Citizens* are the focus of the majority of the organisations. In terms of the type of objectives, *Progress in Science and Technology* ranks first in all five SRIA themes with a high priority level, followed by *Return of Investment* and *Societal Wellness*. The organisations rated *European Environment*, *National Strategies* and *H2020 Societal Challenges* very similarly in relation to their relevance. On the other hand, *Competiveness/Entrepreneurship* and *European Policy* are ranked last.

In Annex 5: Questionnaires (Open Questions) additional objectives related to each of the five core themes of the Water JPI SRIA are enrolled. These objectives were identified by the responding organisations and evaluated according to their perceived relevance.

Table 6. Objectives of the organisations with specific priorities in Water RDI and their level of relevance: H: high; M: medium; and L: low.

Organisations with Specific Priorities on Water RDI: Relevance of the Objectives																				
Objectives	Sustainable Ecosystems				Safe Water for Citizens				Water Industry				Water-Wise Bio-Economy				Water-Cycle Gap			
	H	M	L	SUM	H	M	L	SUM	H	M	L	SUM	H	M	L	SUM	H	M	L	SUM
Return Investment	30	24	6	60	24	22	7	53	22	19	5	46	21	20	7	48	19	27	3	49
Societal Wellness	36	19	4	59	35	11	4	50	14	26	6	46	23	18	6	47	20	22	4	46
Competiveness / Entrepreneurship	18	31	9	58	16	20	12	48	24	15	8	47	17	13	16	46	11	28	7	46
Progress in Science and Technology	53	7	4	64	34	14	4	52	30	13	5	48	33	10	7	50	34	14	3	51
European Environment	42	17	3	62	30	16	4	50	16	21	11	48	26	16	7	49	23	20	5	48
H2020 Societal Challenges	34	23	3	60	23	24	3	50	16	21	6	43	21	19	7	47	25	18	4	47
National Strategies	35	23	3	61	25	18	3	46	13	22	7	42	21	19	7	47	24	20	5	49
European Policy	27	24	4	55	18	20	4	42	14	16	8	38	16	21	7	44	19	17	5	41
Others	13	2	8	23	3	2	5	10	3	1	15	19	4	2	6	12	5	5	10	20

Water RDI Strategies to Address the Societal and Environmental Challenges

Figure 8 describes the contribution of the Water JPI to the participating organisations. The selected options reveal the expected influence of this Joint Programming Initiative on international collaboration, networking and research coordination. Unsurprisingly, *National Level Priorities* and *National Coordination of RDI Programmes* are ranked last.

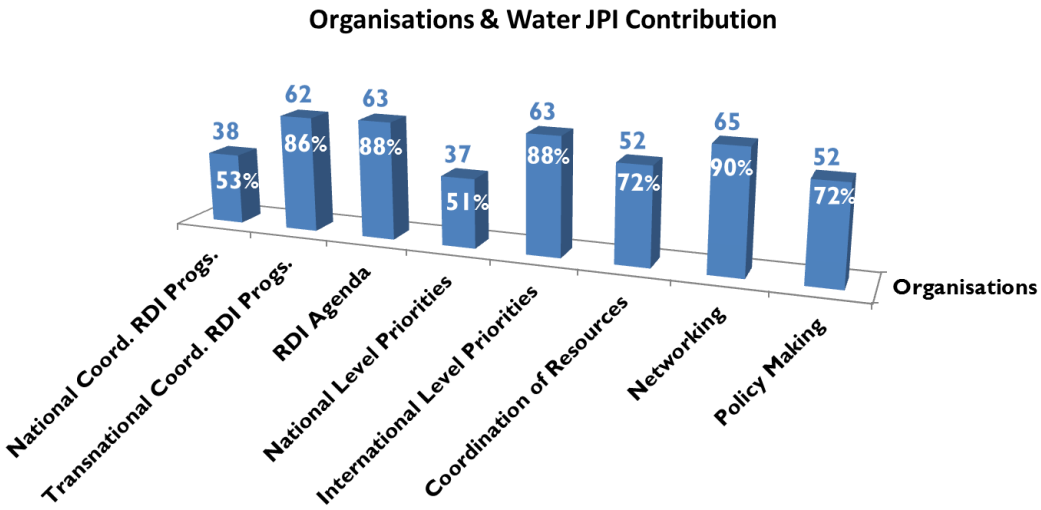

Figure 8. Contribution of Water JPI to the organisations at selected different levels. The percentages included in the figure inset are relative to the total number of organisations responding to this specific question (72). The percentage of non-responding organisations was 22% (20 organisations from a total of 92).

Respondents were inquired in the "Thematic Priorities" questionnaire about the most critical challenges in ensuring which Water RDI governance, management and strategic priorities corresponded to societal and environmental challenges (at a regional, national and international level). The text in full can be read in Annex 5: Questionnaires (Open Questions). For the sake of simplicity, the major concerns displayed were summarised as follows:

- Political will. Regulations. Integration of policy and science;
- Need to develop strategic research agendas, identifying needs and priorities at EU, national and regional levels, long term vision;
- Need to develop implementation plans;
- Coordination of funding and efforts;
- Multidisciplinary, interdisciplinary and cross-sectorial approach - Involvement of all stakeholders (Governmental organisations, research organisations, companies/enterprises);
- Adaptation to climate change and extreme events;
- Pressure on resources and on the environment;
- Addressing social needs but at the same time protecting the environment;
- Need for new and more efficient technologies and upgrading of water facilities;
- Education about water issues.

3.1.3. Governmental Strategies in Water RDI

A total of 19 organisations corresponding to 10 countries have identified themselves as governmental organisations and responded to the "Governmental Strategies" questionnaire, which correspond to 17% of all participating organisations and 62% of the countries involved (Figure 9).

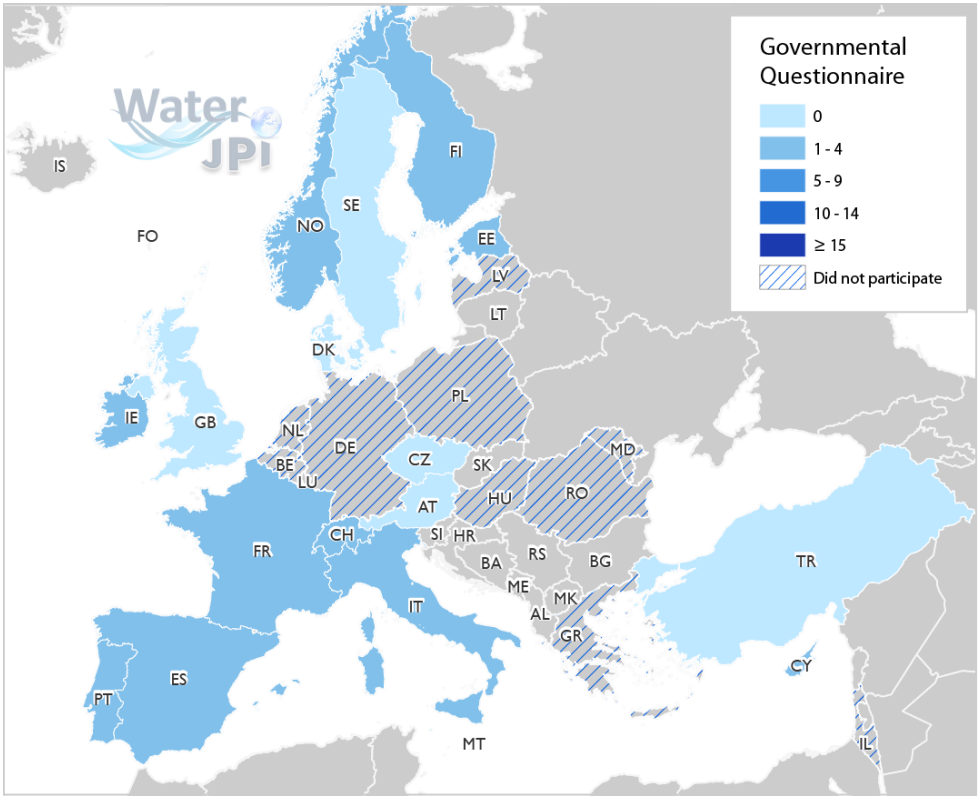

Figure 9. Distribution of respondents to the questionnaire "Governmental Strategies". The colour intensities describe the level of participation, whereas the line-filled coloured countries are part of the Water JPI, but did not participate in this exercise.

Figure 10 describes the target areas of the organisations and the corresponding number of countries involved. The vast majority of the organisations identified *Public RDI Policies* (95%, 18 organisations) and *RDI Projects* (74%, 14 organisations) as their main target areas, whereas only half of the responding countries addressed *Fellowships/Mobility Schemes* (32%, 6 organisations) and *Infrastructures* (42%, 8 organisations) in their priorities. Unsurprisingly, considering that respondents are governmental organisations, the target area showing less interest is *Private RDI Policies* (21%, 4 organisations).

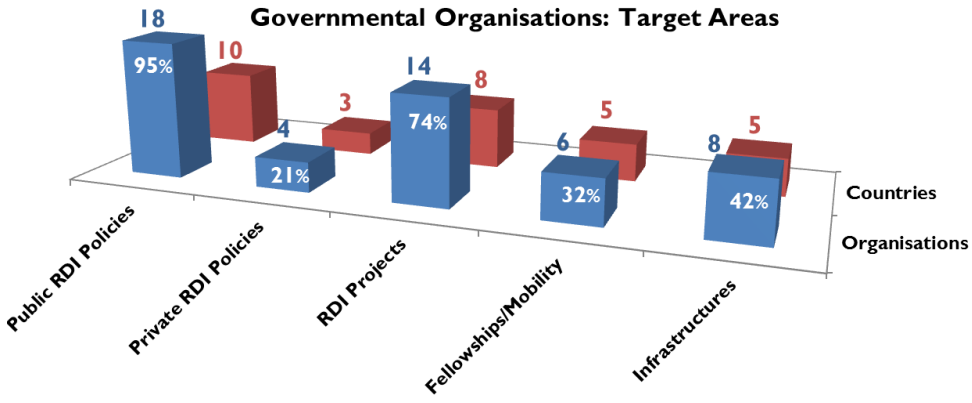

Figure 10. Target areas of the organisations (blue) and the corresponding number of countries involved (red). The figure inset includes the percentages relative to the total number of respondents (19 organisations among 10 countries).

In relation to the policies of the governmental organisations described in Figure 11, 95% (18 organisations) identified the *Natural and Environmental Sciences* as the main area where Water RDI is represented. With a

lower significance at 42% (8 organisations) was reported *Life and Health Sciences* and the *Exact Sciences and Engineering* at 47% (9 organisations). *Social Sciences and Humanities* at 26% (5 organisations), represents the scientific area with the lowest interest, though it gathers half of the participating countries (5 countries).

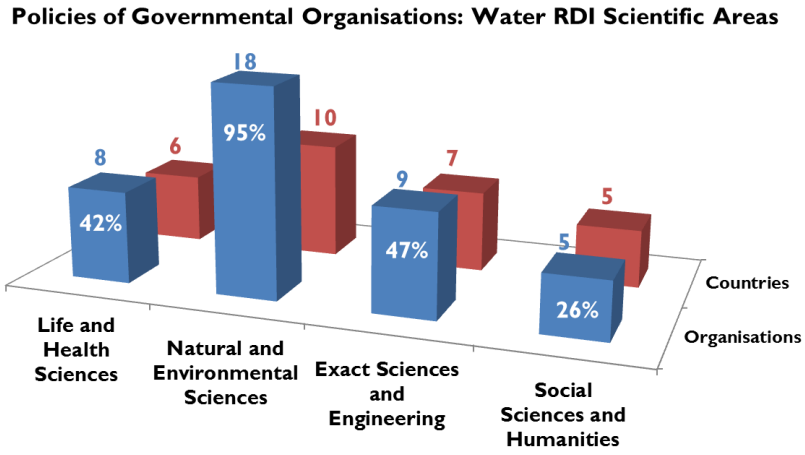

Figure 11. Scientific areas where Water RDI is represented within the policies of the organisation. In blue, it is depicted the number of organisations (19) and in red are displayed the corresponding number of countries (10) involved. The figure inset includes the percentages relative to the total number of respondents.

The *Legislation, Policies and Funding* both at a national and EU level comprise the main drivers of the Water RDI strategy of the responding organisations. Over 95% (18 organisations) responded affirmatively at the national level and 79% (15 organisations) at a EU level, which contrasts to the number of organisations that evoked *national public-private initiatives* as a relevant driver in their Water RDI strategy (25%, 5 organisations).

More than one third of the organisations (8) affirmed that they have a Scientific Council or Water RDI Body. Although it represents 42% of the organisations, it is significant that the latter are associated to 7 countries out of the total 10. *Applied Research* is the most common strategic focus area of governmental organisations at 74% (14 organisations), with *Basic Research* and *Innovation*, both at 52% (10 organisations in both cases). Interestingly, both *Applied Research* and *Innovation* gather the interest of 9 countries, whereas *Basic Research* is still mentioned in 8 countries (Figure 12). The relative percentage dedicated to the three different strategic focus areas is also described in Figure 12 (percentages in orange), with *Applied Research* at 76%, and both *Basic Research* and *Innovation* at 38%.

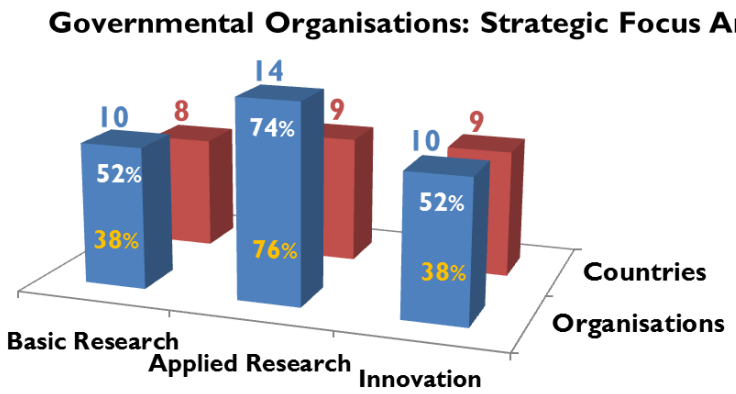

Figure 12. Strategic focus areas of the 19 organisations and 10 countries involved in this questionnaire. Number of organisations (blue), the corresponding relative percentages (white), and the respective number of countries involved (red). The graphic inset includes the average percentage dedicated to each strategic focus area (orange).

RDI Programmes

Regarding RDI Programmes, only 42% (8 organisations) of responding organisations acknowledged that owned/co-owned a RDI Programme in Water. The name of these specific programmes can be consulted in Annex 5: Questionnaires (Open Questions).

Available Data and Evaluation

In what concerns evaluation and selection activities, 60% of respondents (12 organisations) confirm that they directly manage activities of evaluation and selection of funding activities in Water RDI. However, only 32% (6 organisations) have access to a systematic National and/or an International list of reviewers/pool of experts in the field.

The main sources of data/information on which the organisations base their national Water RDI policy are well balanced between *Governmental* (83%, 15 organisations) and *Academic Institutions* (78%, 14 organisations), *EU* (66%, 12 organisations) and *Private Companies* (50%, 9 organisations). A total of 6 respondents (33%) reported other sources of data/information, of which it was highlighted the platforms, conferences, workshops and national exercises of the stakeholders. This can be consulted in Annex 5: Questionnaires (Open Questions).

RDI Organisations

The 19 participating organisations listed 111 performing organisations (see Annex 5: Questionnaries (Open Questions) with an important role in Water RDI in their countries, which accounts to 58% of the possible 190 examples that were asked. The reference to 111 organisations is similar to the overall participating number of organisations (108) in the four questionnaires.

RDI Infrastructures

Question 22 of the questionnaire received ambiguous answers. The question was "Does your country hold specific infrastructures for Water RDI?" The question was not related to the organisations themselves, and so inconsistent answers were provided by different organisations of the same country.

Nevertheless, we decided to still display the data. Thus, one-third of the respondents (9) acknowledged that his country hold specific infrastructures for Water RDI, and 8 organisations stated to have a national roadmap for infrastructures. Relevant water infrastructures, 21 examples, were provided by 5 different countries (see Annex 5: Questionnaires (Open Questions). The type of infrastructures and the corresponding level of access is described in Figure 13. As expected, a strong emphasis was put on *Public Infrastructures* and it is an interesting indicator that above 75% (17 infrastructures) is accessible to non-nationals. Out of the 21 examples only 6 infrastructures are included in roadmaps (1 ESFRI, 3 National and 2 in other types of roadmaps).

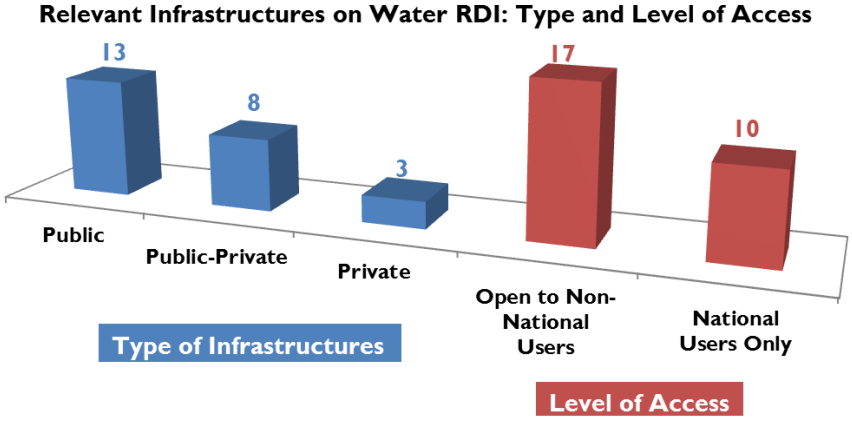

Figure 13. Type of infrastructures (blue) and the corresponding level of access (red). 7 Organisations provided 21 examples of relevant infrastructures on Water RDI, associated to 5 different countries.

Stakeholders Engagement

Regarding stakeholders engagement, 17 organisations responded to have cooperation with stakeholders in Water RDI (Figure 14). This cooperation privileges other governmental organisations, universities, regional/departmental/federal authorities and companies. The level of cooperation with stakeholders was poorly evaluated in only one case, whereas the majority considered it good (9), very good (4) and even excellent (3).

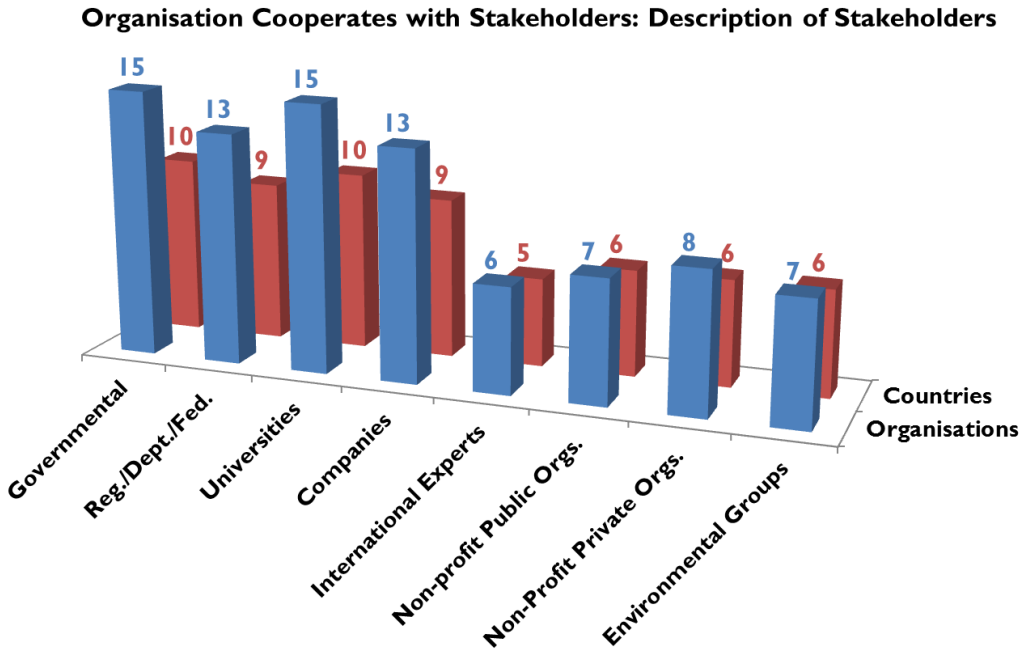

Figure 14. Number of organisations (blue) and the corresponding countries (red) that cooperate with stakeholders, and the description of the type of stakeholders involved. A total of 17 organisations from 10 different countries responded to this question.

International Cooperation

About 38% (7 organisations) indicate to directly manage international cooperation. This type of collaboration is mainly held under open calls, mobility schemes and joint research performance. Only 2 respondents out of these 7, accredit international cooperation in the definition of programmes.

Analysing the type of cooperation established at this level, one can see that most organisations balance bilateral and multilateral relations. Only one organisation mentioned bilateral cooperation as the basis of their management system (Figure 15).

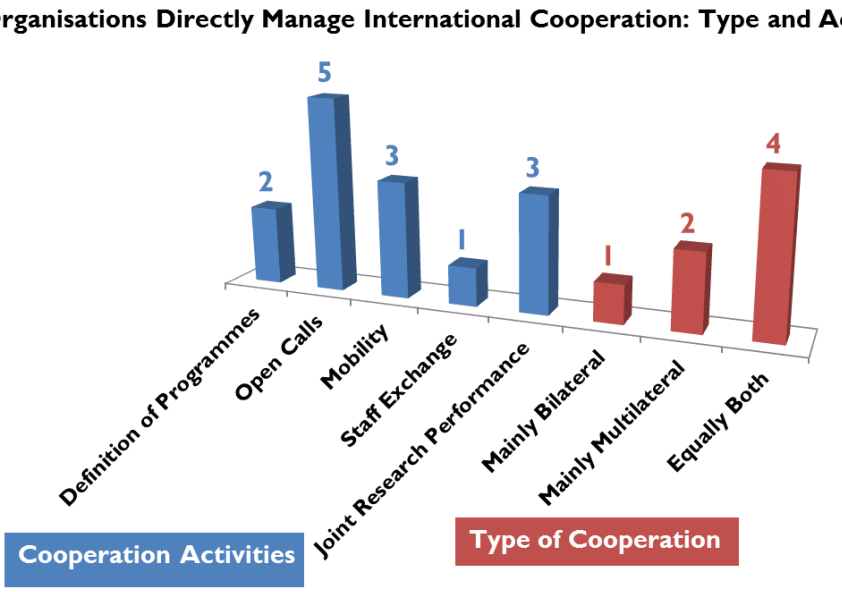

Figure 15. Number of organisations that directly manage international cooperation. It is depicted the Cooperation Activities (blue) and the Type of Cooperation (red).

The Governmental organisations were asked to list up to 3 European and 3 non-European countries with which they cooperated the most in Water RDI. Responses can be analysed in detail in dedicated tables (see Annex 5: Questionnaires (Open Questions). A total of 6 organisations responded to this question (32%), with the UK leading the preferences with 3 references, followed by Spain, France, Germany and the Netherlands (all with the same number of examples, 2). As for the non-European countries, 6 organisations responded and Brazil was the mostly referenced (twice), followed by 10 different countries. About 75% of collaborations target developed countries, while the remaining 25% are developing countries.

Technology Transfer

Only 3 participating organisations (16%) recognised to have a Technology Transfer Office/Working Group in the Water domain in connection of RDI companies and industry. The information provided regarding the main activities performed by these offices/working groups can be consulted in Annex 5: Questionnaires (Open Questions).

3.1.4. Funding Schemes in Water RDI

Actors and Areas of Water RDI Funding

A total of 23 respondents were considered as valid funding organisations and answered to the "Funding Schemes" questionnaire (21% from the total of participating organisations).

Respondents represented a total of 12 countries. The average number of funding organisations per country was approximately two. Ireland and Spain recorded, respectively, 5 and 4 funding organisations (Figure 16).

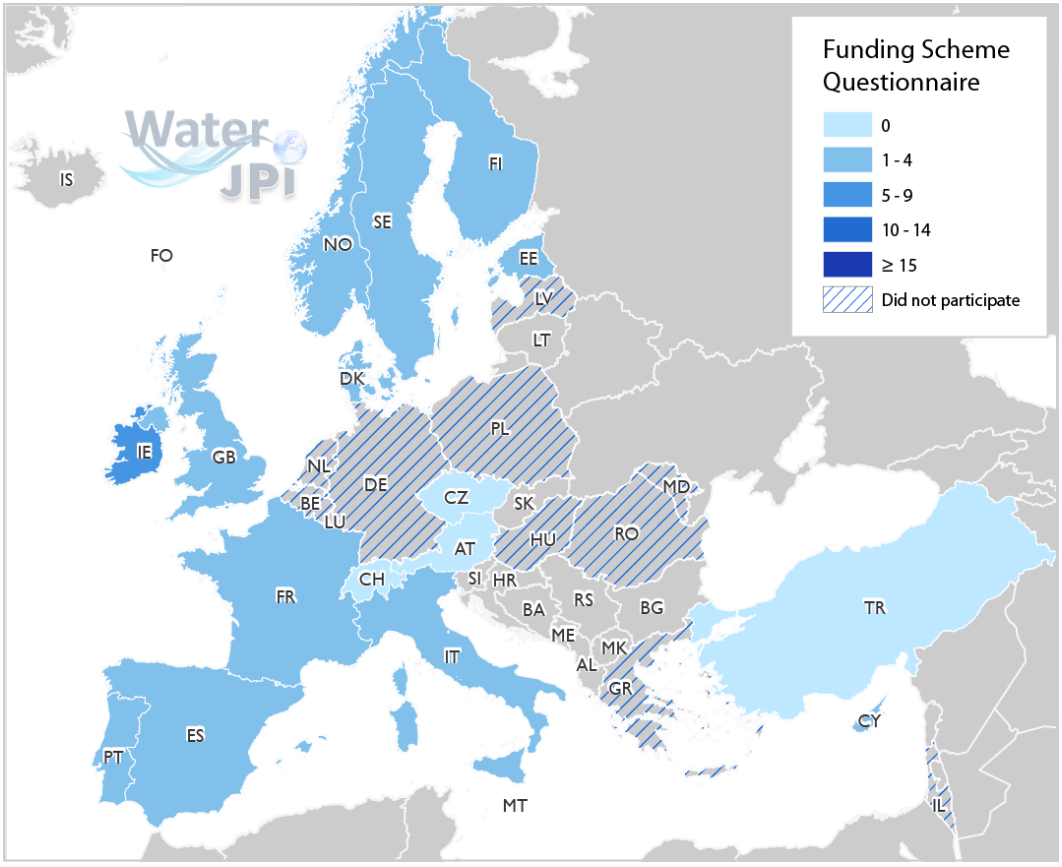

Figure 16. Distribution of respondents to the questionnaire "Funding Schemes". The colour intensities describe the level of participation, whereas the line-filled coloured countries are part of the Water JPI, but did not participate in this exercise.

Figure 17 displays the type of institutions eligible for funding in Water RDI by the participating organisations (23 in total from 12 countries). The most commonly mentioned are public institutions, namely *Universities* (61%, from 14 organisations) from all 12 countries, and *Public Research Organisations* (52%, 12 organisations) from 9 countries. *Non-Profit Public Organisations* (43%, 9 organisations) is followed by private institutions, namely *Universities*, *Research Organisations* and *Non-Profit Organisations*, each at 35% (from 8 organisations, from 7 different countries).

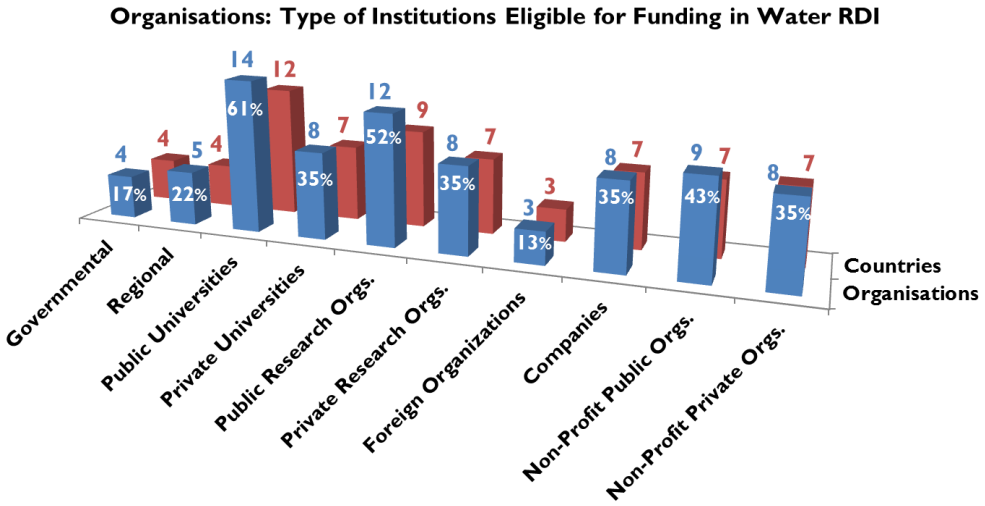

Figure 17. Type of institutions eligible for funding in Water RDI by the participating organisations. A total of 23 funding organisations from 12 countries responded to this question.

Regarding eligible expenses covered by the funding organisations, it was asked to indicate the maximum percentage the funding organisations are allowed to fund, depending on the type of the institutions. Table 7 summarises the number of funding organisations and the corresponding countries that allow 100% of funding to the list of institutions provided. The focus is on Public institutions, as they account for 50% or more of the 20 funding organisations that responded.

Table 7. Number of funding organisations and the corresponding countries that allow 100% funding of eligible expenses, depending on the type of the institutions.

Type of Institution[10]	Number of funding organisations that allow 100% funding	
	Organisations	Countries
Governmental	5	5
Regional	5	5
Public Universities	15	10
Public Research Organisations	14	10
Private Research Organisations	6	5
Private Universities	4	4
Foreign Organisations	6	5
Companies	2	2
Non-profit Public Organisations	10	8
Non-profit Private Organisations	8	7

The focus of funding (Figure 18, left) from the participating organisations is concentrated in *Applied Research* at 97% (21 organisations), with *Basic Research* and *Innovation* at 61% and 43%, respectively. The organisations, however, balance their funding efforts to *Applied Research* and *Basic Research* at 57% and 44%, respectively, and involving almost all countries. *Innovation* receives on average just 17%, with only 5 countries focused on this type of funding. In relation to the funding sources, it was unsurprising to observe that all organisations that responded to this question named *National Public Funds* as their most common source of funding. *EU Funds* at 57% (13 organisations from 8 countries) and *National Private Funds* at 9% (2 organisations from 2 countries) were the other sources of funding mentioned (Figure 18, right).

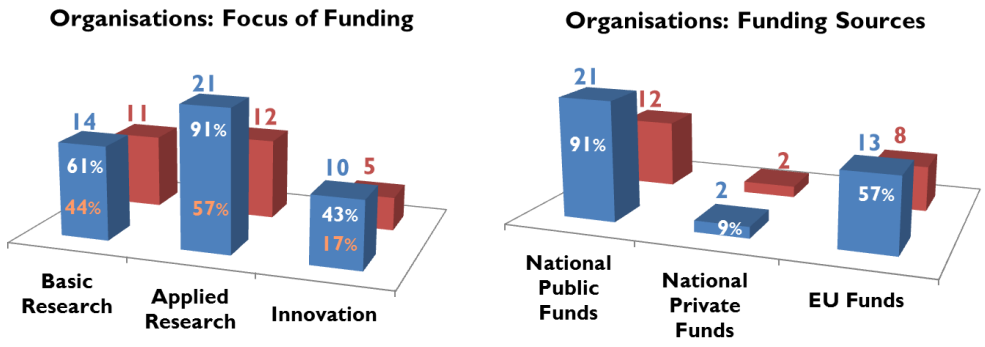

Figure 18. Focus of funding of the participating funding organisations and the corresponding number of countries involved (left). The percentages, namely the number of organisations (white) and the average funding percentage dedicated to each focus area (orange) are included in the figure inset. On the right, the funding sources for the participating organisations, and the countries involved. A total of 21 funding organisations (blue) from 12 countries (red) responded to this question, out of the total 23.

[10] Note: Private Universities, Private research organisations, Companies and Non-Profit Private Organisations range from 50% to 100% in terms of maximum percentage.

National Legislation constitutes the main driver for funding in Water RDI, as it is mentioned by 18 organisations from all 12 countries (78%), whereas EU Legislation and Policies is referenced by 15 organisations from 9 countries (65%). These numbers contrast to the organisations that evoked *National Public-Private Initiatives* as a relevant driver in their Water RDI strategy (9%, 2 organisations).

Funding Activities

A list of *Scientific Activities/Fields of Research* are listed in Figure 19, with *RDI Projects and RDI Programmes* as the most commonly named activities funded by the participating organisations at 57% (13 organisations) and 74% (17 organisations), corresponding to 10 and 9 countries, respectively. *Fellowships/Mobility Schemes* and *Infrastructures* were named by 11 (48%, from 7 countries) and 10 (43%, from 6 countries) organisations, respectively. Detailed responses can be consulted in Annex 5: Questionnaires (Open Questions).

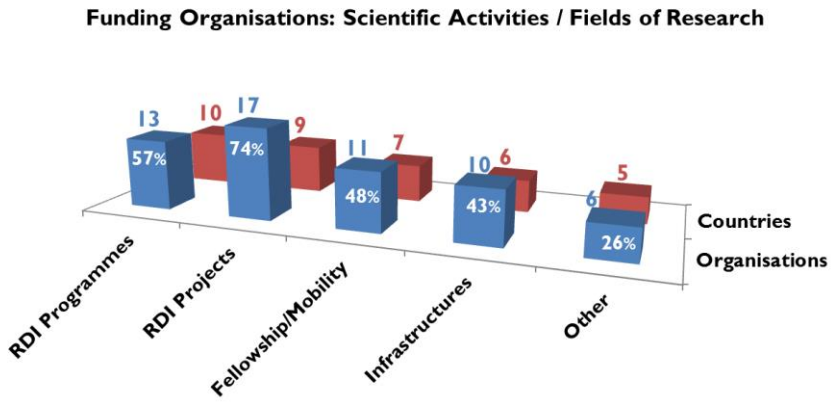

Figure 19. Scientific Activities / Fields of Research, participating funding organisations (blue) and the corresponding number of countries involved (red). The percentages (white) are associated to the total number of organisations (23).

The type of expenses funded by the responding organisations is very homogeneous with *Human Resources*, *Equipment*, *Consumables* and *Travels* associated to over 90% of the organisations (21 or 22 organisations) and all 12 countries. *Workshops and Conferences* is also common to 12 counties although only 83% of the organisations fund this type of expense (19 organisations). *Bibliography* and *Overheads* are ranked next with 11 (48%) and 10 (43%) organisations from 9 and 7 countries, respectively (Figure 20).

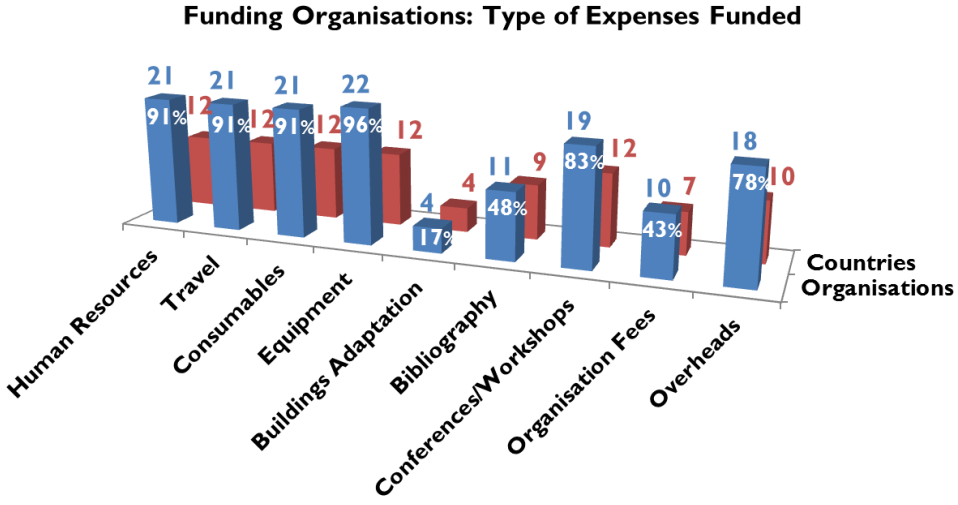

Figure 20. Type of expenses funded by the participating funding organisations (blue) and the corresponding number of countries involved (red). The percentages (white) are associated to the total number of organisations (23).

Competitive Funding of Water RDI Programmes and Water RDI Projects

Only one organisation of out 22 respondents stated that they do not fund *Water RDI Activities* through competitive funding. From the 13 organisations that affirmed to *fund RDI Programmes* (Figure 19), only 3 provided information regarding the average annual funding with amounts of 0,5 million, and two of 3 million euros per year. With a budget of 3 million euros, one organisation funded an average of 11 annual *RDI Programmes*, and with similar budget another organisation funded 3 *RDI Programmes*.

In relation to RDI Projects, it is possible to consult the summarised information described in Table 8. The information was provided by 17 funding organisations from 11 different countries. Due to the varied nature of the information and to the fact that the information is quite heterogeneous, it is more useful to analyse the information individually, and not as a whole, as it has been common practice throughout this document. Nevertheless, and for the sake of reference, the percentage of Water RDI funding compared to the total RDI funding is approximately 2%, considering the data of Table 8 (the sum of Water RDI funding compared to the sum of the total RDI funding).

From a universe of 20 responding organisations (meaning that 3 organisations that fund Water RDI Projects did not provide information that is included in Table 8), the majority of the Calls on Water RDI Projects are either annual (for 8 organisations, 35%) or with a non-specific schedule (for 7 organisations, 30%). The main nature of the *Calls for Water RDI Projects* cover all scientific domains (7 organisations, 30%), and priority topics on Water RDI (5 organisations, 22%). The funding organisations were asked to specify recent priorities on water, with 8 organisations (35%) providing the information (Annex 5: Questionnaires (Open Questions) are listed recent priority topics on water provided by 8 organisations). A discrepancy between the number of organisations having priority topics on Water and the organisations that specified the priorities was observed. This fact may be due to a lapse or misinterpretation of this question in particular.

Table 8. RDI Projects funded during the period of 2007-2013. Numbers broken into general funding and specific Water RDI funding. 17 Organisations responded to these questions. Highlighted in red are numbers that may have been provided incorrectly or were considered inconsistent.

Organisations Fund Water RDI Projects								
Water RDI Projects							All RDI Projects	
Average Annual Funding	Average No. Funded Projects	Average Funding per Project	Maximum Funding per Project	Duration of Projects (in months)			Average Annual Funding	Average No. Funded Projects
Million EUR/ Year		Million EUR/ Year	Million EUR	Min.	Max.	Avg.	Million EUR/ Year	
25.00	15	1.75	No Limit	12	102	48	800.00	950
15.60	130	0.12	No Limit	12	48	36	384.00	3300
10.80	21	0.51	No Limit	12	48	26	950.00	1640
10.00	10	1.00	No Limit	24	48	36	400.00	350
8.00	20	0.43	No Limit		48	36	78.00	250
4.20	2.4	0.24	6.70	36	72	54	2.50	30-35
3.71	27.3		2.00	6	60	30	10.50	120.3
3.17	23	0.13	0.50	12	36	36	75.80	616
3.00	30	1.50	5.00	24	48	36	1000.00	5000
0.70	8	0.10	0.18	12	60	36	12.00	100
0.57	1	0.44	2.40	12	84	36	7.00	25
0.51	16	0.12		12	84	18		
0.40	2-3	0.15		12	48	28	12.00	70
0.26	1.3	0.47	6.00	1.9	81	42	114.00	278
0.08	1	0.6	1.25		60	48	18.00	15
0.01-0.03	2-3		0.005-0.015					
0.009	10.6						3.78	

Non-Competitive Funding of Water RDI

In addition, it is noteworthy that 2 organisations reported that they fund Water RDI activities through non-competitive funding. These organisations stated that the percentage committed to non-competitive funding within the total Water RDI funding was 60% and 20% in each case, with a funding average of 14.6 million EUR/year and 0.09 million EUR/year, respectively. The mechanisms for granting non-competitive funding are formal applications and informal applications or direct contact with performing institutions. In Annex 5: Questionnaires (Open Questions) it is described the reasons for choosing non-competitive funding of activities by the organisations.

Funding of Water RDI Infrastructures

Five out of the 10 organisations that fund Water RDI infrastructures mentioned *Calls* as their funding mechanism, whereas *Non-Competitive Funding* was mentioned by two organisations, just like a mixed mode (*Calls* and *Non-Competitive Funding*). The average annual funding dedicated to Water RDI Infrastructures and the average number of infrastructures funded was only provided by seven funding organisations from four countries (26% from a total of 23 participating organisations, and70% of a universe of 10 that mentioned to fund Water RDI Infrastructures). However, one organisation responded with *Unknown* to all questions in this section (Question 33 and Question 34, "Funding Schemes"). The discrepancy in values ranging from 5.5 million EUR/year for 4 infrastructures to 65,000 euros for 10 infrastructures does not give significance to any analysis performed. Nevertheless, in Table 9 is summarised the information collected from this set of questions. For the sake of guidance, part of the data from Table 8 was included.

Table 9. Organisations that fund Water RDI Infrastructures. Numbers provided by six organisations from four countries. Data from Table 8 are highlighted in italic.

Organisations that Fund Water RDI Infrastructures					
Water RDI Infrastructures		***Water RDI Projects***		***All RDI Projects***	
Average Annual Funding	Average No. Funded Projects	*Average Annual Funding*	*Average No. Funded Projects*	*Average Annual Funding*	*Average No. Funded Projects*
Million EUR/ Year		*Million EUR/ Year*		*Million EUR/ Year*	
5.5	4	*15.60*	*130*	*384.00*	*3300*
0.10	1	*3.00*	*30*	*1000.00*	*5000*
0.065	10	*0.70*	*8*	*12.00*	*100*
0.67	2	*0.51*	*16*		
1.25	1	*0.26*	*1.3*	*114.00*	*278*
0.10					

Figure 21summarises the information on the funding distribution of Water RDI Infrastructures by the aforementioned six organisations. The funding is focused on *National Infrastructures* (all six organisations from four countries) with an average of 81% of the funds allocated. *European Infrastructures* and *International Infrastructures* are awarded an average of 46% and 25% of the funds, respectively, but were only referenced by 2 and 1 organisations, respectively (Figure 21. See also figure caption).

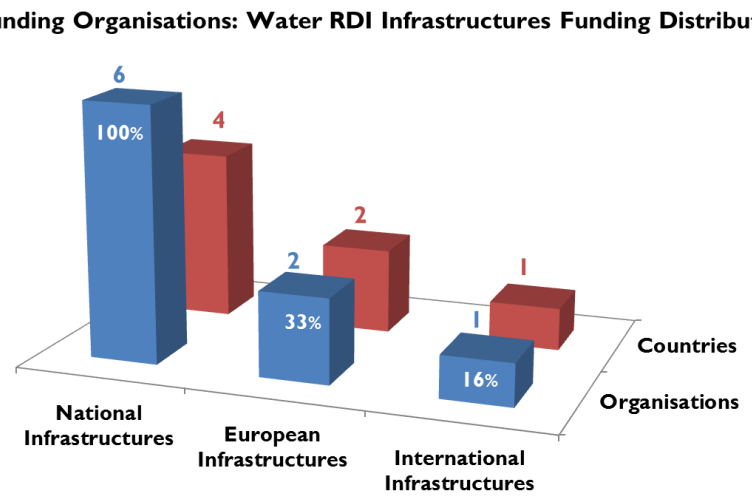

Figure 21. Water RDI infrastructures funding distribution. The percentages are associated to the total number of organisations (blue) responding to this question (6 from 4 countries (red)). The average percentage of funding distribution is: 81% (from 6 organisations) to National Infrastructures; 46% (from 2 organisations) to European Infrastructures; and 25% (from 1 organisation) to International Infrastructures.

Funding of Fellowships/Mobility Schemes

Inconsistency of data was also noted in Question 35 when compared to Question 13. Question 13 was defined as "Please identify the main scientific activities/fields which were funded by your organisation in the last seven years (2007-2013)". Eleven organisations from seven countries mentioned *Fellowships/Mobility*. However, in Question 35 defined as "Does your organisation fund Fellowship/Mobility Schemes?", 14 organisations from 10 different countries answered positively. Disregarding this variance, all 14 organisations mentioned *Calls* as the only funding mechanism with the exception of one organisation that did not specify the mechanism used to fund this type of activities. More than half of the organisations (8) referred annual calls ranging from 1 million to 9.3 million EUR/year to fund on average 4 to 76 *Fellowships/Mobility Schemes* per year. On average, the funding percentage of international *Water RDI Fellowships/Mobility Schemes* (beyond Europe) compared to the total funding of *Water RDI Fellowships/Mobility Schemes* of each organisation ranges from 6% to 17% (considering the 3 examples provided by the organisations).

Figure 22 shows the type of *Fellowships/Mobility Schemes* funded by the responding organisations (14 from 10 countries) with the percentages mentioned in the figure inset relative to these. As expected, *Postdoctoral* and *PhD research grants* are the most commonly referred funding activity.

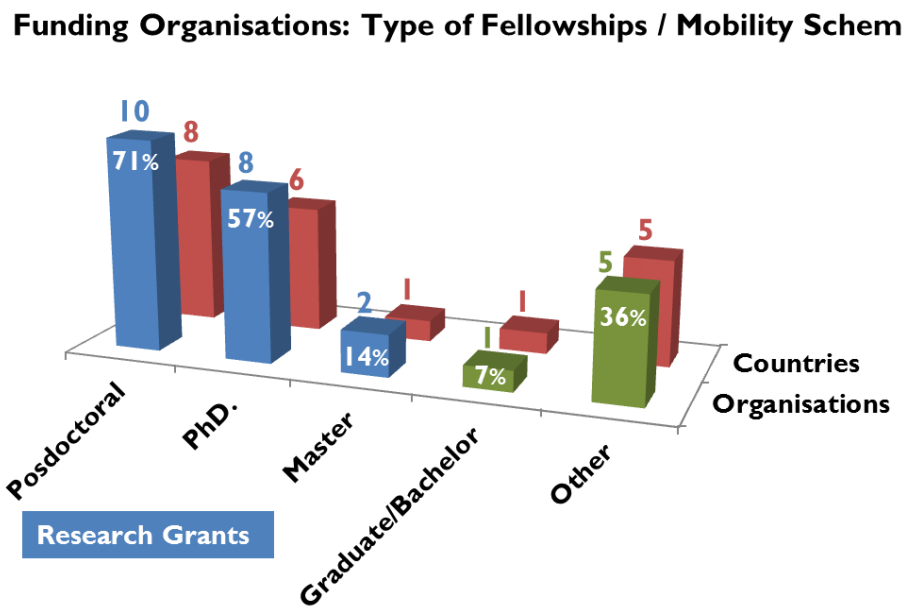

Figure 22. Fellowships/mobility schemes funded by the participating funding organisations (blue and green) and the corresponding number of countries involved (red). The percentages (white) are associated to the total number of organisations responding to this question (14 from 10 countries).

The funding organisations were asked to list up to 3 European and 3 non-European countries with which they most cooperated in relation to Water RDI fellowships/mobility schemes. Responses can be analysed in detail in dedicated tables (see Annex 5: Questionnaires (Open Questions)). A total of six organisations responded to these questions (26%). with the UK leading the European preferences with 3 mentions. followed by Russia, France, Poland and Spain (all with the same number of mentions. 1). Among non-European countries, USA was the mostly referenced (twice) followed by China, Tunisia, Brazil and Japan, all equally referred once. There is a balanced cooperation in regards to developed and developing countries (50-50%).

Aspects Regarding Cooperation

- Cooperation with Companies/Industry

The cooperation with industries or companies was evaluated at different levels. In this case, 16 organisations from 11 countries responded that on average 32% of *Water RDI Research Projects* had an effective cooperation with companies or industries. This contrasts with the 12.5% reported by 8 organisations from 8 countries in the same type of cooperation of funded *Water RDI Infrastructures*.

The question on how the funding organisations evaluated the efforts of the public funding and managing agencies from their respective countries in fostering the collaboration between academic institutions and companies/industries in Water RDI was answered by 20 organisations: 5 organisations rated it as *Very Good* (25% of the organisations), 8 as *Good* (40%), 6 as *Weak* (30%) and 1 as *Non-Existing* (5%).

- International Cooperation

Almost two thirds of the participating funding organisations support *Transnational Cooperation in Water RDI* (14 organisations from 11 countries. compared to the total 23 organisations from 12 countries). Out of these 14 organisations, 10 reported that the type of transnational funding is via a virtual common pot whereas the remaining 4 stated a mixed mode.

In Annex 5: Questionnaires (Open Questions) is provided a list of the European initiatives/instruments related to Water RDI, in which 12 respondent organisations participated. It is notable that 9 of these organisations acknowledged the participation in Water JPI, WatEUr CSA or activities performed by both.

The cooperation is mostly performed on a *Multilateral* level. as mentioned by 8 organisations from 7 countries (Figure 23), with less emphasis given to *Bilateral* (3 organisations) or an equal balance of the two (2 organisations).

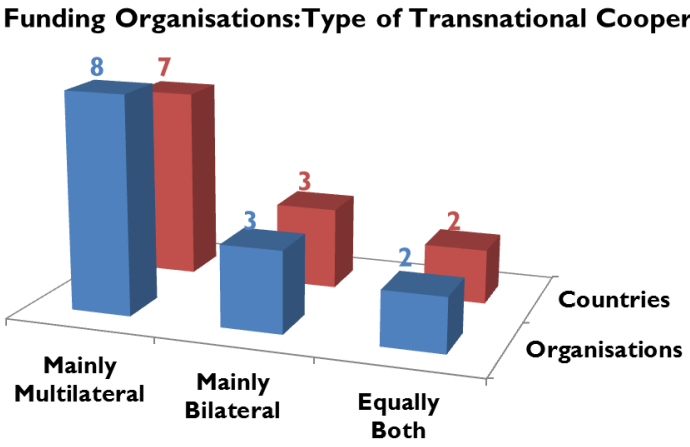

Figure 23. Type of transnational cooperation, the participating funding organisations (blue) and the corresponding number of countries involved (red). A total of 14 organisations from 11 countries responded to this question.

The type of foreign organisations funded in *Water RDI Research Projects* by the participating organisations (14 organisations from 11 countries responded to this topic), is represented in Figure 24. It is noteworthy that the focus is put on public institutions, namely *Universities*, *Research Organisations* or *Non-Profit Organisations*.

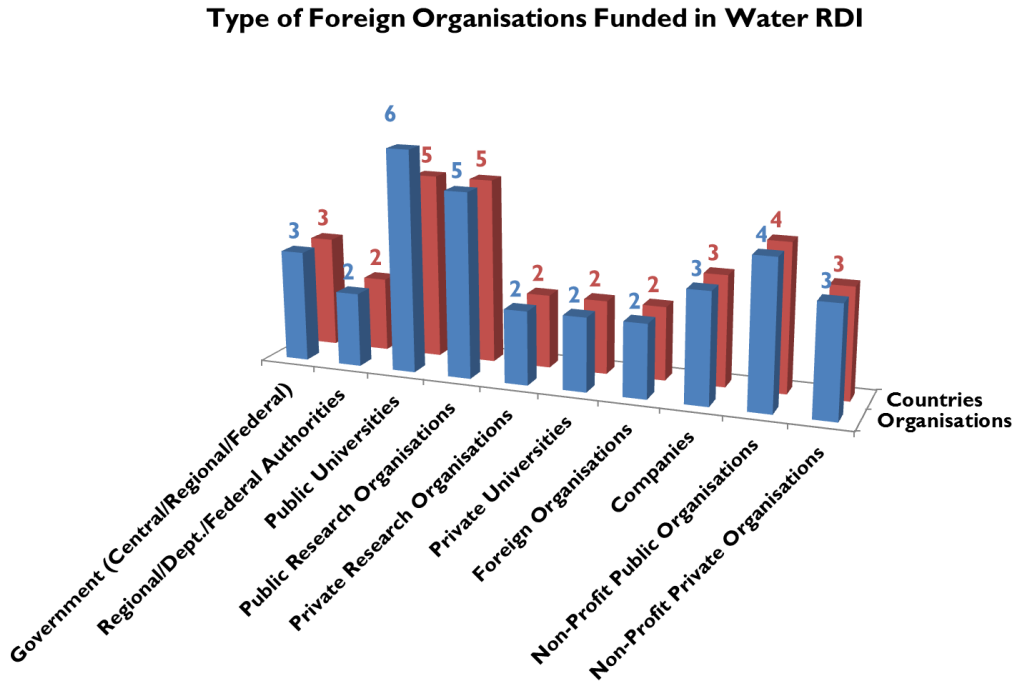

Figure 24. Type of foreign organisations funded in Water RDI Projects by the participating funding organisations (blue) and the corresponding number of countries involved (red). A total of 14 organisations from 11 countries responded to this question.

The average annual funding from the responding 11 organisations (10 countries) in the context of collaborative Water RDI within transnational calls is 0.65 million euros per year (ranging from 1.6 to 0.01 million euros).

Available Data and Evaluation of Water RDI

The evaluation processes of the funding organisations is summarised in Table 10. About half of the funding organisations reported to have a list of *National Experts* or *International Experts* specifically 11 organisations (48%) from 7 and 9 countries, respectively. The *Panels on Water RDI Research Projects* are defined in all the 12 countries that responded to this questionnaire while Panels on *Fellowships/Mobility* and *Infrastructures* is referenced in 10 and 7 countries, respectively. *RDI Projects* or *Fellowships/Mobility Schemes* rely more frequently on mixed or national panels. *Infrastructures* are apparently more prone to be evaluated by international panels.

Table 10. Type of evaluation and the corresponding type of evaluation panels or experts for each activity. Number of organisations that evoked each category and the number of countries involved.

Type of Panels	Type of Evaluation					
	RDI Projects		Fellowships/Mobility		Infrastructures	
	Orgs.	Countries	Orgs.	Countries	Orgs.	Countries
International	5		3		5	
Mixed	7	12	5	10	2	7
National	7		5		2	

To finalise this section it is important to mention the identified outputs of Water RDI funded activities monitored or evaluated by the organisations through Scientific Committees or Evaluation Panels. Out of the 23 organisations involved only 15 (65%) mentioned specific outputs, namely *Reports* (15 organisations), *Papers* (7), and *Workshops or Conferences* (8).

3.1.5. Water RDI Performing

A total of 48 respondents identified themselves as performing organisations and responded to the "Performing Organisations" questionnaire (44%). Respondents represented a total of 10 countries. Distribution of respondents to the questionnaire is depicted in Figure 25, with the colour intensities describing the level of participation.

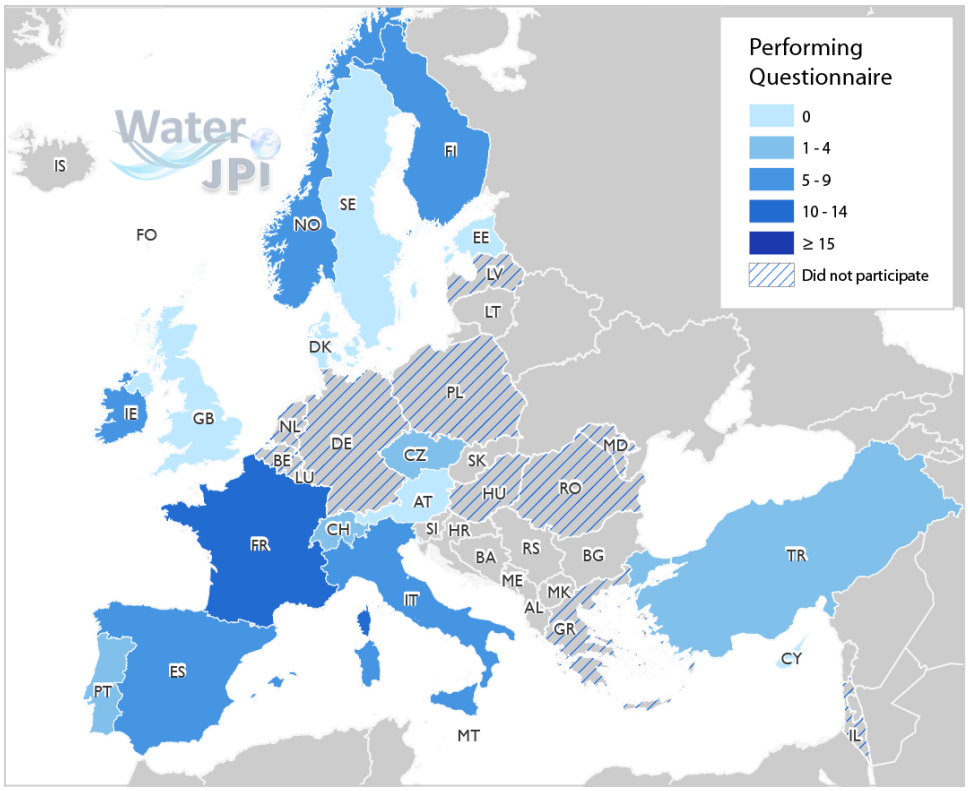

Figure 25. Distribution of respondents to the questionnaire "Performing Organisations". The colour intensities describe the level of participation, whereas the line-filled coloured countries are part of the Water JPI, but did not participate in this exercise.

Areas of Water RDI

Figure 26 describes the number of performing organisations and the scientific areas where Water RDI is represented. This question was answered by 46 out of the 48 participating organisations, with *Natural and Environmental Sciences* being represented in almost 90% of them (41 organisations from 9 countries). This is followed by *Exact Sciences and Engineering* at 50% (23 organisations from 8 countries) and *Social Sciences and Humanities* at 39% (18 organisations from 7 countries). Contrasting to what was previously described in the "Governmental Organisations" section (Figure 11). *Life and Health Sciences* was indicated by only 20% of the organisations, though it is still covered in 6 different countries.

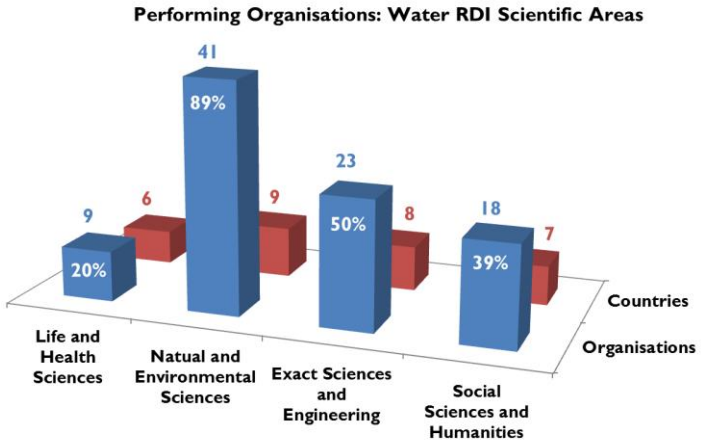

Figure 26. Scientific areas where Water RDI is represented in the participating organisations. A total of 46 organisations (10 countries) provided an answer. The number of organisations (blue) and the corresponding countries (red) is distinguished among the various scientific domains.

In relation to the strategic focus areas and from a total of 47 organisations that addressed this issue. *Applied Research* was included by 91% (43 organisations from 10 countries) of them, with both *Basic Research* and *Innovation* with a similar number of organisations at 53% (25 organisations from 8 countries) and 55% (26 organisations from 9 countries), respectively. The performing organisations also measured the dedication to each of these areas in terms of percentage, and again *Applied Research* is clearly distinguished with an average of 58% with both *Basic Research* and *Innovation* at 30% (Figure 27).

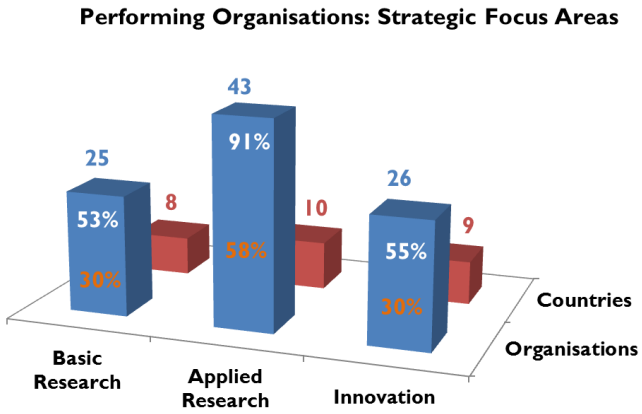

Figure 27. Strategic focus areas defined by the participating organisations. A total of 47 organisations (10 countries) provided an answer. The number of organisations (blue) and the corresponding countries (red) is distinguished among the different focus areas. The percentages, namely the number of organisations (white) and the average percentage dedicated to each focus area (orange) are included in the figure inset.

The list of the main *Water RDI Scientific Activities/Fields* performed by the respondent organisations can be seen in Annex 5: Questionnaires (Open Questions).

RDI Infrastructures

It is noteworthy that 69% (33 organisations in 48) responded that the organisation holds specific Water (or themes closely related with Water) RDI infrastructures. A list of 91 infrastructures for Water RDI was provided by the participating performing organisations. This list can be viewed in detail in Annex 5: Questionnaires (Open Questions).

Figure 28 describes the type of infrastructures and their level of access. There is an equilibrated distribution between public, private and public-private infrastructures, with a special emphasis on infrastructures with international relevance. Only 7 infrastructures (out of the 75 respondents) mentioned that they are included in the ESFRI roadmap, whereas 16 (out of 73 respondents) referred to be included in the National roadmap of the corresponding countries.

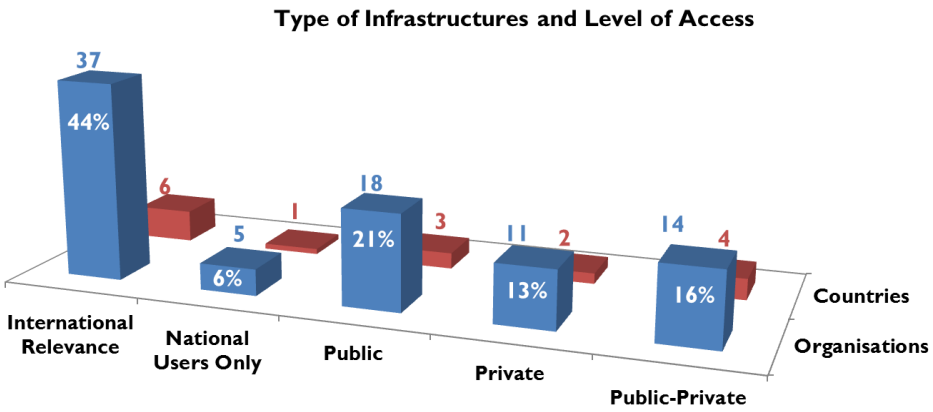

Figure 28. Type of infrastructures and level of access. A total of 91 infrastructures were provided by the performing organisations (86 responded). The number of organisations (blue) and the corresponding countries (red) is distinguished among the levels of access. The percentages, namely the number of infrastructures (white), are included in the figure inset.

Performing organisations were requested to provide information on the mentioned infrastructures, namely if any of the infrastructures were open to researchers from outside or if there was a specific funding for research activities. In relation to the former issue, 25 out of 33 organisations mentioned that the named infrastructures are open to non-national researchers, with 20 out of 33 organisations stressing the existence of a specific funding for research activities.

Stakeholders Engagement

The majority of the participating organisations (44 out of 48 organisations from 10 countries) affirmed to cooperate with stakeholders. Figure 29 describes the number of performing organisations and the type of stakeholders involved. Expectedly, there is a uniform distribution between *Governmental*, *Local Authorities, Universities* and *Companies* with over 80% of performing organisations holding cooperation with this type of stakeholders. It is also positive the levels of cooperation with *Non-Profit Private Organisations,* and *Environmental Groups* at 45% and 41%, respectively. The evaluation of the levels of cooperation with stakeholders was rated as excellent 7 organisations (5 countries), 27 organisations as very good (9 countries), and 10 organisations as good (6 countries).

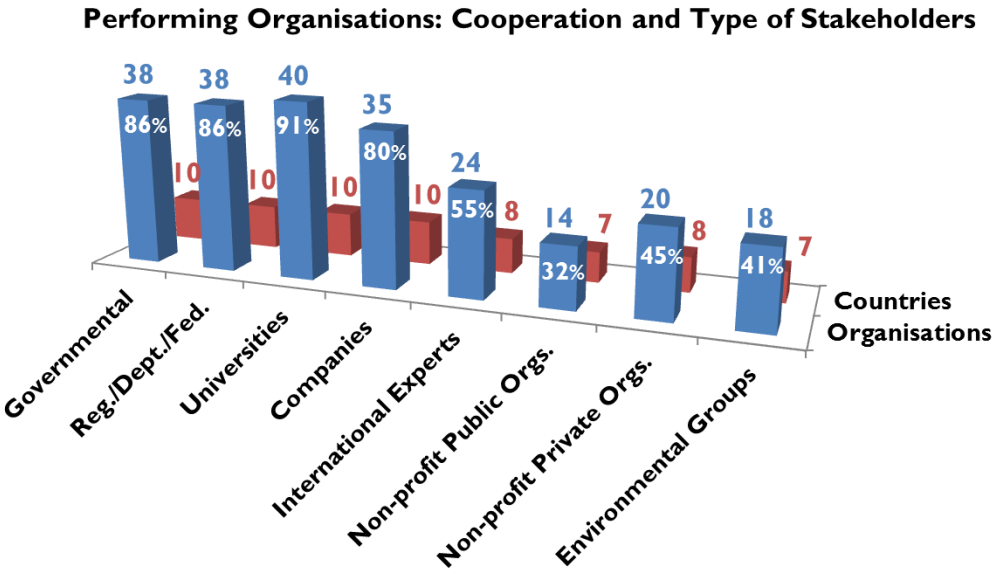

Figure 29. Number of performing organisations (blue) and the corresponding countries (red) that have cooperation with stakeholders and the type of stakeholders is represented. The percentages,

relative to the number of organisations out of a total of 44 respondents (white). are included in the figure inset.

Technology Transfer

Regarding the level of RDI performance in Technology Transfer was rated as excellent by 3 organisations (3 countries), very good by 11 organisations (6 countries), good by 22 organisations (8 countries), and poor/non existing 4 organisations (4 countries) in each of the two. Some successful examples of technology transfer concerning the Water RDI performance of the organisation is listed in Annex 5: Questionnaires (Open Questions).

International Cooperation

Of relevant interest is the fact that 37 organisations out of a total of 46 respondents, mentioned that they are participating in international cooperation in Water RDI. Open Calls, Mobility and Staff Exchange are the most common type of activities that are mentioned, as described in Figure 30. In addition, the type of cooperation is basically defined as *Mainly Multilateral* or *Equally balanced by Bilateral or Multilateral*, with less stress put on *Bilateral* cooperation.

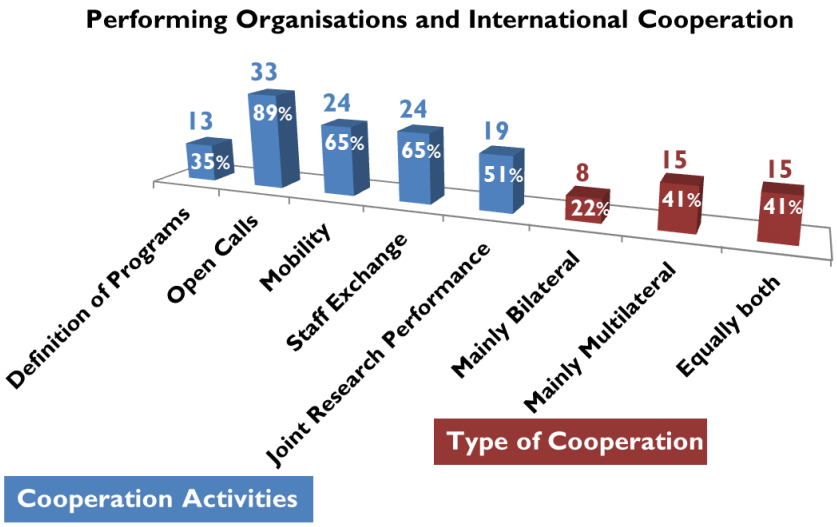

Figure 30. Number of performing organisations that have international cooperation in Water RDI. The cooperation activities (blue) and the type of cooperation (red) is distinguished. The percentages, relative to the number of organisations out of a total of 37 respondents (white), are included in the figure inset.

In Annex 5: Questionnaires (Open Questions) are listed the scientific/technological areas where international cooperation in Water RDI is needed, from the point of view of 28 responding organisations. It is also listed the type of mobility schemes with European dimension, performed by the organisations in Water RDI.

Figure 31describes the main European initiatives or instruments related to Water RDI in which the organisations participate (full list available at Annex 5: Questionnaires (Open Questions). The instruments are varied and so there is none that could be singled out.

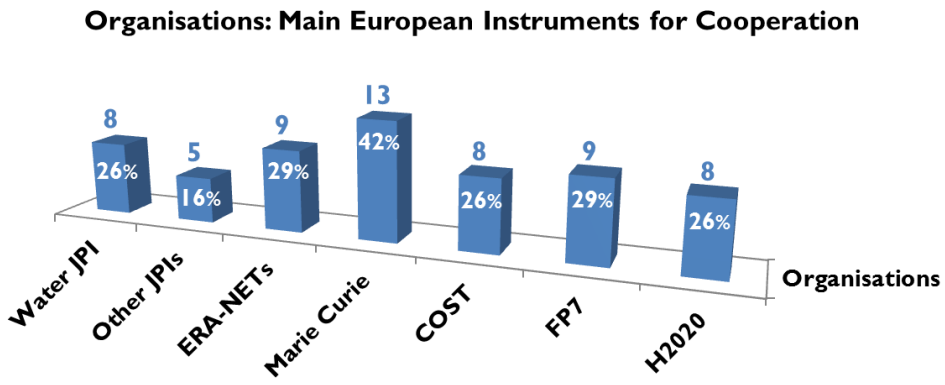

Figure 31. Number of performing organisations (blue) that mentioned European instruments for cooperation. The percentages, relative to the number of organisations out of a total of 31 respondents (white), are included in the figure inset. Only the most commonly referred are included.

The countries with whom 33 performing organisations cooperate more frequently in Water RDI are the UK (14 mentions), Spain (12 mentions). France and The Netherlands (10 mentions each), Germany (9 mentions) and Sweden (8 mentions). The total list, including the names of 15 additional European countries mentioned by less than four respondents each, can be consulted in Annex 5: Questionnaires (Open Questions). Regarding non-European countries that were more frequently mentioned by the performing organisations (28 in total) are the USA (9 mentions), Canada (7 mentions), Brazil and China (6 mentions each). As referred, the total listing of non-European countries can be found in Annex 5: Questionnaires (Open Questions). Overall, there are 39 mentions to collaborations with developing countries (about 60%) and 26 mentions to developed countries (about 40%).

Still in this section, respondents were asked to list the type of mobility schemes with European dimension, performed by their organizations in Water RDI (please see Annex 5: Questionnaires (Open Questions). A total of 35% of the organisations (17 out of 48 organisations) acknowledged performing mobility schemes with European dimension, corresponding to 8 countries (80% of the countries involved in this questionnaire). The mobility dynamics of these schemes was evaluated by 58% of the organisations (28 out of 48 organisations), 29% of which rated it as *Very Good*, 46% as *Good* and 25% mentioned *Poor* or *Non-Existing*.

Figure 32 describes the type of cooperating foreign institutions and the corresponding number of performing organisations with whom they are collaborating with. Globally, Public Institutions (*Universities. Local Authorities*, and *Research Institutions*) and *Governmental Agencies* gather the most interest, but it is important to highlight the relevance that *Companies* are also acquiring. The performing organisations were also enquired if there was an unsatisfied demand for international cooperation. This was answered by 75% of the organisations (36 out of 48 organisations), 44% (16 organisations) of which responded affirmatively (8 out of 9 countries).

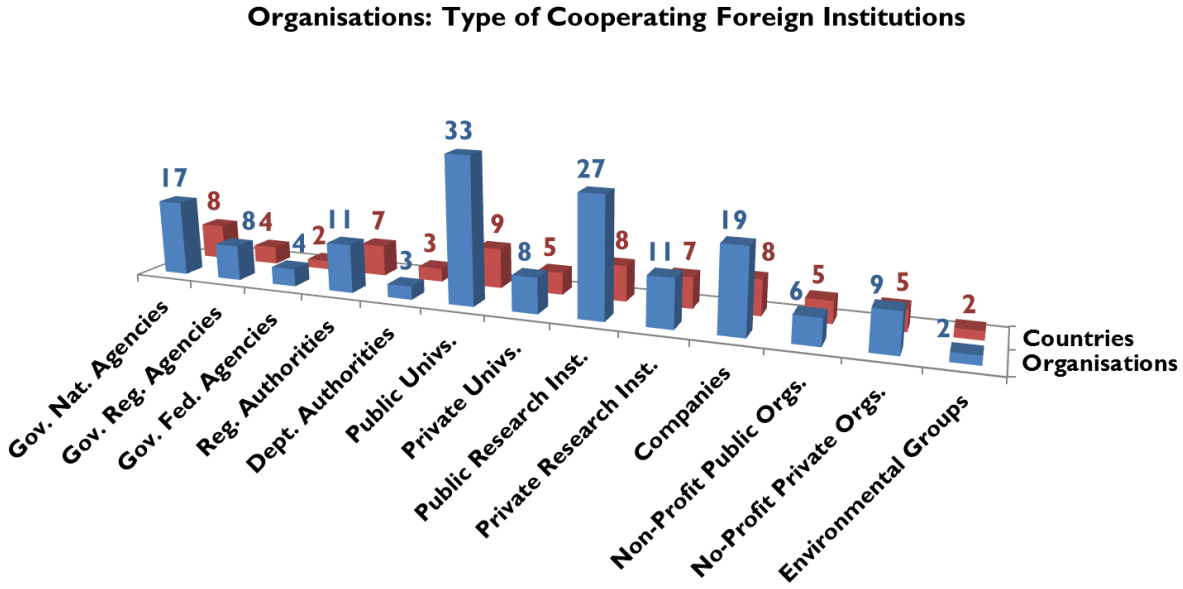

Figure 32. Type of foreign institutions that are collaborating with the performing organisations (blue). A total of 35 organisations from nine countries (red) responded to this question.

Question 36 "How relevant is international cooperation in your organisation compared to other activities?" had options ranging from *Excellent* to *Non-existing*. This is somewhat misleading, as the answers are not exactly matching the question. Given that out of the 36 responding organisations, 3 answered *Excellent* and 23 *Very Good*, 10 *Good*, and only one *Poor,* it is difficult to understand if the organisations are rating the quality of international cooperation or its importance or its priority level relative to other activities. On the other hand, it was also enquired how the performing organisations would qualify the opportunities available in the corresponding countries relatively to fostering international cooperation in Water RDI. The performing organisations rated them as *Excellent* (3), *Very Good* (14), *Good* (13) and *Poor* (9). It is noteworthy that the organisations that rated the opportunities available as *Poor* belong to 6 different countries out of the 9 that participated in this question.

Water RDI Competitive and Non-Competitive Funding

The performing organisations (39 from 10 countries) provided information on the proportion of competitive versus non-competitive funding received during 2007-2013, which was evaluated in terms of percentages: on average the ratio was 79%:44% (competitive : non-competitive), with 22 organisations mentioning non-competitive funding in Water RDI.

Figure 33 describes the type of Water RDI expenses that are covered by external funding, with most responding organisations (43 organisations from 10 countries). The data is unsurprisingly consistent.

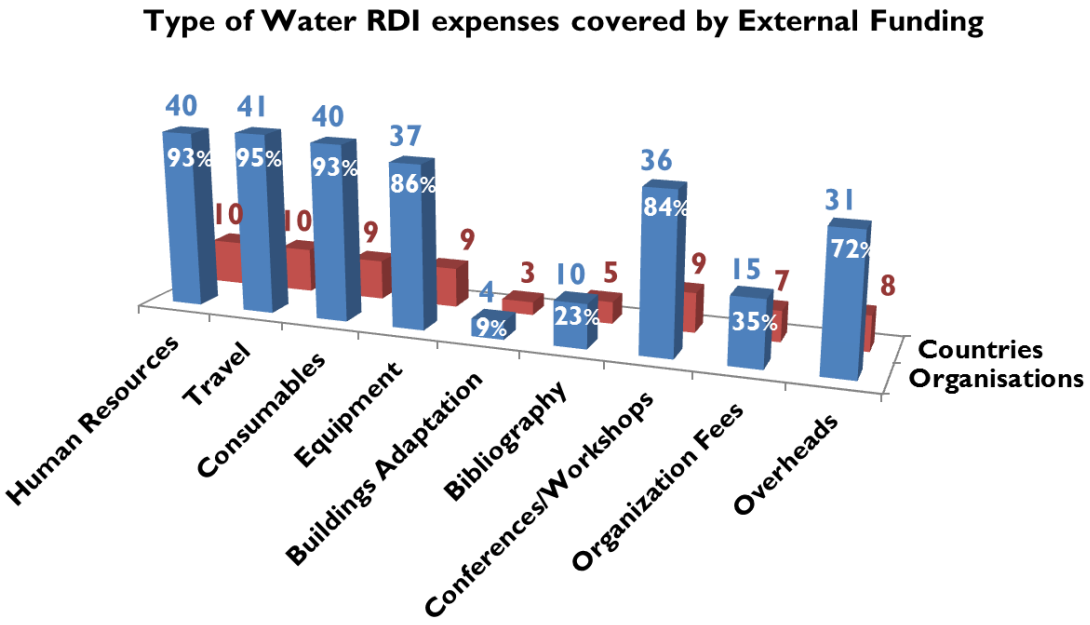

Figure 33. Type of Water RDI expenses covered by external funding, the number of performing organisations (blue) and the corresponding countries (red). A total of 43 organisations from 10 countries responded to this question. The percentages (white) are relative to the total number of responding organisations.

Figure 34 depicts the sources of funding received by the performing organisations. This question was answered by a total of 43 organisations from 10 countries (out of a total of 48 participating organisations in this questionnaire). It is important to highlight the close relationship between *National Public* and *EU funding* covering 98% and 81% of the responding organisations (42 and 35 organisations from 10 and 8 countries, respectively). Also of relevance is the 56% of organisations (24 organisations from 7 countries) mentioning *National Private* funding as their source.

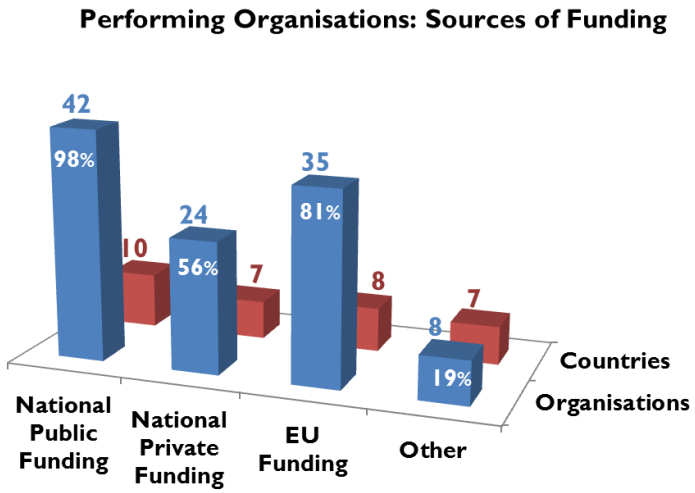

Figure 34. Sources of Water RDI funding received by the performing organisations (blue) and the corresponding countries (red). Percentages (white) are relative to the total number of organisations participating in this question. A total of 43 organisations from 10 countries responded to this question.

Considering the number of organisations that received non-competitive funding for Water RDI activities (22 organisations from 8 countries), they were enquired on the submission procedures for

this type of funding. The majority (15 organisations) indicated *Formal Applications* as their method of choice, while *Informal/Direct Contact* was mentioned by 10 organisations.

The main scientific areas within Water RDI whereby respondents receive support through non-competitive funding can be consulted in Annex 5: Questionnaires (Open Questions).

Water RDI Self-Funding

Interestingly, 56% (26 out of 46 organisations) of the organisations answered that they have the ability to self-fund part of their Water RDI activities (RDI projects, Fellowships/Mobility/Infrastructures). Taking into account the 26 responding organisations, it was referred that the self-funding covers 44% of the expenses, on average, for their Water RDI activities.

Evaluation

For the sake of completeness, Tables 11 and 12 summarise the type of evaluation, the evaluation criteria, and the type of panels considered in the case of organisations that undergo evaluation of its performance in Water RDI.

Table 11. Organisations that undergo evaluation of its performance in Water RDI, and the corresponding type of evaluation and panels.

Type of Panels	Type of Performance Evaluation					
	Formal		Audits		Studies/ Comparative Analysis	
	Orgs.	Countries	Orgs.	Countries	Orgs.	Countries
International External	14	9	7	7	5	6
National External	13		10		8	
Internal	11		11		7	

Table 12. Organisations that undergo evaluation of its performance in Water RDI, and the corresponding criteria for the evaluation and panels.

Type of Panels	Funding and Prizes							
	Funded Projects		Innovation Level		Prizes Awarded		Research Team Qualifications	
	Orgs.	Countries	Orgs.	Countries	Orgs.	Countries	Orgs.	Countries
International External	12	9	9	9	8	8	13	8
National External	15		14		10		13	
Internal	14		11		12		11	

Type of Panels	Publications							
	International with Refs.		National with Refs.		International no Refs.		National no Refs.	
	Orgs.	Countries	Orgs	Countries	Orgs.	Countries	Orgs.	Countries
International External	13	8	5	7	2	6	1	6
National External	15		14		5		5	
Internal	13		12		10		10	

Type of Panels	Internationalisation and Technology Transfer							
	Research Team Internationalisation		National Network Level		International Network Level		Technology Transfer Level	
	Orgs.	Countries	Orgs.	Countries	Orgs.	Countries	Orgs.	Countries
International External	9	6	3	7	10	8	8	8
National External	11		13		12		9	
Internal	8		6		6		8	

Other forms of evaluation of performance in Water RDI identified by the respondents and the corresponding evaluation criteria are outlined in Annex 5: Questionnaires (Open Questions).

3.2. Desk Research

The following coloured maps illustrate the current status of Water RDI in Europe in terms of: i) raw data about scientific publications and patents (Figures 35 and 38); ii) publications and patents normalised by GDP (Figures 36 and 39); and iii) publications and patents normalised by population (Figures 37 and 40). Each of these six figures (three for publications and three for patents) contain six maps corresponding to the five Water JPI priorities of the SRIA plus the general theme *All Water issues*.

These maps were elaborated following the methodology summarised in section 2.3, and were made available in an extended version in Annex 3. Each SRIA map exhibits a colour, the same in all the figures, with five different shades or classes. The darkest shade corresponds to the highest level on the ranking, which corresponds to the highest level of scientific publications and patents.

The ranking of European countries in terms of Water RDI differs depending on the used data set (raw or normalised). In general, countries with high economic capacity are expected to have a high intensity (dark colour) on Water RDI. This point of view can be checked in Figures 35 and 38 with raw data on publications and patents, respectively. Overall, and to clarify the terminology used in this section, the number of publications is related to Water Research and the number of patents to Water Innovation.

However, the intensity of Water RDI between European countries can be better understood using the normalised maps (Figures 36 and 37 for publications, and Figures 39 and 40 for patents), where the strength of the country in terms of population (number of habitants) or economy (GDP) is taken into account. Normalised maps provide a more comparable classification of Water RDI in Europe, and also enable comparison with countries outside Europe.

Countries show different intensity on Water Research and Innovation in each SRIA theme. There are more countries with high level on Water Research than countries with high level on Water Innovation.

Regarding the intensity of publications per SRIA theme, the highest intensity corresponds to Q3- *Water Industry*, with ten times the number of publications on Q4- *Water-wise Bio-Economy*. Patents intensity on the priority themes Q2- *Safe Water for Citizens* and Q3- *Water Industry* are similarly high, seven times higher than the level of patents on other SRIA themes.

Water RDI in Europe is characterised by a relatively high production on Q3- *Water Industry*.

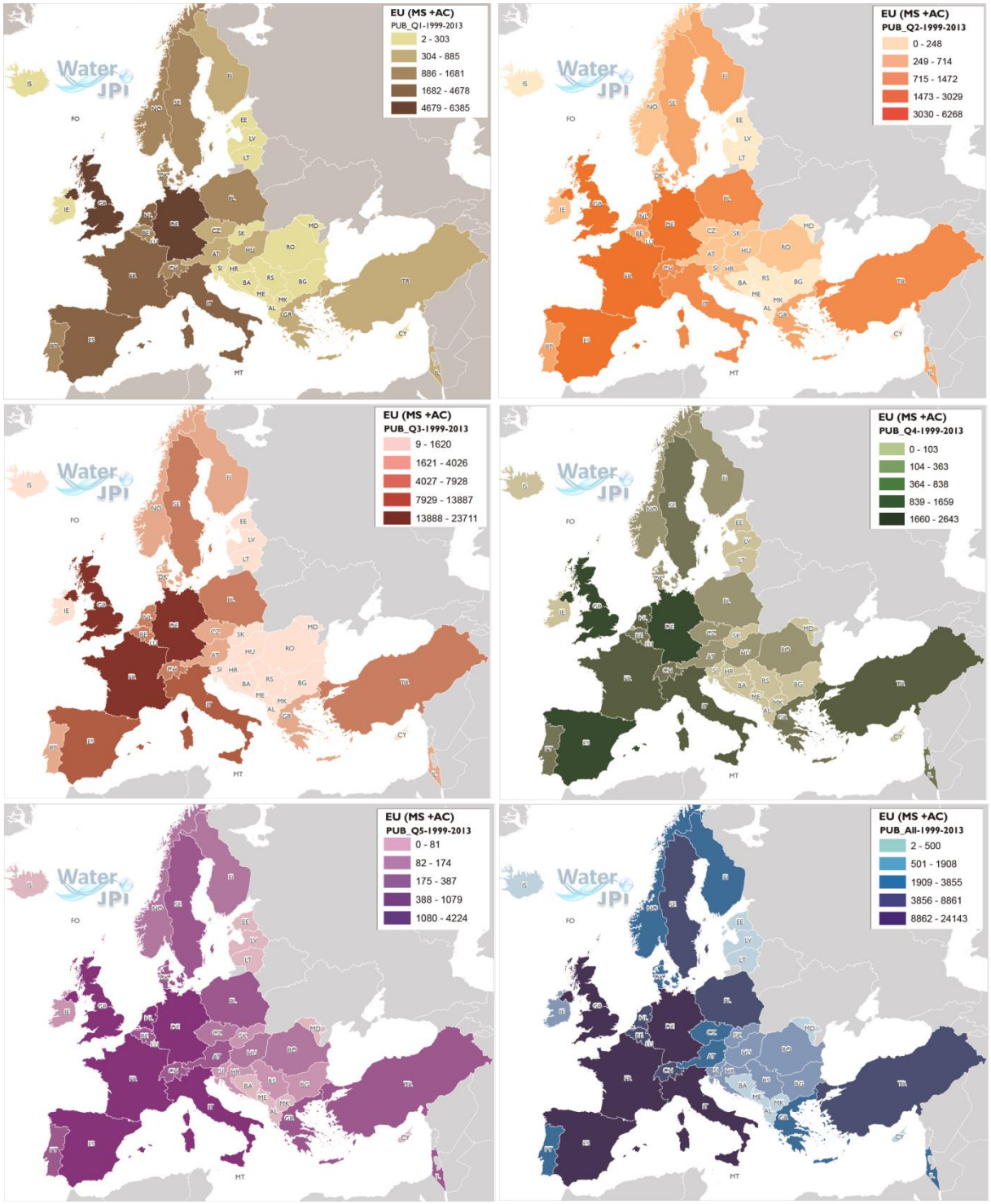

Figure 35. Intensity of publications in Europe (Member States and Associated Countries), from 1999 to 2013, based on raw data, for the five Water JPI SRIA priorities (Q1- Sustainable Ecosystems, Q2- Safe Water for Citizens, Q3- Water Industry, Q4- Water-wise Bio-economy, Q5- Water Cycle Gap) and Q6- All Water issues.

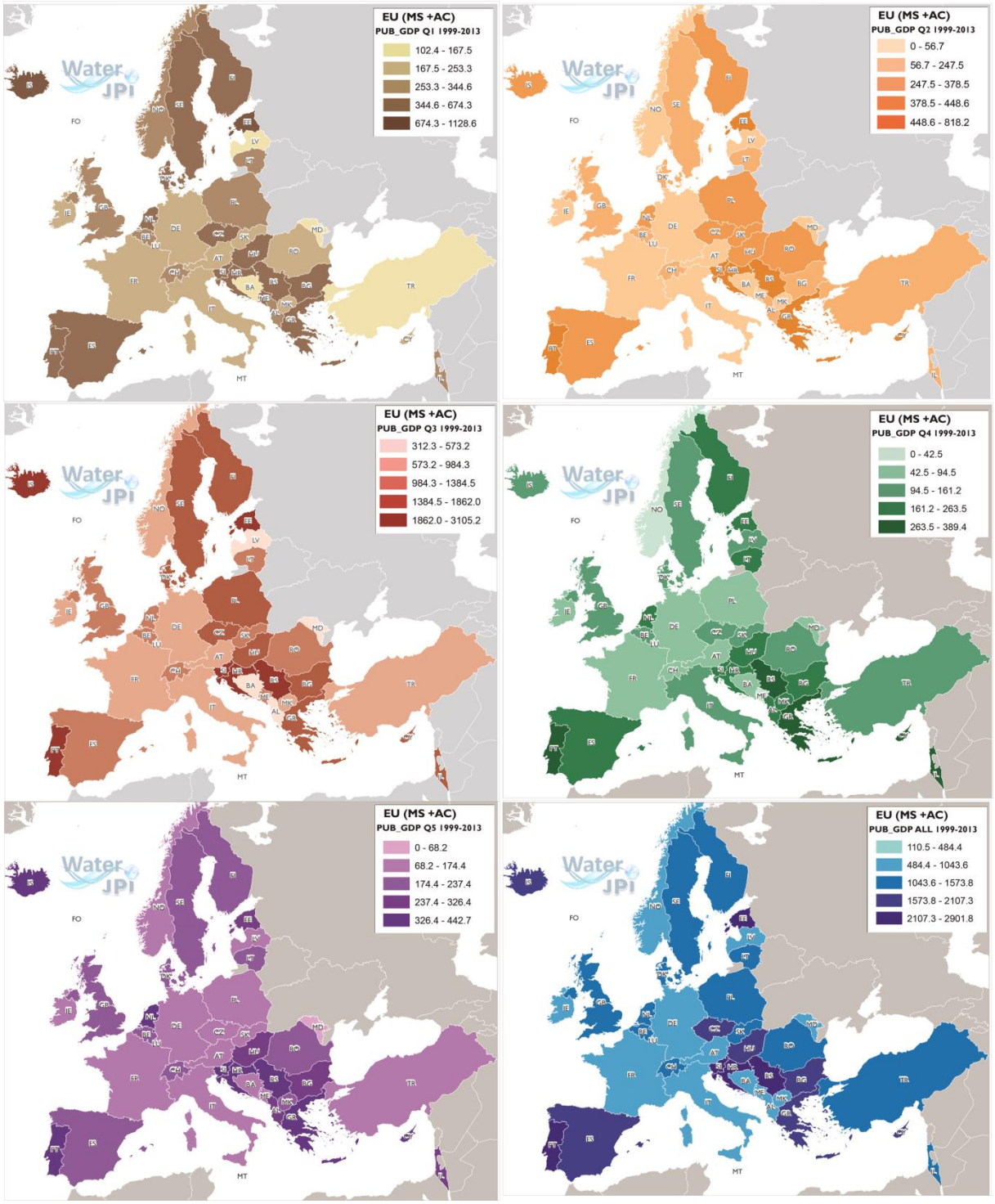

Figure 36. Intensity of publications in Europe (Member States and Associated Countries) normalised by GDP, from 1999 to 2013, for the five Water JPI SRIA priorities (Q1- Sustainable Ecosystems, Q2- Safe Water for Citizens, Q3- Water Industry, Q4- Water-wise Bio-economy, Q5- Water Cycle Gap) and Q6- All Water issues.

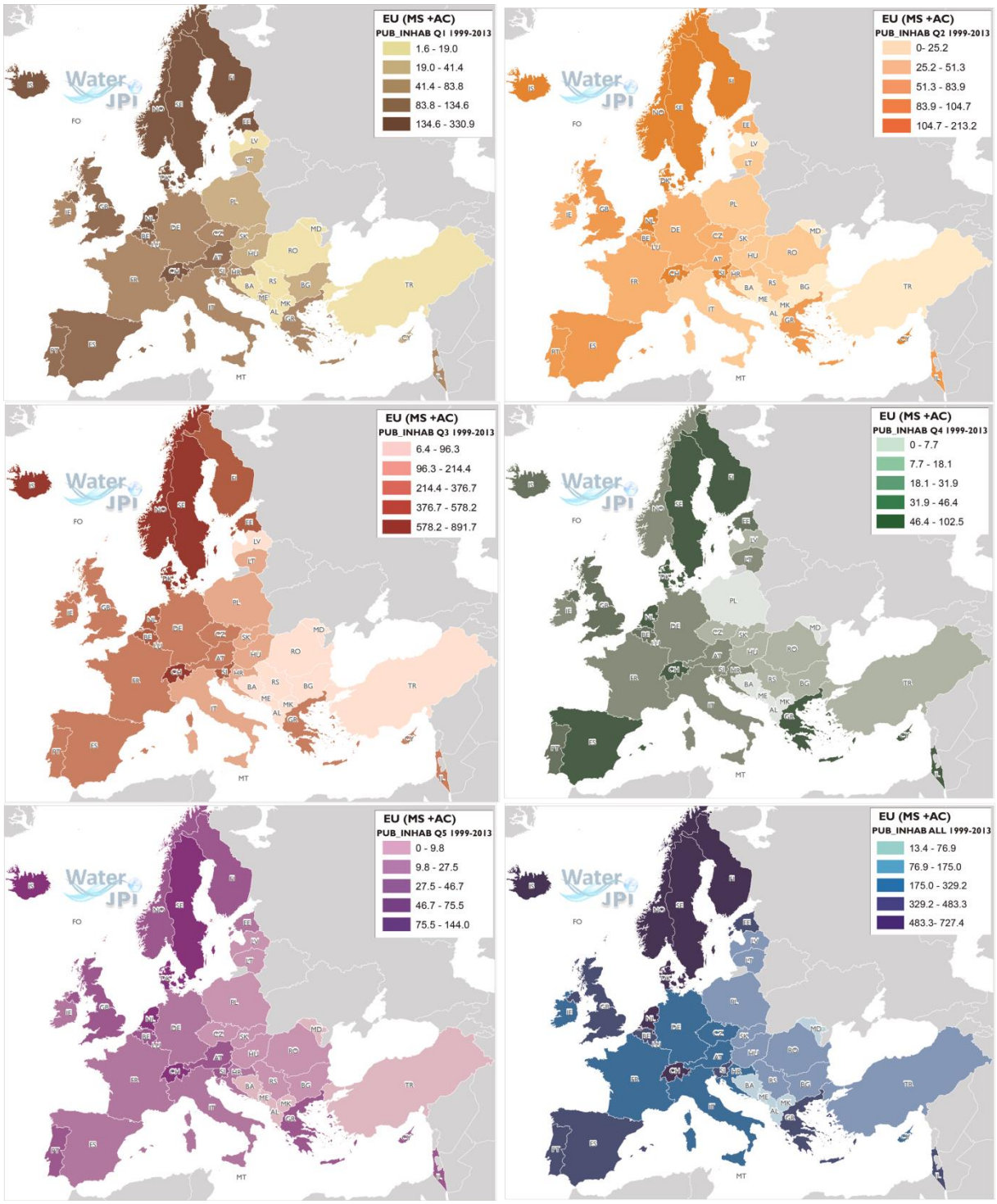

Figure 37. Intensity of publications in Europe (Member States and Associated Countries) normalised by population, from 1999 to 2013, for the five Water JPI SRIA priorities (Q1- Sustainable Ecosystems, Q2- Safe Water for Citizens, Q3- Water Industry, Q4- Water-wise Bio-economy, Q5- Water Cycle Gap) and Q6- All Water issues.

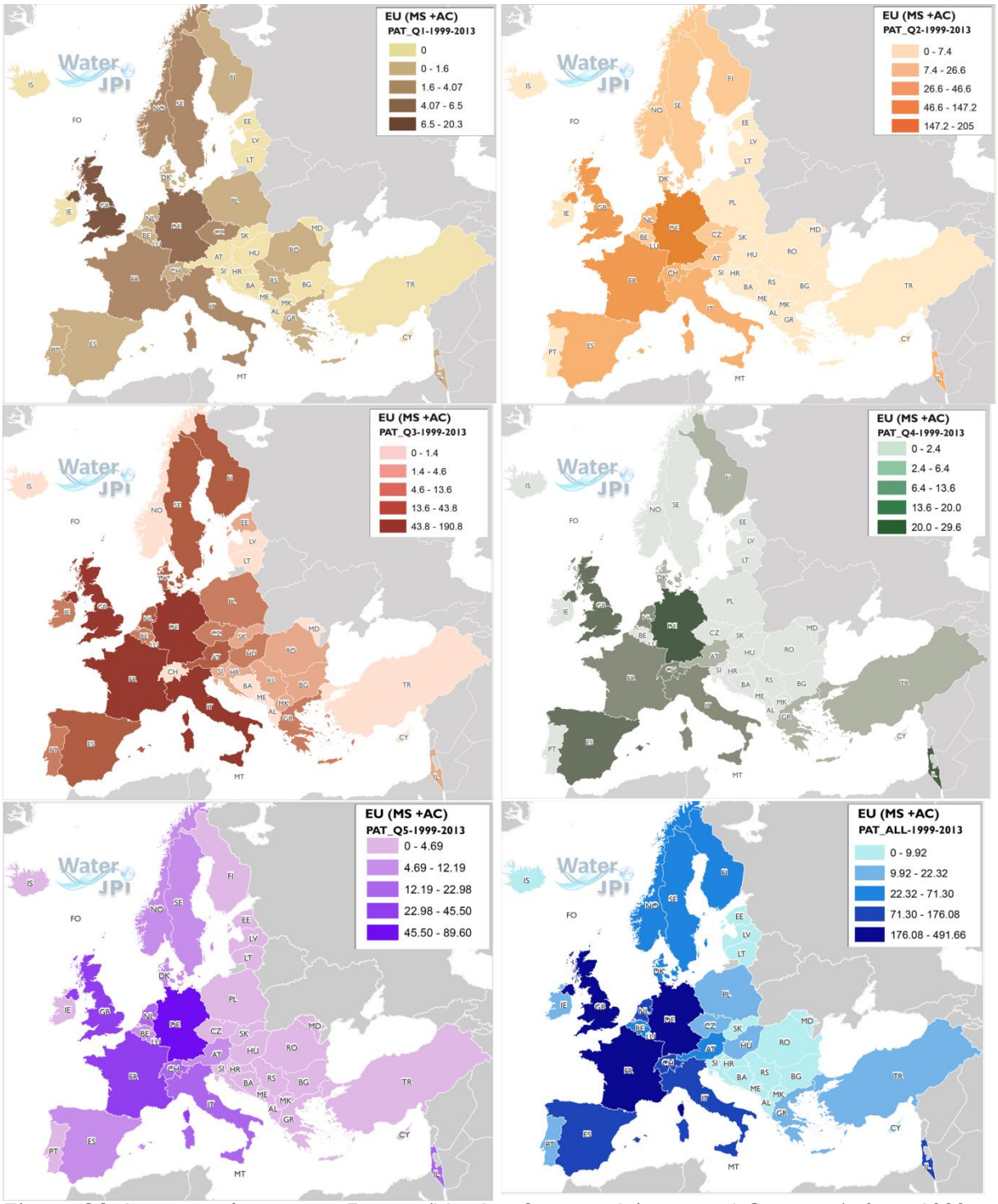

Figure 38. Intensity of patents in Europe (Member States and Associated Countries), from 1999 to 2013, based on raw data, for the five Water JPI SRIA priorities (Q1- Sustainable Ecosystems, Q2- Safe Water for Citizens, Q3- Water Industry, Q4- Water-wise Bio-economy, Q5- Water Cycle Gap) and Q6- All Water issues.

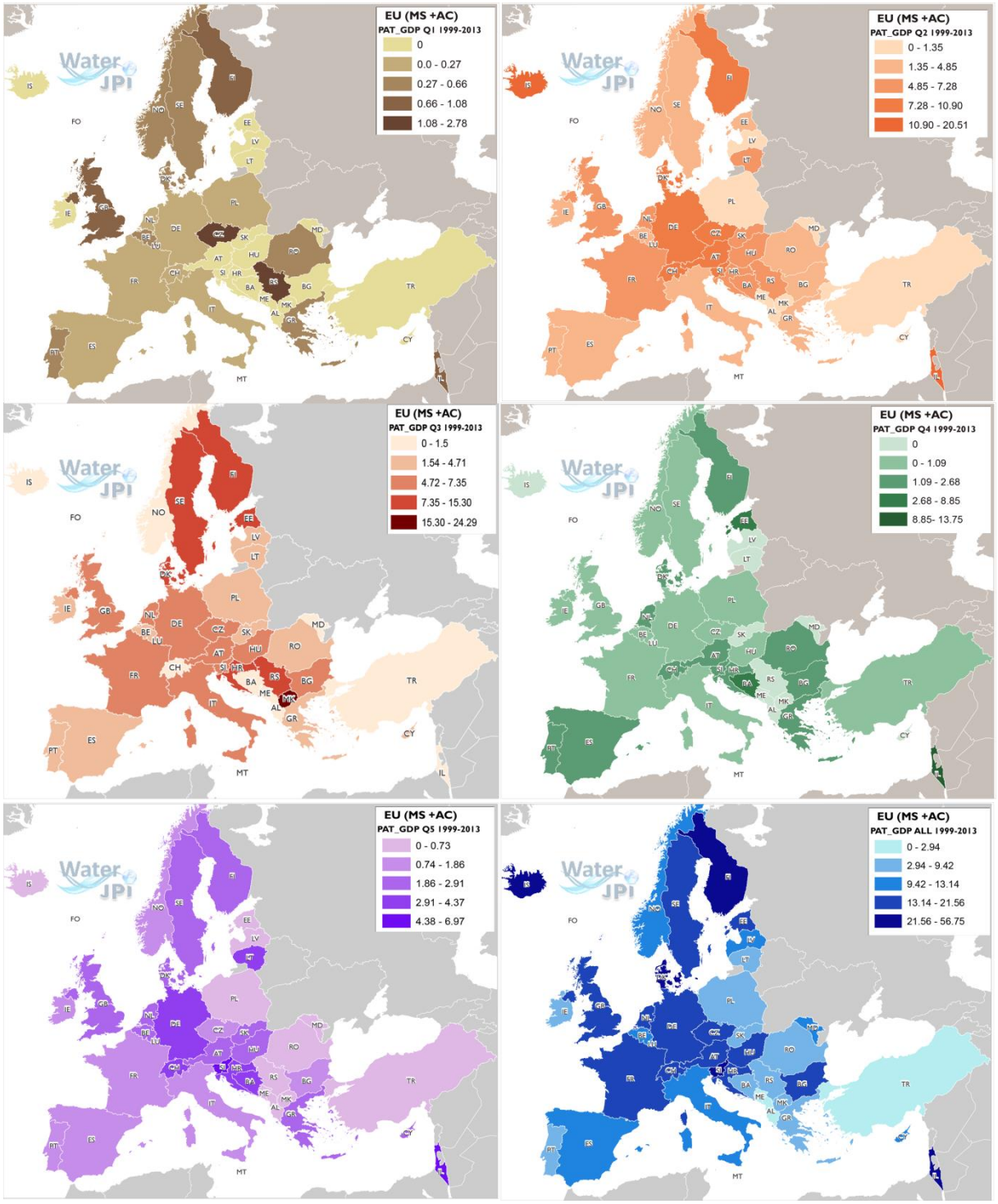

Figure 39. Intensity of patents in Europe (Member States and Associated Countries) normalised by GDP, from 1999 to 2013, for the five Water JPI SRIA priorities (Q1- Sustainable Ecosystems, Q2- Safe Water for Citizens, Q3- Water Industry, Q4- Water-wise Bio-economy, Q5- Water Cycle Gap) and Q6- All Water issues.

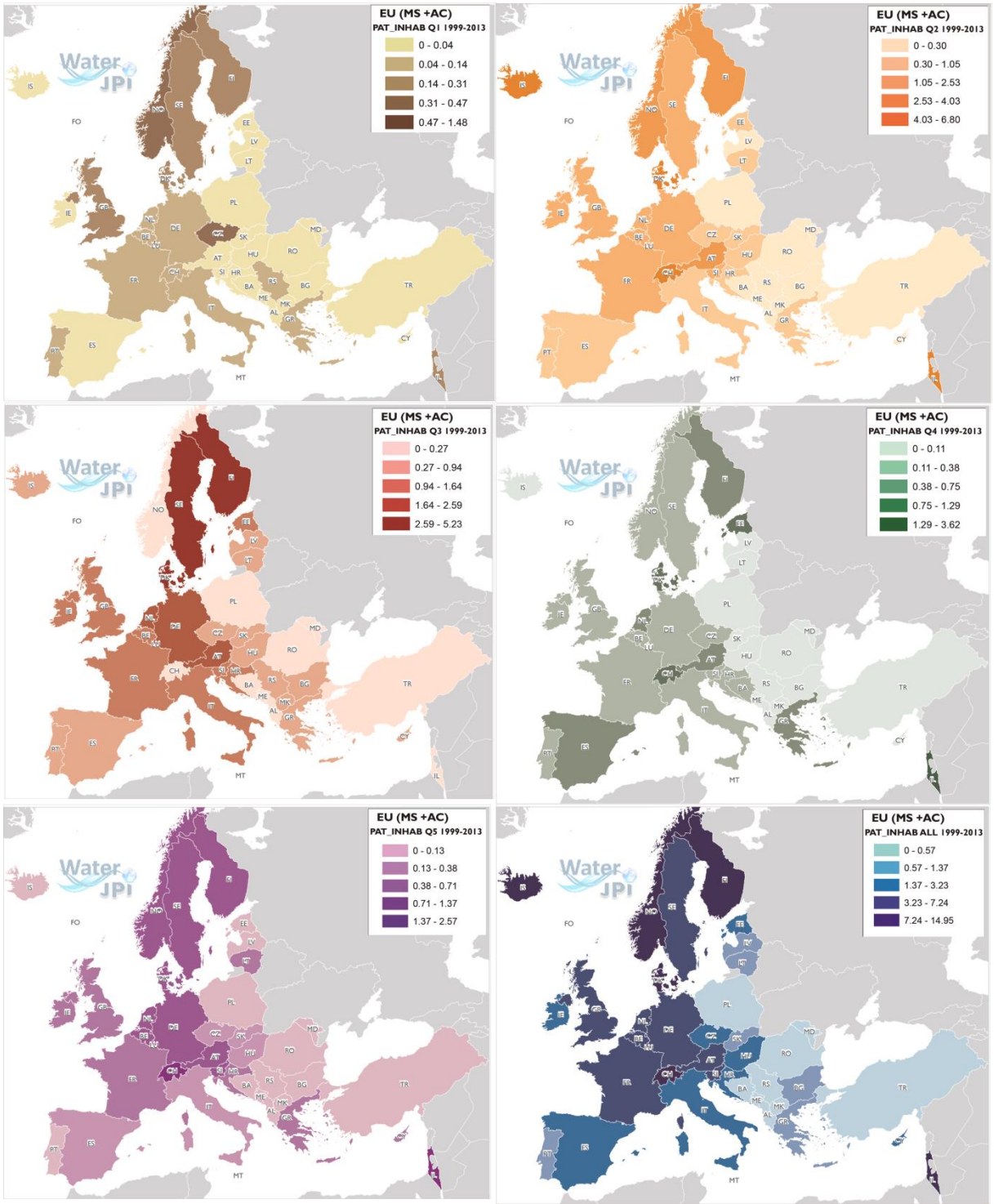

Figure 40. Intensity of patents in Europe (Member States and Associated Countries) normalised by population, from 1999 to 2013, for the five Water JPI SRIA priorities (Q1- Sustainable Ecosystems, Q2- Safe Water for Citizens, Q3- Water Industry, Q4- Water-wise Bio-economy, Q5- Water Cycle Gap) and Q6- All Water issues.

3.2.1. Increasing rate of publications and patents on Water in Europe

The increasing rate of publications and patents on Water is an indicator of the time evolution of Research and Innovation on the Water domain. On average, in the last 15 years, publications and patents on Water RDI in Europe increased by 5.7 and 1.5 times, respectively. The same index computed for EU Member States is 3.6 and 1.6, respectively. On average, the increasing rate of publications in Europe is slightly higher if Associated Countries are taken into account.

Mean values of this index per SRIA theme are summarised in Table 13. The highest increasing rate computed for Europe is 8.6, and corresponds to the publications on Q2- *Safe Water for Citizens*; it is followed by publications on Q5- *Water Cycle Gap*, with and index of 7.4. The increasing rate of publications on Q2 and Q5 is about two times higher in Europe than in EU Member States

Regarding the publications of EU Member States, the highest rates can be found in research on Q1- *Sustainable Ecosystems* (4.6) and on Q5- *Water Cycle Gap* (4.2). Slightly lower rates can be observed in the rest of water priorities. Publications on Q3- *Water Industry* show the smallest rate, with an increase of 2.8 times in European Member States.

The maps in Figures 41 show the increasing rate of publications in Europe by Water JPI SRIA priority. The increasing rate of publications shows significant differences among European countries. This index reaches particularly high values in countries with a low or zero number of publications / patents in the first time period used in the index (1999-2003). The maximum increasing rate per country ranges from 192 on Q2- *Safe Water for Citizens* to 14 on Q4- *Water-wise Bio-economy*, with an index of 45 on Q6- *All Water issues*.

Detailed records on these indexes per country are available in the Water JPI website. Regarding the publications computed on "All water issues" as an example, Serbia showed the highest increasing rate (45), followed by Bosnia (23), Montenegro (15), Luxembourg (10) and Cyprus (9). When the different SRIA themes are compared, one can observe that the differences in the increasing rate of patents[1] are comparatively small. While it was observed a clear evolution of publications in Europe over the last 15 years, patents did not accompanied this pace, except in the Q2- *Safe Water for Citizens* theme. However, if one only considers EU-MS, the evolution rate for patents is slightly higher. This index ranges from 1.9 on Q3- *Water Industry* and Q5- *Water Cycle Gap*, to 1.3 on Q1- *Sustainable Ecosystems* and Q4-*Water-wise Bio-based Economy*. The maximum increasing rate of patents in Europe (MS-AC) was observed on Q3- *Water Industry* (1.8). The minimum rates correspond to patents on Q1- *Sustainable Ecosystems* (1.1) and on Q4- *Water-wise Bio-based Economy* (1.3).

Table 13. The two indexes summarized per SRIA theme: The increasing rate of publications and patents in Europe; and patents per 1,000 publications.

SRIA Theme	Increasing rate				Patents / 1,000 Publications	
	Publications		Patents			
	EU40[2]	EU MS[3]	EU40	EU MS	EU40	EU MS
Q1	4.6	4.3	1.1	1.3	1.2	1.3
Q2	8.6	3.7	1.5	1.4	15.7	14.6
Q3	4.2	2.8	1.8	1.9	5.1	5.8
Q4	3.5	3.1	1.3	1.3	9.5	8.4
Q5	7.4	4.2	1.7	1.9	9.1	9.3
ALL	5.2	3.2	1.7	1.7	11.8	12.3
Mean	5.7	3.6	1.5	1.6	8.1	7.9

[1] The increasing rate of patents is calculated only in countries with the number of patents from 1999 to 2003 > 0.
[2] Member States and Associated Countries
[3] MS: Member States

The percentage of the increasing rate of an individual country in relation to Europe (MS+AC) is a relative rate which is meant to show how fast water publications/patents are increasing in time in a given country. Table 14 shows the differences on these relative increasing rates per SRIA theme. Detailed country data are available in the Water JPI website. Regarding publications, the index is higher than 100 in a significant number of countries, ranging from 23 to 31 (out of a total of 40) depending on the different SRIA themes (Table 14). This means that the abovementioned group of countries have improved on Water Research faster than Europe as a whole. Concerning the patents, the number of countries prompting in Europe is more limited, from 2 in Q1- *Sustainable Ecosystems* to 15 in Q3- *Water Industry*.

Table 14. Relative increasing rate of publications and patents by SRIA theme, averaged from country data, and number of countries with this percentage higher than 100 on water publications[1].

SRIA Theme	Percentage of Increasing rate respect to Europe				Number of countries with % > 100
	Publications		Patents		Publications
	EU40	EU MS	EU40	EU MS	27
Q1	169	160	59	69	26
Q2	374	161	122	120	31
Q3	236	160	133	134	23
Q4	136	121	77	74	29
Q5	262	149	100	113	30
ALL	244	150	127	131	27
Mean	236	150	98	102	28

3.2.2. Patents intensity related to publications on Water in Europe

The number of patents per 1,000 publications is an index which allows quantifying the balance between Innovation and Research on Water in Europe at the country level. This index was mapped for each SRIA theme, and it is depicted in Figure 42. These maps show how the activity of each country is more or less biased to the side of Research or to the side of Innovation.

The average value of this index is different for the five Water SRIA priorities (Table 13). The highest value (15.7) corresponds to Q2- *Safe Water for Citizens*, whereas the topic Q1- *Sustainable Ecosystems* presents the minimum (1.2). SRIA priorities Q3- *Water Industry*, Q4- *Water-wise Bio-economy* and Q5- *Water Cycle Gap* show intermediate values. This index does not show significant differences when EU-MS is compared to EU40.

The index mapped in Figure 42 shows that Q4- *Water-wise Bio-economy* displays the highest absolute value, 67, followed by Q2- *Safe Water for Citizens* with 51. These indexes correspond to the countries with the darkest shade in the respective maps, Q4 and Q2. In contrast, Q1- *Sustainable Ecosystems* attains the minimum impact on patents, with a maximum index of 11.

[1] Patents have not be included as the number of countries with increasing rate calculated is limited by the occurrence of zero patents in the first period analyzed (1999-2003.

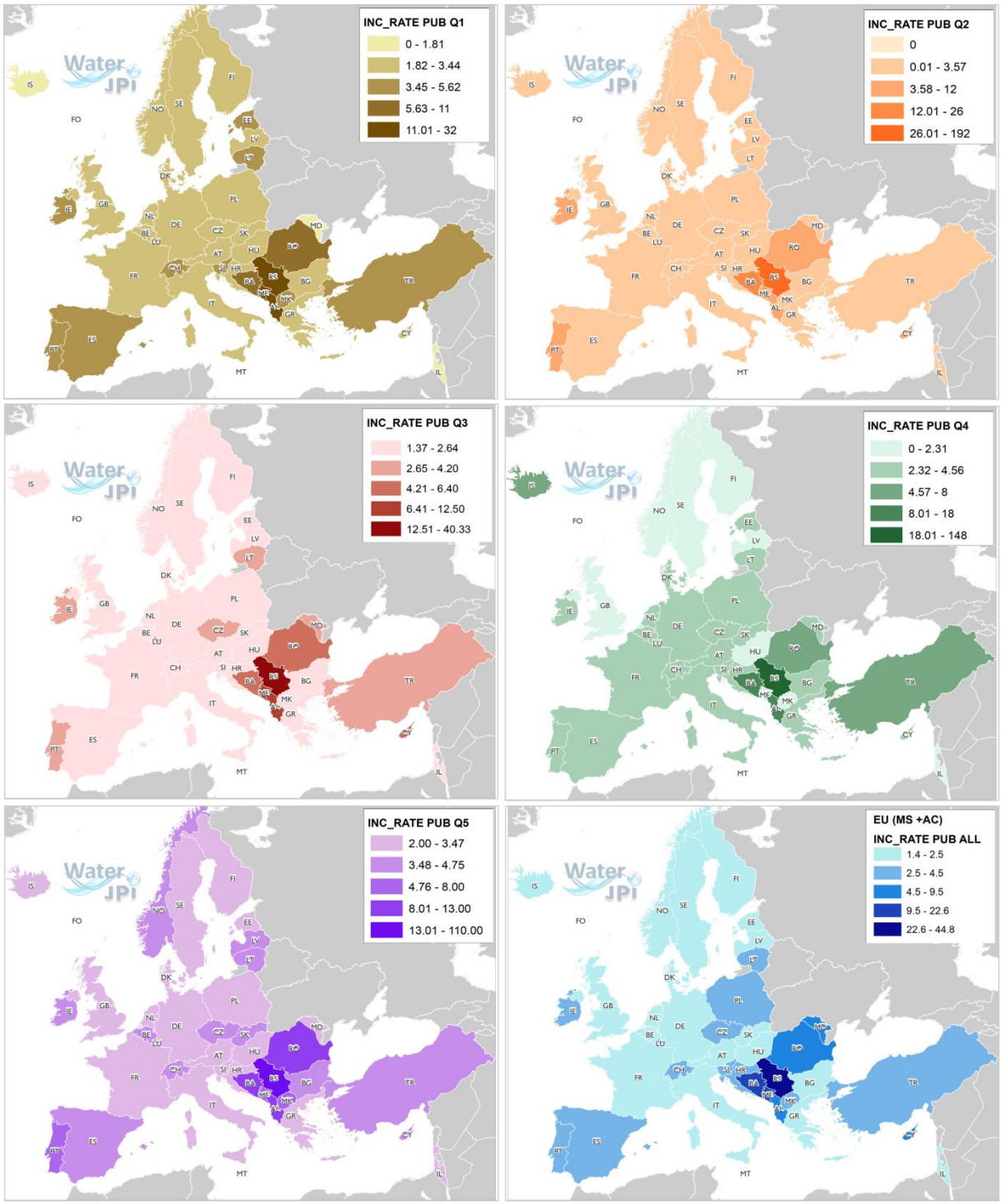

Figure 41. Increasing rate of publications in Europe, from 1999 to 2013, on Water SRIA themes (Q1- Sustainable Ecosystems, Q2- Safe Water for Citizens, Q3- Water Industry, Q4- Water-wise Bio-economy, Q5- Water Cycle Gap) and Q6- All Water issues.

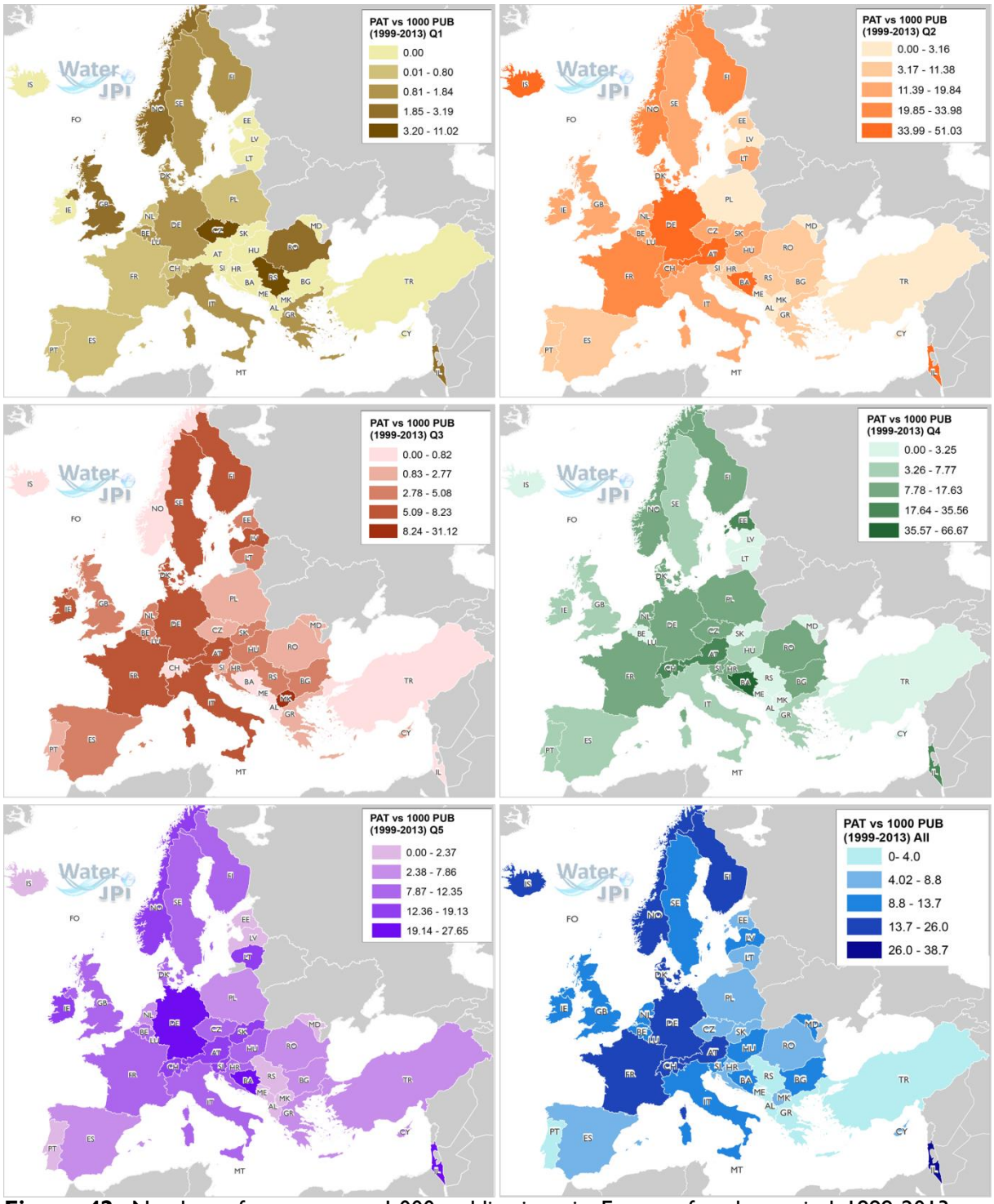

Figure 42. Number of patents per 1,000 publications in Europe, for the period 1999-2013, on Water SRIA themes (Q1- Sustainable Ecosystems, Q2- Safe Water for Citizens, Q3- Water Industry, Q4- Water-wise Bio-economy, Q5- Water Cycle Gap) and Q6- All Water issues.

3.2.3. Funding Organisations

The analysis of funding organisations was performed for the 24 partner and observer countries joining the Water JPI: 20 of them are EU Member States and 4 are Associated Countries. One of the associated countries is also a Candidate Country.

The analysis conducted on funding organisations was based on data extracted from publications. The quality of these data was assured by the quality of the Web of Science™ database (WOS). In the WOS, the data on funding institutions was extracted from the authors' funding acknowledgement in the publications. All the institutions cited in the Acknowledgments section were systematically introduced in the WOS database. The analysis presented in this report strictly focuses on this information.

Frequently it was found in the database that several names are used to describe a given funding institution. This is mainly due to the lack of rigor from the authors or lack of specific mandate from the funding institutions. The following additional sources of error were identified and should also be taken into account in the interpretation of the results of this study:

- Not all the Institutions funding Water research and innovation are normalised in the WOS, Sometimes funding institutions are not acknowledged, while universities granting scholarships are mentioned instead. These issues have received specific treatment[1] in this analysis to use a unique name per funding institution (the English name was not always available).
- The normalisation (named 'enhanced' in the WOS) is not always suitable for our purposes. Some institutions integrating a large Agency which performs other themes than Water have been grouped, even though it may have been correct to differentiate them. This is the case of CSIC in Spain, CNRS in France, and some Institutions in additional countries. This issue only has been revised and improved in the Country Fiches thanks to the feedback obtained from Water JPI partners.

In this context, the suggestions and contributions collected from Water JPI partners during the elaboration of this mapping exercise were critical to improve the corresponding national data included in the *Country Fiche* and, hence, the resulting mapping of Europe.

Considering only the countries joining the Water JPI, there are 50 main institutions funding Water Research. For this analysis, only national funding institutions having an intensity of citations above 50 were used. They are listed in Table 15 and mapped in Figure 43. The number of SRIA themes funded by each Institution is also showed in Table 15.

Among the 24 countries for which national funding was reported, 9 (18%) have only one main Funding Agency on the water domain, while 6 (12%) have 2 main Funding Agencies. The 5 countries (10%) having 3 or 4 relevant Funding Agencies are Belgium, France, UK, Poland, and Sweden. No Moldavian Funding Agencies were identified in the studied period.

Summarising by SRIA themes, the Q4- *Water-wise* Bio-economy was funded by the highest number of Agencies (35), followed by Q2- *Safe Water for Citizens* (34). Theme Q1- *Sustainable Ecosystems* has been supported by a total of 27 main institutions in the Water JPI partners.

[1] See Annex 3 for details on Methodology

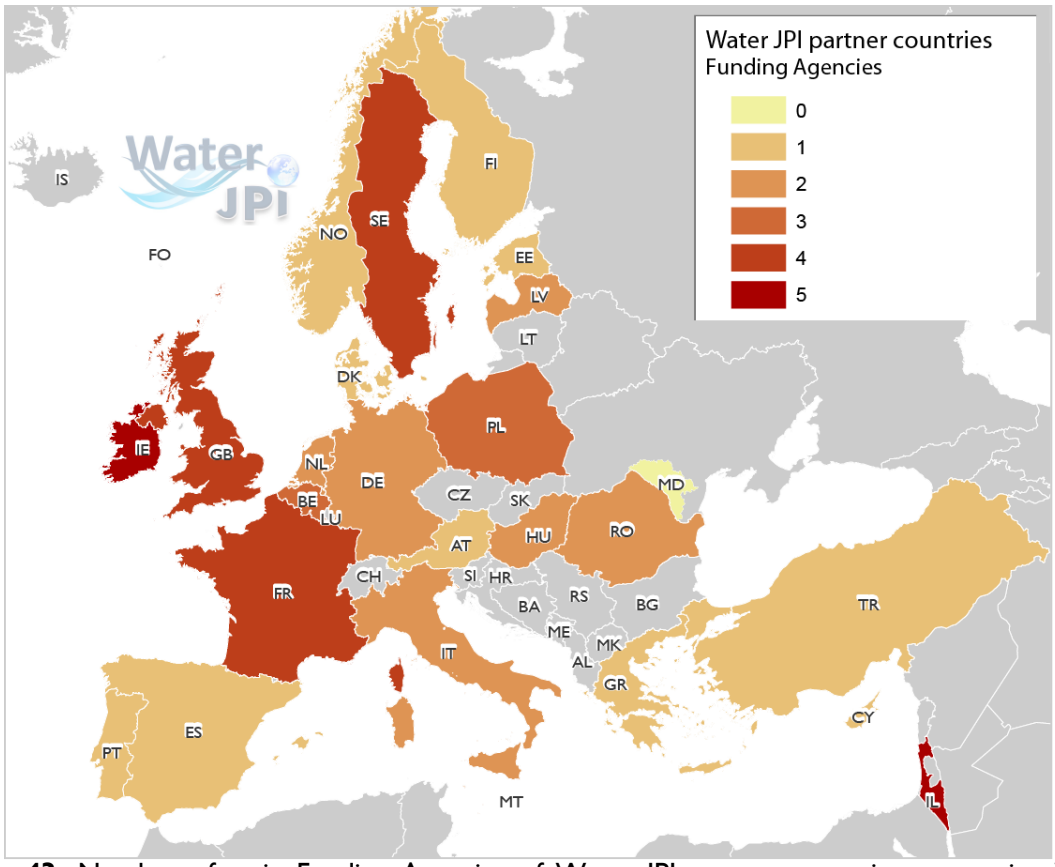

Figure 43. Number of main Funding Agencies of Water JPI partner countries supporting Water RDI.

Table 15. Main Institutions of Water JPI country partners funding Research on Water, and with an intensity of citations higher than or equal to 50.

Code	Name of Funding Agency	Number of SRIA themes
AT	AUSTRIAN SCIENCE FUND	6
BE	RESEARCH FOUNDATION FLANDERS	6
	AGENCY FOR INNOVATION BY SCIENCE AND TECHNOLOGY	1
	BELGIAN SCIENCE POLICY OFFICE	1
CY	CYPRUS RESEARCH PROMOTION FOUNDATION	6
DE	GERMAN RESEARCH FOUNDATION	6
	GERMAN FEDERAL MINISTRY OF EDUCATION AND RESEARCH	3
DK	DANISH MINISTRY OF HIGHER EDUCATION AND SCIENCE	6
EE	ESTONIAN RESEARCH COUNCIL	6
ES	SPANISH MINISTRY OF ECONOMY AND COMPETITIVENESS	6
FI	ACADEMY OF FINLAND	6
FR	THE FRENCH NATIONAL RESEARCH AGENCY	6
	FRENCH NATIONAL CENTER FOR SCIENTIFIC RESEARCH	6
	FRENCH CENTER FOR INTERNATIONAL COOPERATION ON AGRICULTURAL RESEARCH FOR DEVELOPMENT	1
	FRENCH MINISTRY OF FOREIGN AFFAIRS AND INTERNATIONAL DEVELOPMENT	1

GB	UK ENGINEERING AND PHYSICAL SCIENCES RESEARCH COUNCIL	3
	BIOTECHNOLOGY AND BIOLOGICAL SCIENCES RESEARCH COUNCIL	1
	UK DEPARTMENT FOR ENVIRONMENT FOOD & RURAL AFFAIRS	1
	UK NATURAL ENVIRONMENT RESEARCH COUNCIL	6
GR	HELLENIC REPUBLIC MINISTRY OF EDUCATION AND RELIGIOUS AFFAIRS	6
HU	HUNGARIAN SCIENTIFIC RESEARCH FUND	5
	HUNGARIAN NATIONAL INNOVATION OFFICE	3
IE	ENVIRONMENTAL PROTECTION AGENCY OF IRELAND	5
	SCIENCE FOUNDATION IRELAND	3
	IRISH DEPARTMENT OF AGRICULTURE FOOD AND THE MARINE	2
	AGRICULTURE AND FOOD DEVELOPMENT AUTHORITY	1
	MARINE INSTITUTE OF IRELAND	1
IL	ISRAEL SCIENCE FOUNDATION	5
	ISRAEL MINISTRY OF SCIENCE, TECHNOLOGY AND SPACE	3
	ISRAEL MINISTRY OF AGRICULTURE AND RURAL DEVELOPMENT	2
	ISRAEL WATER AUTHORITY	2
	US ISRAEL BINATIONAL AGRICULTURAL RESEARCH AND DEVELOPMENT FUND	1
IT	ITALIAN MINISTRY OF EDUCATION, UNIVERSITIES AND RESEARCH	6
	ITALIAN MINISTRY OF AGRICULTURE AND FORESTRY POLICIES	1
LV	LATVIAN COUNCIL OF SCIENCE	1
	MINISTRY OF EDUCATION AND SCIENCES OF THE REPUBLIC OF LATVIA	1
NL	MINISTRY OF ECONOMIC AFFAIRS OF THE NETHERLANDS	5
	NETHERLANDS ORGANIZATION FOR SCIENTIFIC RESEARCH	5
NO	THE RESEARCH COUNCIL OF NORWAY	6
PL	MINISTRY OF SCIENCE AND HIGHER EDUCATION IN POLAND	6
	CZESTOCHOWA UNIVERSITY OF TECHNOLOGY	1
	NATIONAL SCIENCE CENTRE POLAND	1
PT	PORTUGUESE FOUNDATION FOR SCIENCE AND TECHNOLOGY	6
RO	ROMANIAN GOVERNMENT	6
	EXECUTIVE UNIT FOR FINANCING HIGHER EDUCATION, RESEARCH, DEVELOPMENT AND INNOVATION OF ROMANIA	4
SE	THE SWEDISH RESEARCH COUNCIL FORMAS	5
	THE SWEDISH RESEARCH COUNCIL VR	5
	SWEDISH INTERNATIONAL DEVELOPMENT COOPERATION AGENCY	3
	SWEDISH UNIVERSITY OF AGRICULTURAL SCIENCES	1
TR	THE SCIENTIFIC AND TECHNOLOGICAL RESEARCH COUNCIL OF TURKEY	6

3.2.4. Performing Organisations

The analysis of performing organisations was also performed for the 24 partner and observer countries joining the Water JPI. The analysis presented in this report strictly focuses on the information extracted from the analytical tool "Enhanced organisations", which performs a search in a database of organisations with their homogenised names.

Each organisation corresponds strictly to the first address written in the addresses field by each author in the article. The fact that researchers often develop their careers in different performing institutions cannot be tracked in this analysis.

The selection criterion involved the selection of performing organisations with an intensity of citations equal to or higher than 50 at a national level. Following this criterion, a total of 95 performing institutions were identified in Water JPI partners and observers. These organisations are listed in Table 16 together with the number of SRIA themes they perform. Please note that the number of performing institutions per country is related to the distribution of citations, not to the number of citations. Countries with a few large dominating research institutions will result in the listing of a small number of performing institutions.

The number of institutions performing Water Research per country is displayed in Figure 44, ranging from one to 7 in Germany (all universities and research organisations) and 8 in Turkey (7 of which universities).

The number of performing institutions per SRIA theme ranged from 44 to 60. The maximum number of Institutions corresponds to Q2- *Safe Water for Citizens* and the minimum to Q1-*Sustainable Ecosystems*.

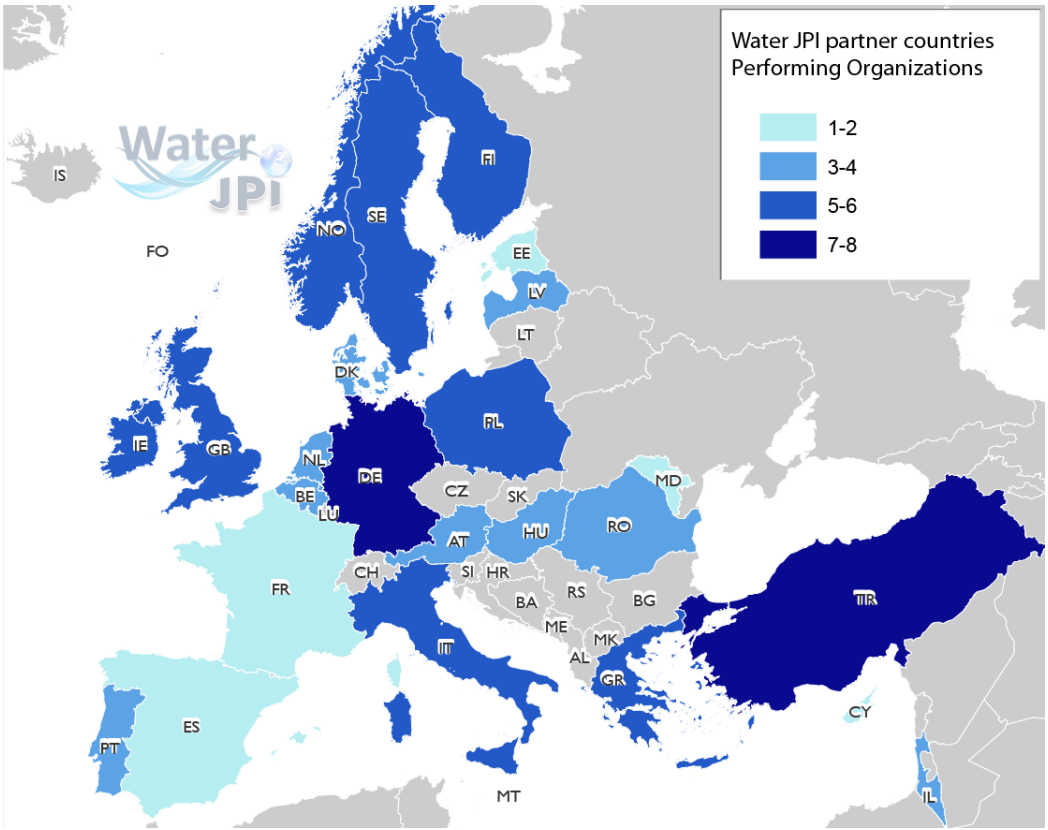

Figure 44. Number of main organisations performing Research on Water, among Water JPI partner countries.

Table 16. Main Institutions of Water JPI country partners performing Research on Water, and with an intensity of citations higher than or equal to 50.

Code	Performing Institution	Number of SRIA Themes
AT	UNIVERSITY OF VIENNA	5
	VIENNA UNIVERSITY OF TECHNOLOGY (TUWIEN)	4
	UNIV NAT RESOURCES APPL LIFE SCI (BOKU)	4
	UNIVERSITY OF INNSBRUCK	3
BE	CATHOLIC UNIV LOUVAIN	6
	GHENT UNIVERSITY	6
	FREE UNIVERSITY OF BRUSSELS	5
	UNIVERSITY OF ANTWERP	2
CY	UNIVERSITY OF CYPRUS (UCY)	6
DE	HELMHOLTZ ASSOCIATION	6
	MAX PLANCK SOCIETY	5
	UFZ HELMHOLTZ CENTER FOR ENVIRONMENTAL RESEARCH	4
	UNIVERSITY OF BONN	2
	UNIVERSITY HOHENHEIM	1
	KARLSRUHE INSTITUTE OF TECHNOLOGY	1
	TECHNICAL UNIVERSITY OF BERLIN	1
DK	AARHUS UNIVERSITY	6
	UNIVERSITY OF COPENHAGEN	6
	TECHNICAL UNIVERSITY OF DENMARK	4
EE	UNIVERSITY OF TARTU	6
ES	CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS	6
	UNIVERSITY OF BARCELONA	1
FI	UNIVERSITY OF HELSINKI	6
	NATL PUBL HLTH INST	1
	UNIVERSITY OF EASTERN FINLAND	1
	FINNISH ENVIRONM INST	1
	AALTO UNIVERSITY	1
	FINNISH FOREST RES INST	1
FR	CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE CNRS	6
	INSTITUT NATIONAL DE LA RECHERCHE AGRONOMIQUE INRA	3
GB	NERC NATURAL ENVIRONMENT RESEARCH COUNCIL	6
	UNIVERSITY OF LONDON	5
	NERC CENTRE FOR ECOLOGY & HYDROLOGY (CEH)	4
	IMPERIAL COLLEGE LONDON	2
	CRANFIELD UNIVERSITY	1
GR	ARISTOTLE UNIVERSITY OF THESSALONIKI	6
	NATIONAL TECHNICAL UNIVERSITY OF ATHENS	3
	UNIVERSITY OF ATHENS	2

	AGRICULTURAL UNIVERSITY OF ATHENS	1
	HELLEN CTR MARINE RES	1
HU	HUNGARIAN ACADEMY OF SCIENCES	6
	SZENT ISTVAN UNIVERSITY	2
	EOTVOS LORAND UNIVERSITY	1
IE	UNIVERSITY COLLEGE DUBLIN	6
	NATIONAL UNIVERSITY OF IRELAND NUI GALWAY	2
	UNIVERSITY COLLEGE CORK	2
	TEAGASC	1
	TRINITY COLLEGE DUBLIN	1
IL	HEBREW UNIVERSITY OF JERUSALEM	6
	BEN GURION UNIVERSITY	6
	TECHNION ISRAEL INSTITUTE OF TECHNOLOGY	3
	AGR RES ORG	2
IT	CONSIGLIO NAZIONALE DELLE RICERCHE CNR	6
	UNIVERSITY OF NAPLES FEDERICO II	1
	UNIVERSITY OF PADUA	1
	SAPIENZA UNIVERSITY ROME	1
	UNIVERSITY OF BOLOGNA	1
LV	UNIVERSITY OF LATVIA	3
	RIGA TECHNICAL UNIVERSITY	2
	LATVIA UNIV AGR	1
MD	MOLDAVIAN ACAD SCI	5
NL	WAGENINGEN UNIVERSITY RESEARCH CENTER	6
	DELFT UNIVERSITY OF TECHNOLOGY	4
	UNIVERSITY OF UTRECHT	1
NO	UNIVERSITY OF OSLO	5
	UNIVERSITY OF BERGEN	4
	NORWEGIAN UNIVERSITY OF SCIENCE TECHNOLOGY	3
	INST MARINE RES	1
	NORWEGIAN UNIVERSITY OF LIFE SCIENCES	1
PL	POLISH ACADEMY OF SCIENCE	6
	SILESIAN UNIVERSITY OF TECHNOLOGY	1
	POZNAN UNIVERSITY OF LIFE SCIENCES	1
	GDANSK UNIVERSITY OF TECHNOLOGY	1
	ADAM MICKIEWICZ UNIVERSITY	1
PT	UNIVERSIDADE DE LISBOA	6
	UNIVERSIDADE DO PORTO	3
	INSTITUTO SUPERIOR TECNICO	3
	UNIVERSIDADE DE AVEIRO	1
RO	GH ASACHI TECHNICAL UNIVERSITY	5
	ALEXANDRU IOAN CUZA UNIVERSITY	3
	POLYTECHNIC UNIVERSITY OF BUCHAREST	2

	UNIVERSITY OF BUCHAREST	1
SE	LUND UNIVERSITY	5
	SWEDISH UNIVERSITY OF AGRICULTURAL SCIENCES	5
	STOCKHOLM UNIVERSITY	5
	UPPSALA UNIVERSITY	4
	ROYAL INSTITUTE OF TECHNOLOGY	1
TR	ISTANBUL TEKNIK UNIVERSITY	5
	ISTANBUL UNIVERSITY	4
	ORTA DOGU TEKNIK UNIVERSITY	3
	EGE UNIVERSITY	3
	TARIM VE KOY ISLERI BAKANLIGI	1
	CUKUROVA UNIVERSITY	1
	HARRAN UNIVERSITY	1
	KARADENIZ TEKNIK UNIVERSITY	1

3.2.5. Water RDI funding in Europe

Water RDI funding is summarised in Table 17 for EU40 countries. Data on National Water RDI funding was produced using three hierarchic criteria: i) current declared data requested to the Water JPI partner countries; ii) declared data from the previous survey developed in 2010; and iii) estimated data.

Current declared Water RDI funding was reported by Water JPI Partners and Observers in relation with qualitative and quantitative data about National RDI programmes with mentions to specific programmes on Water. A total of five countries declared its national Water RDI funding. In general, declared funding on Water RDI refers to RDI Projects or Research programmes. The amount of Water funding on infrastructures, innovation and mobility programmes was not systematically identified.

Previous declared data on Water RDI funding were generated in the survey developed by the Water JPI in 2010 in the frame of the first "Mapping Water Research in Europe" exercise[1], available on the Water JPI website. National Water RDI funding of 8 out of the 13 countries which declared in 2010 were incorporated to this report (Table 17).

As a result, Water RDI funding data includes amounts declared by 13 Water JPI country partners. These Water RDI funding data were checked with that of questionnaires when available. For the rest of European countries, the Water RDI funding was calculated from an estimation procedure including as main statistical country indicator the GDP from 2013, recently published by EUROSTAT.

Water RDI funding in EU40 totalises 482 M EUR, with 95% (456 M EUR) corresponding to the 28 Member States and 5% (25 M EUR) to the 12 Associated Countries. The average of national funding on Water RDI in Europe is 12.35 M EUR. The national average for EU Member States is 18 M EUR and for Associated Countries, 2 M EUR.

[1] Survey results available on http://www.waterjpi.eu/images/documents/Water_JPI_Maturity_Template_20110420.pdf

Table 17. EUROSTATS data of EU40 countries on GDP and RDI expenditure as percentage of GDP in 2010 and 2013, together with estimated data on Water RDI funding and its increasing between 2010 and 2013.

ISO code	Water JPI Status	EU Status	GDP M EUR			% GDP Expenditure on RDI			Water RDI funding M EUR		
			2010	2013	% Increase	2010	2013[1]	Difference	2010	2013[2]	% Increase
AL		Candidate Country					(a)0.15			0.02	
AT	Partner	MS	294207.9	322594.6	9.65	2.74	2.81	0.07	9.47	13.23	39.70
BA		Potential candidate					(b)0.02				
BE	Observer	MS	365747.0	395262.1	8.07	2.05	2.28	0.23	8.60	13.15	52.91
BG		MS	36764.3	41047.9	11.65	0.59	0.65	0.06	0.22	0.39	77.27
CH		AC					(e)3.13		6.20	(f)6.20	0.00
CY	Partner	MS	19062.9	18118.9	-4.95	0.45	0.48	0.03	0.60	0.60	0.00
CZ		MS	156369.7	157284.8	0.59	1.34	1.91	0.57	2.78	4.37	57.19
DE	Partner	MS	2576220.0	2809480.0	9.05	2.72	2.94	0.22	81.19	120.30	48.17
DK	Partner	MS	241516.9	252938.9	4.73	2.94	3.05	0.11	11.45	(f)11.45	0.44
EE	Partner	MS	14707.5	18738.8	27.41	1.58	1.74	0.16	0.17	0.48	182.35
ES	Partner	MS	1080913.0	1049181.0	-2.94	1.35	1.24	-0.11	20.99	(g)37.70[3]	79.61
FI	Partner	MS	187100.0	201341.0	7.61	3.73	3.32	-0.41	31.95	(f)31.95	0.00
FO		AC								0.02	
FR	Partner	MS	1998481.0	2113687.0	5.76	2.18	2.23	0.05	22.00	(f)22.00	0.00
GB	Partner	MS	1816615.0	2017405.7	11.05	1.69	1.63	-0.06	41.28	47.81	15.82
GR	Observer	MS	226210.0	182438.0	-19.35	0.60	0.78	0.18	1.71	2.08	21.64
HR		AC	45004.3	43561.5	-3.21	0.74	0.81	0.07	0.66	0.52	-21.21
HU	Observer	MS	97814.8	100536.5	2.78	1.15	1.41	0.26	0.00	2.06	

[1] Data on % GDP Expenditure on RDI which was not available for 2013 is indicated as (a): 2008; (b): 2009; (c): 2010; (d): 2011; and (e): 2012.
[2] Water RDI Funding declared by Water JPI Partners and Observers is indicated as (f): 2010; and (g):2013.
[3] Water RDI Funding declared by Spain on RDI projects was extracted from the total (51 M EUR) which includes also infrastructures, training and mobility programmes.

IE	Partner	MS	164931.2	174791.3	5.98	1.62	(e)1.58	-0.04	8.93	(f)8.93	0.00
IL	Partner	AC							9.50	(g)11.00	15.79
IS		Candidate Country	10013.3	11534.8	15.19		(d)2.49		0.33	0.38	15.15
IT	Partner	MS	1605694.0	1618904.0	0.82	1.22	1.25	0.03	4.81	(f)4.81	0.00
LI		AC	28001.3	34955.6	24.84	0.78	0.95	0.17	0.26	0.48	84.62
LU		MS	39370.8	45288.1	15.03	1.50	1.16	-0.34	0.82	0.76	-7.32
LV	Observer	MS	18015.1	23265.0	29.14	0.60	0.60	0.00	0.10	0.20	100.00
MD	Partner	AC								0.03	
ME		Candidate Country							0.04	0.02	-50.00
MK		Candidate Country	7108.3	8122.6	14.27	0.22	(c)0.22	0.00	0.02	0.02	0.00
MT		MS	6599.5	7510.1	13.80	0.64	0.85	0.21	0.02	0.09	350.00
NL	Partner	MS	631512.0	642851.0	1.80	1.72	1.98	0.26	73.20	(g)100.00	36.61
NO	Partner	AC				1.68	1.69	0.01	3.33	(g)3.00	-9.91
PL	Partner	MS	359816.0	395962.4	10.05	0.72	0.87	0.15	6.30	(f)6.30	0.00
PT	Partner	MS	179929.8	171211.0	-4.85	1.53	1.36	-0.17	1.75	(g)3.20	82.86
RO	Partner	MS	126746.4	144664.4	14.14	0.45	0.39	-0.06	0.61	0.81	32.79
RS		Candidate Country	29766.3	34262.9	15.11	0.74	(e)0.91	0.17	0.44	0.42	-4.55
SE	Observer	MS	369076.6	436458.3	18.26	3.22	3.21	-0.01	16.17	20.41	26.22
SI		MS	36219.6	36144.0	-0.21	2.06	2.59	0.53	0.75	1.36	81.33
SK		MS	67204.0	73593.2	9.51	0.62	0.83	0.21	0.39	0.89	128.21
TR	Partner	Candidate Country				0.84	(e)0.92	0.08	4.12	(f)4.12	0.00

Water JPI Partners and Observers totalise 466 M EUR, 97% of the total EU40 funding on Water. 89% of the total (428 M EUR) corresponds to the contribution of Water JPI Partners, while 8% (38 M EUR) corresponds to the contribution of Water JPI Observers. Water RDI funding by the Water JPI consortium is illustrated in Figure 45 in terms of Partners and Observers, Member States and Associated Countries.

The national funding of Water JPI consortium shows an average of 19 M EUR, 23 M EUR of national average for Water JPI Partners and 8 M EUR for Water JPI Observers.

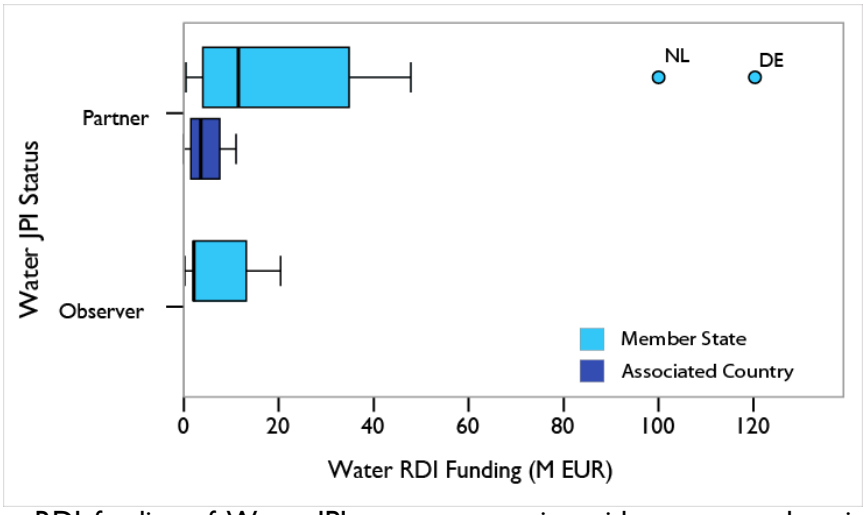

Figure 45. Water RDI funding of Water JPI partner countries with extreme values indicated (NL, The Netherlands; DE: Germany). The black line of the boxes represents the median.

The national Water RDI Funding data was compared on a country basis with the national Water RDI funding data generated in the previous survey developed by the Water JPI in 2010. For comparison purposes, we have taken into account the difference of the GDP in the same period (Table 17).

Between 2010 and 2013, national GDP data increased an average of 8% in EU40. Regarding only EU Member States, the RDI expenditure as percentage of GDP increased an average of 0.08% between 2010 and 2013, reaching an RDI expenditure of 2.02% of GDP in the EUMS in 2013[20]. Maximum national increases on RDI expenditure of GDP correspond to Czech Republic (0.57), Slovenia (0.53), and The Netherlands and Hungary, both countries with 0.26.

These increases on RDI expenditure did not occur in parallel to the increases on GDP (Figure 46). Countries with maximum increases on GDP from 2010 to 2013 are Latvia (29%), Estonia (27%), Lithuania (25%), and Sweden (18%). Conversely, a maximum decrease on RDI expenditure was observed in Finland (-0.41) even if its GDP augmented by 7% between 2010 and 2013 (Table 17; Figure 46).

The growth on RDI expenditure, even if small, enlarged by 110.4 M EUR the amount of Water RDI funding in Europe in 2013 respect to that of 2010. On average, it corresponds to an increase of 41%. Top European funders on Water RDI are Germany (120.3 M EUR) and The Netherlands (100 M EUR), followed by UK (47.8 M EUR), Spain (37.7 M EUR), Finland (32 M EUR), France (22 M EUR) and Sweden (20.4 M EUR) (Figure 46). The Water RDI funding data of the Water JPI partner countries are available on the Country Fiches (Annex I).

Most European countries show an increase on Water RDI funding (Table 17, Figure 46). The highest growth was observed in Malta (350%), Slovakia (128%) and Latvia (100%), followed by Lithuania (83%), Portugal (84%) and Slovenia (81%). In spite of this increase, most of them are not visible in Figure 46 because of its small amount on Water RDI funding.

[20] http://europa.eu/rapid/press-release_STAT-14-1861_en.htm
http://epp.eurostat.ec.europa.eu/cache/ITY_PUBLIC/9-17112014-BP/EN/9-17112014-BP-EN.PDF)

Montenegro, Croatia, Norway, Luxemburg, and Serbia showed a decrease on Water RDI funding between 2010 and 2013, with percentages ranging from 50% to 5%. This reduction on Water RDI funding did not correspond to a drop on GDP in these countries.

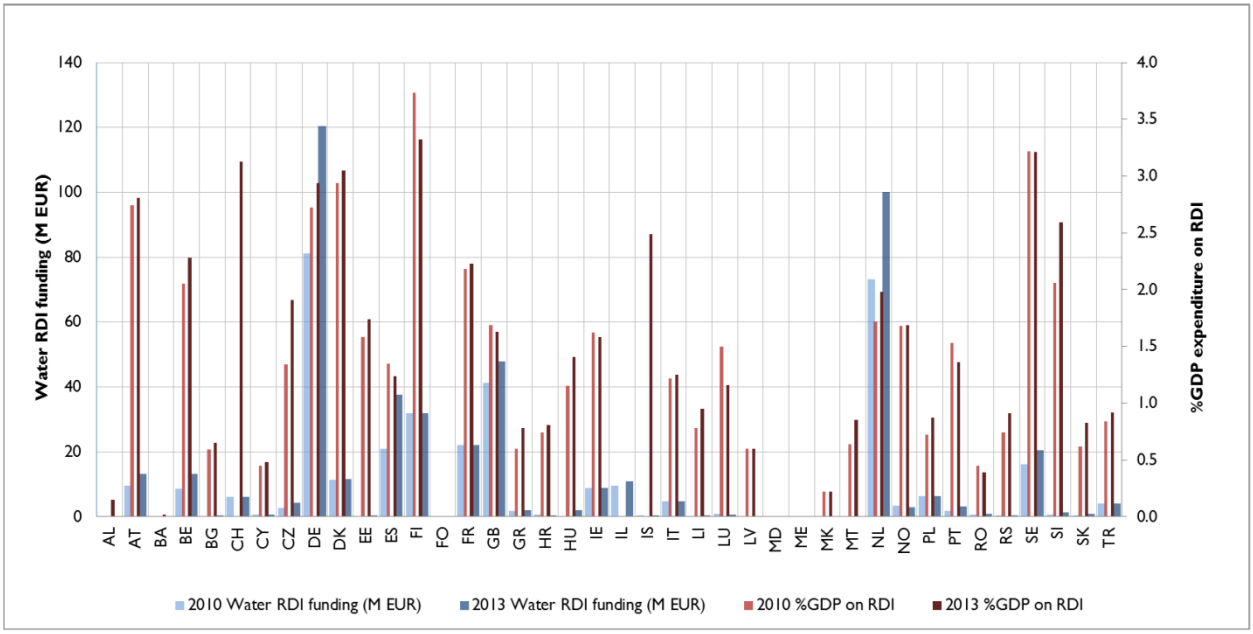

Figure 46. Water RDI funding (blue) and RDI expenditure as percentage of GDP (red) in 2010 and 2013 simultaneously represented and calculated for countries with GDP data available in EUROSTATS).

3.2.6. Europe in the World

Intensity of Publications and Patents: Raw Data

The current Water RDI status in Europe as a whole (Member States and Associated Countries) can be examined from an international perspective by comparing it to countries with a different economic development. The production of publications and patents on the water domain was examined in Australia, Canada, Japan and the USA, as representatives of developing countries, whereas Brazil, China and India was included in the analysis as representative of emerging countries. With this, we have an ample and significant covering for the International analysis of Europe.

The raw number of publications and patents were obtained for Europe and the seven aforementioned countries (Figure 47). Raw data supplies basic numbers to compare the crude strength of every country worldwide. On average, the number of publications is higher than the number of patents in one order of magnitude.

Data on Water RDI production for each SRIA theme was represented keeping the same graphic scale as much as possible in order to ease the quantitative comparison between SRIA themes. In Figure 47, Q3- *Water Industry* and Q6- *All water issues* use a Y-axis scale one order of magnitude higher that the other themes, since the number of publications is 4 times that of the other themes. The number of patents in Q1- *Sustainable Ecosystems* is one order of magnitude lower than it is in the other themes.

Europe has the leadership in publications in all SRIA themes, especially in Q1 to Q3 and Q6. In general, Europe is closely followed by the USA and, from a relative distance (about 50% of publications), by China. Regarding the patents production, Figure 47 shows much more variability. The top producer of patents on Water Innovation is the USA in Q3- *Water Industry*, followed by Japan and Europe (about 50% of the USA). With similar number of patents, Europe leads the first position in Q2- *Safe Water for Citizens*, followed by the USA and Japan. Europe is also the first producer of patents on water in Q1- *Sustainable Ecosystems* and Q4- *Water-wise Bio-economy*, followed by the USA; and in Q5- *Water Cycle Gap*, followed again by Japan and the USA.

China is the main producer of emerging countries, both in publications and patents, in all SRIA themes. China holds the third position on number of publications in all themes, and the third or fourth position in patents.

Figure 47. Raw number of publications (PUB) and patents (PAT) in Europe and selected countries.

Data normalised per Gross Domestic Product

The number of publications and patents obtained for Europe and the seven selected countries was normalised by GDP and represented for each SRIA water theme (Figure 48). GDP data used is detailed in the Methodology section.

Data on Water RDI production for each SRIA priority was represented keeping the same graphic scale as much as possible in order to ease the quantitative comparison between SRIA themes. Relevant differences are observed when comparing standardised data with previous raw data, depending on the specific water topics. Q1- *Sustainable Ecosystems* and Q4- *Water-wise Bio-economy* (the "greenish" topics) use a different Y-axis scale adapted to the low production on publications and patents, especially in Q4. On average, the intensity of publications is higher than that of patents by two orders of magnitude.

Regarding the intensity of publications on the water domain, Europe holds an intermediate position followed by the USA and Japan in all SRIA water topics. The highest intensity of EU Water Research corresponds to Q3- *Water Industry*, Q5- *Water Cycle Gap*, and Q6- *All Water issues*, with a production close to 1,000 publications per GDP.

In general, Europe is intensely surpassed both by developed and emerging countries. The leadership on Water Research is for Australia and Canada, followed by India in Q2- *Safe Water for Citizens*, Q3- *Water Industry* and Q6- *All Water issues*. In Q4- *Water-wise Bio-economy*, India goes to the second position after Australia.

Japan shows the lowest intensity on Water Research, especially concerning Q1- *Sustainable Ecosystems* and Q4- *Water-wise Bio- economy*. India stands out among emerging countries, with higher intensity on Water Research than Europe except in Q1 and Q3.

The strength on Water Innovation shows a different distribution. The Innovation on Water concentrates mainly in issues related to Q3- *Water Industry*, with its maximum values about twice the intensity on Q2- *Safe Water for Citizens*, and three times the intensity on Q5- *Water Cycle Gap*. All these categories are headed by Japan, which has a very high relative level, except in Q4- *Water-wise Bio-economy*.

The relative position of EU40 is highly variable depending on the SRIA theme. Innovation in Q4- *Water-wise Bio-economy*, similar to publications, is headed by Australia, where EU40 runs a second position followed by the USA. EU40 shows the highest position on Water Innovation in Q1-*Sustainable Ecosystems*, sharing this level with the top countries (Australia and Japan) even though this is the category with the lower production in patents. In Q3- *Water Industry*, Europe shows similar intensity to that of emerging countries. With the same production, in Q2- *Safe Water for Citizens*, Europe is above emerging countries, Canada and the USA.

The Japanese patents in Q3- *Water Industry* double the patents of other developed countries such as the USA, Canada and Australia, and are five times the patents of EU40. Also in Q2- *Safe Water for Citizens*, Japanese patents double EU40 patents. In Q5- *Water Cycle Gap*, Japan has much more intensity than any other country.

Comparing the water topics, the standardised production of patents in Europe is very low in Q1-*Sustainable Ecosystems*, low in Q4- *Water-wise Bio-economy* and Q5- *Water Cycle Gap*, medium in Q2- *Safe Water for Citizens* and Q3- *Water Industry*, and high in Q6- *All Water* issues, where EU has a second position after Japan.

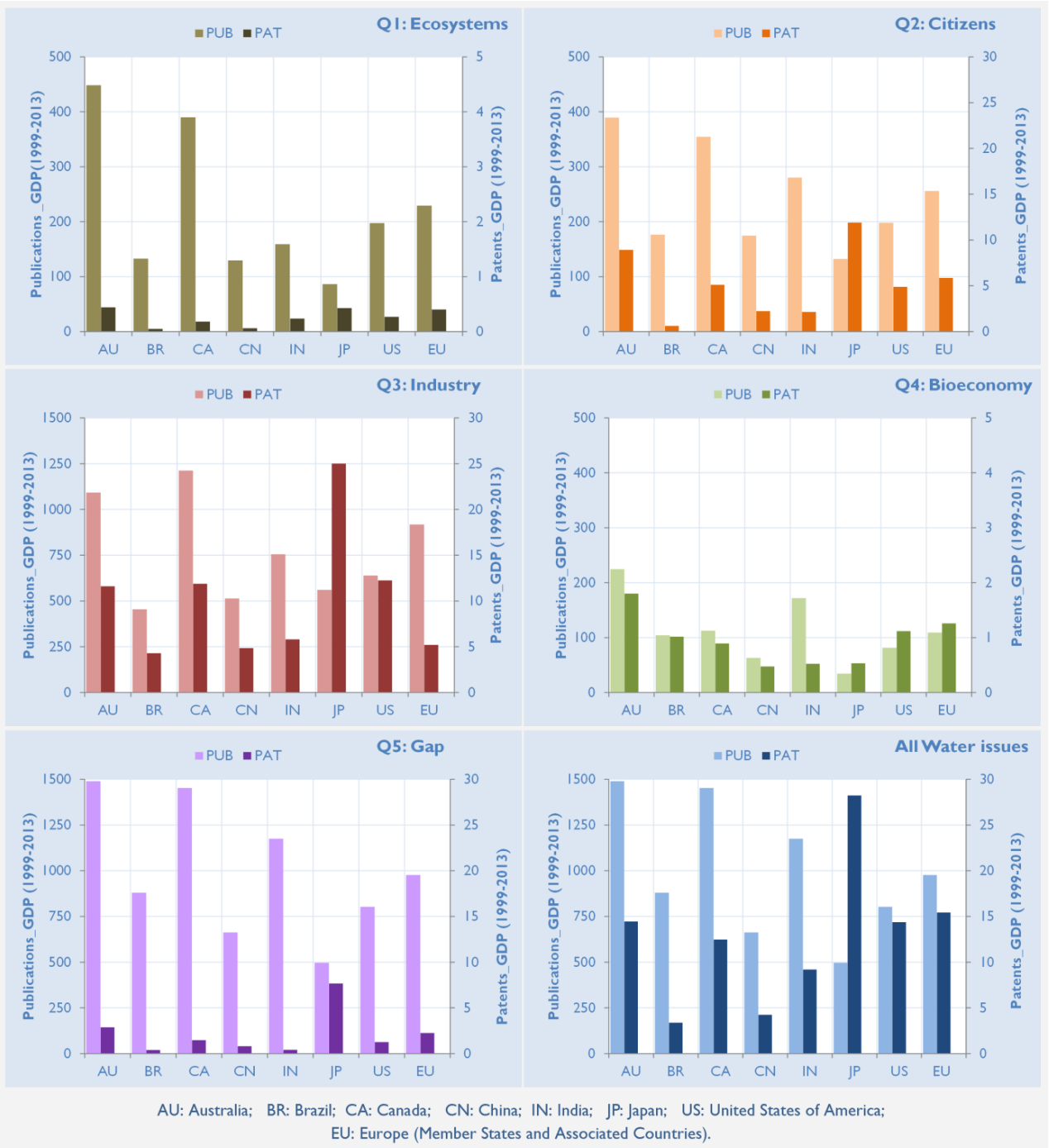

Figure 48. Number of publications (PUB) and patents (PAT) normalised by Gross Domestic Product in Europe and selected countries.

Data normalized per population

The number of publications and patents obtained for Europe and the seven selected countries was normalised by the population and represented for each SRIA water theme (Figure 49). Population data used for the estimation of this indicator is detailed in the Methodology section.

Data on water production for each SRIA topic was represented keeping the same graphic scale as much as possible in order to ease the quantitative comparison between SRIA themes. In Figure 49, two Y-axis scales are displayed for publications and for patents. In both cases the two scales are of the same order of magnitude. The graphic representation corresponding to Q3- *Water Industry* and Q6-*All Water* issues have a scale adapted to the higher intensity of the production in these topics: about 3.5 times higher the intensity in publications and two times in patents.

The number of publications and patents normalised by population for each water issue results in a very marked difference between the intensity of developed countries and that of emerging countries (Figure 49). The intensity of publications follows a similar pattern in all the topics though with different absolute values. Australia is leading, followed by Canada, the USA, Europe and finally, Japan.

Actually, China and India have extreme low values in publications and patents intensity in all the topics since these countries are vastly populated, with 1365 and 1245 M inhabitants, respectively. It represents two orders of magnitude higher than Canada (35 M Inhabitants) and Australia (24 M Inhabitants), and one order of magnitude higher than the rest of countries. Brazil runs similar intensities in spite of being much less populated.

The leadership in patent intensity is shared between developed countries. Australia is followed by Japan in Q2- *Safe Water for Citizens*. In general, developed countries share the intensity of patents in Q3- *Water Industry*, where Japan has the highest position and EU40 the lowest value. Patents on Q4- *Water-wise Bio-*economy are headed by Australia, while Patents on Q5- Water Cycle Gap and Q6- All Water issues are headed by Japan.

There is not a clear negative relationship between population and intensity of publications and patents worldwide. This is partly due to the fact that the production on Water RDI in some countries stands too high with respect to the average intensity. This is the case of Australia and Canada in most water topics, excepting on patents intensity which is visibly headed by Japan in many water issues.

Europe, moderately populated with 625 M Inhabitants, hosts an intermediate position on intensity of publications and patents in all the water themes. Though slightly, Europe surpasses the patents intensity of the USA only in Q5- *Water Cycle Gap*. In Q6- *All Water issues*, Europe runs the lowest position among developed countries.

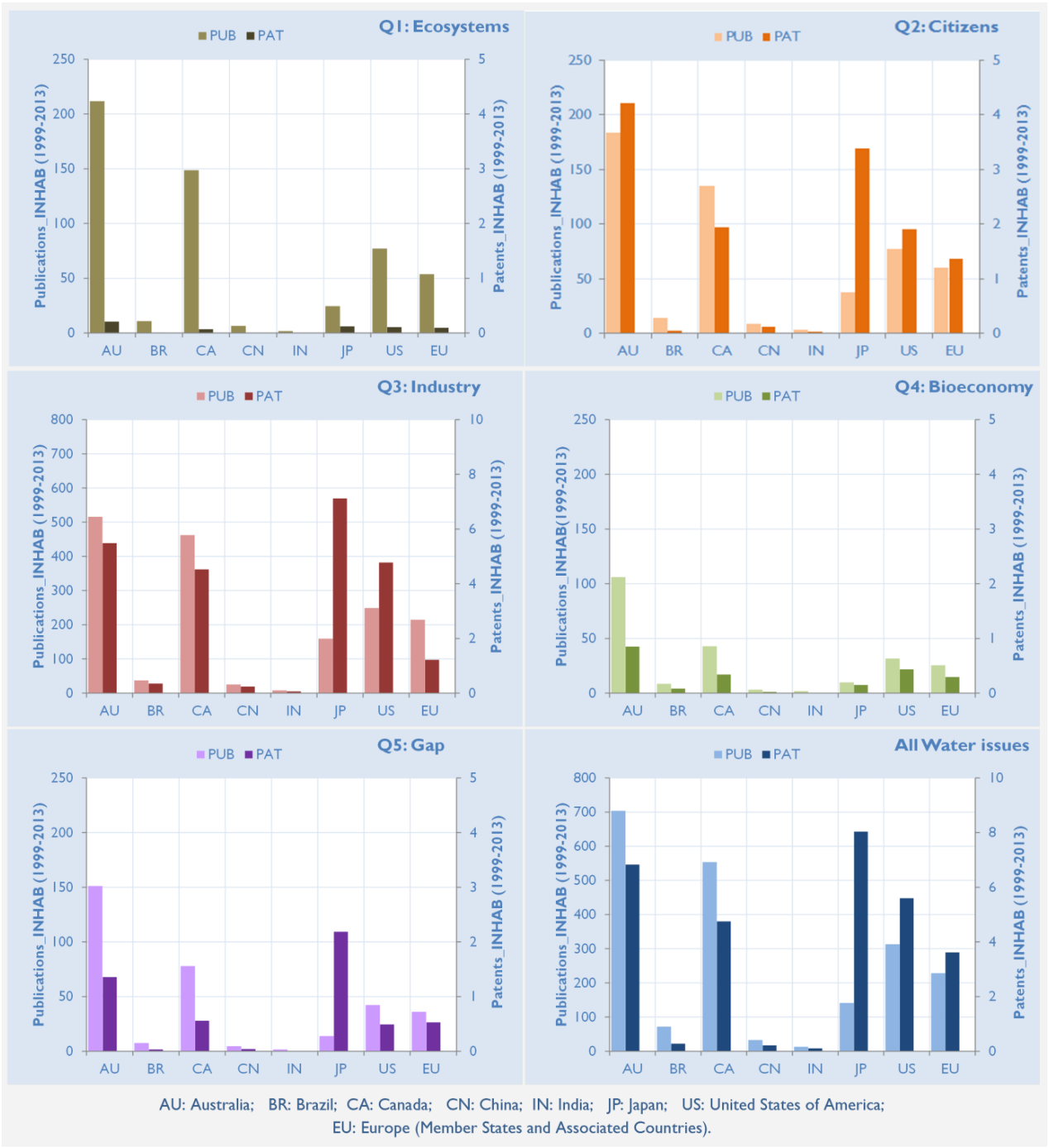

Figure 49. Publications (PUB) and Patents (PAT) normalised by population, in Europe and selected countries. The axes units have been homogenised as much as possible (a different scale for Q3- *Water Industry* and Q6- *All Water issues*) in order to enable visual comparisons between SRIA themes.

The time evolution

The increasing rate of publications and patents (1999 to 2013) greatly differs between countries and between SRIA themes (Figure 50).

a) Analysis of publications

In general, the increasing rate of publications is more evident than that of patents in Q1- *Sustainable Ecosystems* (except the USA), and Q2- *Safe Water for Citizens* (except Japan). The opposite occurs in Q3- *Water Industry* (except Australia). In theme Q5- *Water Cycle Gap*, half of countries show relevant increase in patents (Brazil, China, India, and Japan), while the other half increases in publications (Australia, Canada, the USA, and Europe). Maximum rates are reached in Q3- *Water Industry* patents (about 28) followed by Q5- *Water Cycle Gap* and Q2- *Safe Water for Citizens*.

Regarding theme Q6- *All Water issues*, Europe shows an increasing rate of publications between two and three, similar to that of most developed countries but visibly lower than the rate reached by emerging countries, particularly Brazil and China.

China exhibits the highest increasing rates on publications, five times the EU40 rate, varying from 8 in Q4- *Water-wise Bio-economy* to 11 in Q2- *Safe Water for Citizens*. Apart from China, other countries with clear growth on water scientific production are Brazil (Q1- *Sustainable Ecosystems*, Q2- *Safe Water for Citizens*, Q4- *Water-wise Bio-economy*, and Q5- *Water Cycle Gap*); and India and Australia in Q5.

b) Analysis of patents

EU40 shows a moderate increasing rate in patents (approximately 2). On average, the increase in patents is very similar among developed countries. Japan is an exception, growing at a slightly higher rate (about 3). As in the analysis for publications, emerging countries (particularly Brazil and China) show a higher growth in patents.

Brazil shows the maximum increasing rate of patents in Q6- *All Water issues*, with a value of 16. China shows record increasing rates of patents: in Q4- *Water-wise Bio-economy* (a rate of 11), Q5- *Water Cycle Gap* (a rate of 11), and Q3- *Water Industry* (a rate of 28). India has a very high increasing rate of patents in Q5, similar to that of China and Brazil.

Among the developed countries, only Australia stands out with a patents growth of 12 in Q4- *Water-wise Bio-economy*, higher than that of China and about 6 times the rate of the rest of developed countries. Japan stands above Europe and the USA in different Innovation themes, such as Q2-*Safe Water for Citizens*, Q3- *Water Industry*, and Q5- *Water Cycle Gap*.

Figure 50. Increasing rate of publications and patents in Europe and selected emerging and developed countries. The axes units have been homogenised as much as possible (two scales as maximum) in order to enable comparisons between SRIA themes.

Growth in patents and publications relative to Europe

The increasing rate index relates the production rate of patents and publications on Water RDI in selected countries in respect to Europe (%). Figures 51a and 51b show that the highest values of these two indexes correspond to the patents growth. The increasing rate of patents can reach up to four times the rate of publications.

Regarding patents, China grows nearly 20 times faster than Europe in Q3-*Water Industry*, and 6 times the rate of Europe in Q4- *Water-wise Bio-economy* and Q5- *Water Cycle Gap*. Australia has a rate almost 7 times that of Europe in Q4, and it is more than twice in Q1- *Sustainable Ecosystems* and Q2- *Safe Water for Citizens*. Brazil and India also show an important growth, with an increasing rate 6 times the European rate in Q5- *Water Cycle Gap* together with Japan.

The increasing rate on publications of the different countries relative to Europe is not so striking and is more homogeneous between SRIA themes (Figure 51b). Europe shows a growth similar and even slightly higher than other developed countries such as the USA, Japan and Canada. However, emerging countries show a high relative growth, especially China. In the last 15 years, this country has multiplied between 3 and 5 times the increasing rate of publications in Europe. Australia has an average growth slightly higher than Europe and lower than that of emerging countries.

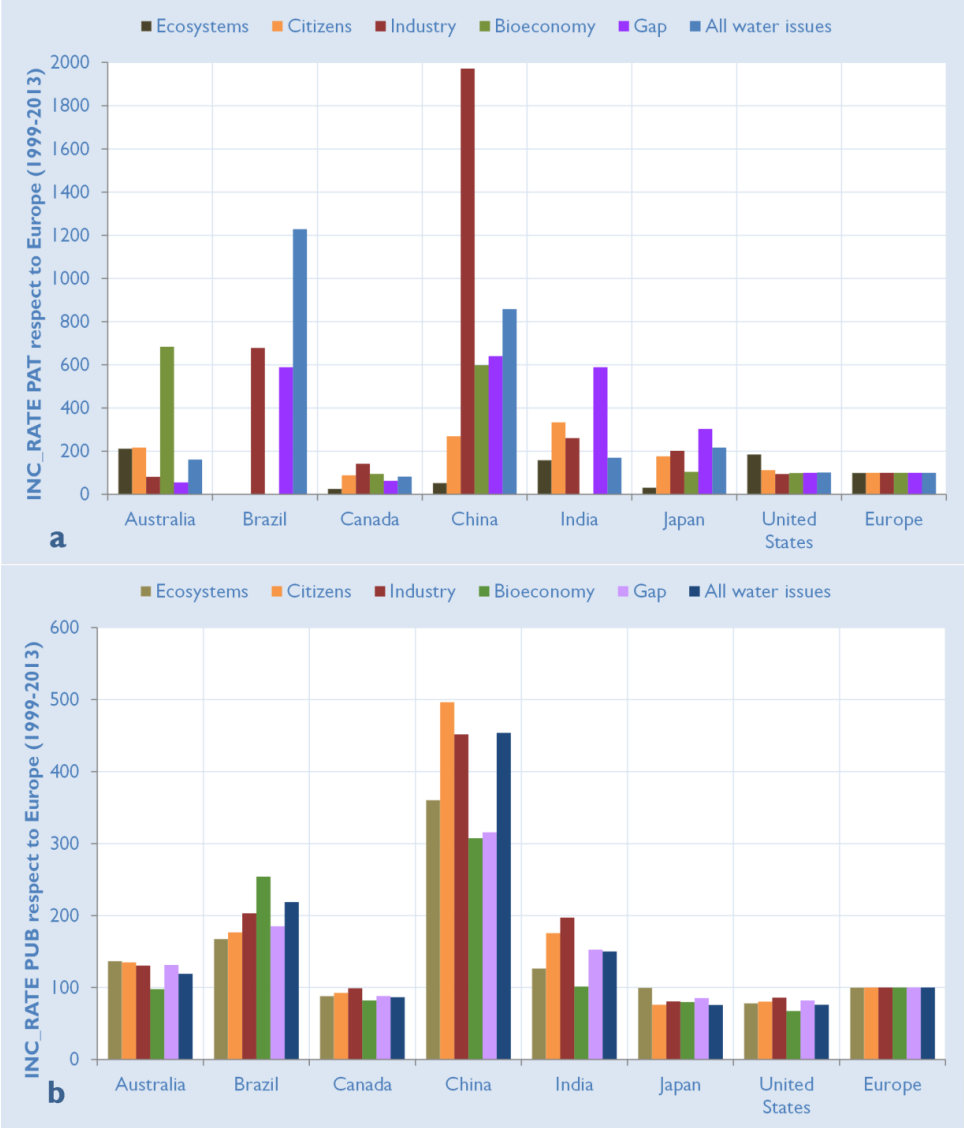

Figure 51. Increasing rate of publications (a) and patents (b) relative to Europe.

The index relating the production of patents with the production of publications on water issues presents a different view of Europe in relation to other countries (Figure 52). Japan strongly differentiates the world ranking in all SRIA themes except on Q4- *Water-wise Bio-economy*, denoting an important production on water Innovation respect to Water Research. The Japanese indexes range between 46 (Q3- *Water Industry*) to 160 (Q5- *Water Cycle Gap*), with an average of 62.

The rest of the developed countries and emerging countries have a much smaller growth intensity than Japan on Water Innovation compared to Research. The maximum ratio is reached by these countries in the topic Q2- *Safe Water for Citizens*. Europe, Australia and the USA share a similar relative high ratio in the topic Q2, about 23 on average.

The USA owns a higher position than Europe in all the water topics except for Q1- *Sustainable Ecosystems* and Q5- *Water Cycle Gap*. In the topic Q3- *Water Industry*, the USA displays a ratio of 19.2, more than three times than that of Europe (ratio of 5.7), and twice the ratio of the rest of countries. The latter group exhibits on average a ratio of 10, except India with a ratio of 7.7.

Q1- *Sustainable Ecosystems* is characterized by a very low intensity on Water Innovation with respect to the intensity of Research. After Japan (ratio of 5), Europe and India share the second position, with ratios of 1.8 and 1.5, respectively.

After Japan, Europe holds the maximum ratio of Water Innovation facing Research in the topic Q5- *Water Cycle Gap*, with a ratio of 14.6, followed by the USA. In Q4- *Water-wise Bio-economy*, Europe follows the USA and Japan a very short distance, with 11.5, 13.7, and 17.5 respectively.

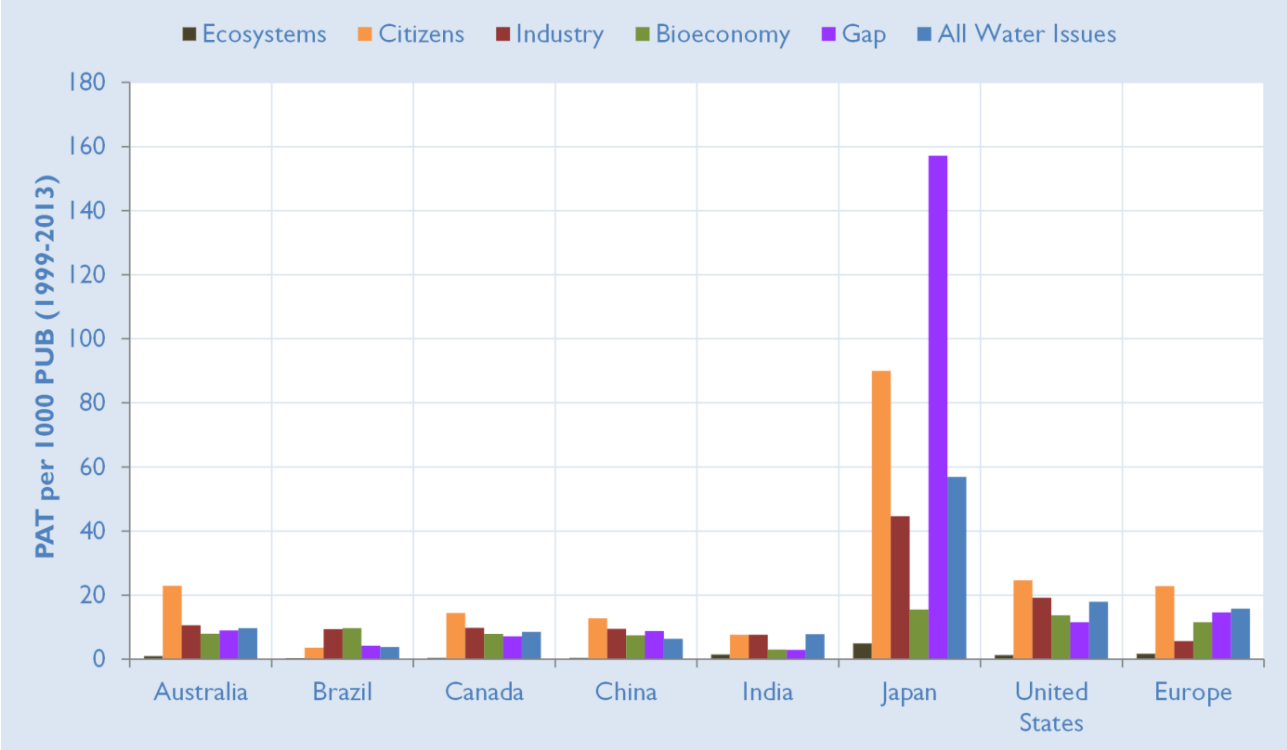

Figure 52. Number of patents per 1,000 publications per SRIA theme, in Europe (EU40) and third countries.

In the general topic Q6-*All water issues*, Europe produces 1.4 times the publications of US, three times the publications of China, 9 times that of Australia and 10 times that of Brazil. Regarding the production of patents related to water issues, Europe produces 1.3 times the production of the USA, 7.8 times that of China, 14 times that of Australia, and 41 times the patents of Brazil.

When normalising the production of publications and patents by GDP, Europe holds an intermediate position in Water Research and Innovation. Emerging countries are better positioned regarding publications whereas Japan stands out in patents on the topic Q3- *Water Industry*.

Considering the general topic Q6- *All water issues*, the increasing rate of publications in Europe (rate of 2.1) is only higher than that of the USA and Japan (1.6), and Canada (1.9), and is visibly surpassed by China (rate of 9.7), Brazil (rate of 4.7), India (rate of 3.2) and slightly by Australia (rate of 2.5).

Regarding patents, a similar top position of the emerging countries is observed. Europe hosts a rate of 1.3, similar to that of the USA, whereas Brazil holds the highest increasing rate (16.3) followed by China (rate of 11.3), about 12 times the rate of Europe.

3.3. Discussion

In this Mapping Report, three different instruments were used to characterise the European landscape on Water RDI. A bibliometric research focused on a total of 40 European and 7 non-European countries was conducted, covering the five SRIA topics from 1999-2013. The questionnaires gathered the information from 108 organisations (16 countries), with different levels of contribution from governmental, funding and performing organisations. Interviews to prominent figures in the Water RDI domain contributed decisively to illustrate the data collected from the other aforementioned instruments and reinforced the major conclusions taken from this mapping exercise. In this section, we have integrated the three instruments and tried to provide a global perspective on Europe's current strengths and weaknesses on the water scientific domain.

The *Desk Research* analysis was instrumental at providing a clearer view on the efforts that European countries have been developing in Water RDI. Europe landscape in this topic has been enriched with high levels of scientific productivity in both publications and patents, independently of the countries' geographic status or economic size. The numbers are more evident if one considers the universe of countries that recently joined the EU, and a clear evolution on Water RDI production was also observed in the Associated Countries (see Figure 35 to Figure 40).

Strategic priorities in Water RDI, main research topics and target areas

Approximately 78% of respondents (from a universe of 72 organisations and 12 countries) to the questionnaire "Thematic Priorities" admitted to have strategic priorities for Water RDI. This is a clear indicator of a growing awareness of the importance of Water RDI in the national programmes across Europe. However, only 42% of governmental organisations own or co-own a specific RDI programme in Water, meaning that there is a vast room for improvement.

Countries show a varied productivity on Water RDI depending on each SRIA theme. These differences are consistent with the level of "expertise" or "dedication" of a given country on specific themes related to the water scientific domain. In general, countries with high levels of publications are not the same as those showing high levels of patents in a given thematic (see Figure 35 to Figure 40).

Based on the data extracted from the questionnaires, *Natural and Environmental Sciences* is the main scientific area where Water RDI is represented within the policies of governmental organisations. Understandably, this is then reflected on the two themes from the SRIA that are gathering the most attention from the organisations that responded to the questionnaires: maintaining the ecosystem sustainability (Q1) and developing safe water systems for the citizens (Q2). These two topics are also prominent on the level of priority attributed to the various themes (Figure 6).

The fact that the organisations are ranking both Q1 and Q2 on top of their present priorities is a clear sign of the development and shift that has been occurring in the scientific community over the recent years. This assumption is based on the analysis of the data displayed in the *Desk Research* section. *Water Industry* (Q3) had the highest level of scientific productivity between 1999-2013, which was measured in number of publications and patents. Q1 and Q2 had a good level of publications, but Q1 had one of the lowest numbers in relation to patents. However, if one analyses the increasing rates of publications, with both Q1 and Q2 ranking highly and Q3 showing the smallest increases, it is possible to confirm these significant changes. That this process of change is still facing its early years is confirmed by the fact that the number of performing institutions per SRIA theme revealed Q2 as the highest and Q1 as the lowest.

Another indicator of change is the fact that the organisations are currently focused on medium and long term goals (Figure 6 and Figure 7), which can also be correlated to a modification of the paradigms on Water RDI agendas. Europe's leading position in Water RDI has also been reinforced and encouraged by the significant increasing rates of scientific production of countries like Serbia, Bosnia, Montenegro, Luxembourg and Cyprus, specifically in theme Q6 - *All Water issues*.

In relation to funding during 1999-2013, it is interesting that the theme Q4- *Water-wise Bio-based Economy* was funded by the highest number of funding agencies (35), followed by Q2 (34 funding agencies). Theme

Q1 was supported by a total of 27 main institutions in the Water JPI partners. This corroborates what was mentioned above: there is clear shift in the direction taken by Water RDI in Europe, in alignment with what has been outlined by all Water JPI partners.

Research topics that cover environmental aspects, climate extremes and the societal wellness will *more naturally* be considered of primordial importance by the organisations that participate in questionnaires (Table 3), when compared to regulatory frameworks, for example. There is a marked tendency of organisations to reply to more popular themes, but as Durk Krol, Director of the European Technology Platform for Water Research and Innovation, stated: "coping with increasing water stress (quantity and quality), reducing the impact of extreme events (droughts and floods), managing aging or lacking infrastructures" remain as key challenges in the water domain.

Jean-Philippe Torterotot, as Deputy Director of Research, Development and Innovation of the Ministry of Ecology, Sustainable Development and Energy, provided more information from the French standpoint, which probably emulates the opinion of other member states. It was described that "action plans are being undertaken based on an assessment of public policy". These are being designed to fight both pollution and an ineffective water management, as well as to try to recover "the quality of aquatic ecosystems and ecological continuities" or to maximise the "articulation of water policy with other policies impacting aquatic ecosystems".

Again, the ecosystem sustainability is at the epicentre of the discussion with the necessity of "an energetic transition for green growth", aligned with an increased awareness from the general public for these challenges. "A national strategy for ecological transition towards a sustainable development has been presented to public consultation. The initial drivers are climate change, loss of biodiversity, growing scarcity of natural resources, increase of environmental health risks, which are all concerns of the water sector" (all citations from Jean-Philippe Torterotot).

For the Environment Protection Agency (EPA), under the representation of the Director-General Laura Burke, "water research is considered a priority within the EPA research programme, (…) and it is highlighted as one of the three pillars (along with climate and sustainability) of the programme for the period 2014-2020". Laura Burke added that "protected water resources are a key environmental goal for the EPA, and *Clean Water* has been identified as a strategic priority" included in short-term goals.

These aforementioned statements reflect the interdisciplinary character of the water domain, and the complexity risen when trying to clearly differentiate research topics and objectives.

While *Water Availability/Quality/Management/Use* are at the forefront of research interests (Figure 4 and Figure 5), it contrasts with *Water Technologies* or the *Economic Use of Resources*. This is combined with the fact that few participating organisations mentioned research topics related to the SRIA theme Q4 as short-term goals. It is yet to be determined if certain research themes or topics are not clearly defined or of facile identification by the participating organisations, and how accurate all the research interests are revealed. Nevertheless, the stratification of the various thematic priorities was rated with a high level of consistency throughout the 4 questionnaires.

Overall, the analysed data and these comments reflect not only a growing uniformity of priorities, but also reinforce the need for cooperation with industry, companies and the private sector in general. Responses to the "Thematic Priorities" questionnaire did not raise new needs or themes not already foreseen in the Water JPI SRIA 1.0. When asked to indicate other themes, needs and priorities, the majority of respondents repeated issues already considered in the SRIA, revealing a superficial knowledge of this document. Nonetheless, the data allows for collecting the general interests and priorities of respondent's organisations.

Basic research, applied research, and innovation

The pressure for applied scientific knowledge to solve present industrial challenges or to have an immediate impact on the lives of the European citizens is inextricably linked to the dilemma of delivering fast results and simultaneously invest on basic research.

Promoting a well-balanced and dynamic equilibrium between *Basic Research/Applied Research/Innovation* has been a long-standing debate not only for scientists but also for governmental and funding institutions. In Table 18, and for the sake of guidance in this discussion, it is resumed the results from the participating organisations in each questionnaire where the strategic focus areas were analysed.

Besides the number of governmental organisations that pointed out their focus areas (19 organisations from 10 countries), information regarding the efforts dedicated to each area was measured in percentages, and this was broken into *Applied Research* at 76%, and *Basic Research* or *Innovation*, each at 38%.

In relation to the percentage of funding, the organisations that participated in the "Funding Schemes" questionnaire (23 organisations from 12 countries) mentioned *Applied Research* at 57%, compared to 44% to *Basic Research* and 17% to *Innovation*.

Table 18. Number of organisations and the different strategic focus areas, depending on the type of organisations. This data was presented separately in previous sections of the questionnaires, and it was compiled for the sake of guidance and support for this discussion section.

	Basic Research	Applied Research	Innovation	Total # Organisations
Governmental Organisations	10	14	10	19
Funding Organisations	14	21	10	23
Performing Organisations	25	43	26	48

The analysis of the data evidenced a stronger focus on *Applied Research* and less efforts being dedicated to *Innovation*. This is in line with the issues raised by the various interviewees that contributed to this manuscript. Marina Villegas, General Director of Scientific and Technical Research Ministry of Economic Affairs and Competitiveness and President of the Water JPI, for example, stated that "emphasis is needed on setting research results in value" Desk Research studies also reflect the tendency for applied research and scientific publications and less dedication to patents and innovation. As shown in Table 13, the increasing rate of patents is still surpassed by the increasing rate of publications over the last years, meaning that efforts need to be directed towards ensuring "that the research results will become applied in practice", as stated by Robert Schroeder, Policy Officer at the European Commission, President of the European Innovation Partnership on Water (EIP on Water). However, he adds that "there will always remain a need for fundamental research, to underpin policy development and increase knowledge on societal issues".

As aforementioned in Table 6, it was displayed the type of objectives and the corresponding relevance relatively to the organisations that have specific priorities in Water RDI: *Progress in Science and Technology* ranked first in all five SRIA themes with a high priority level, followed by *Return of Investment* and *Societal Wellness*. The organisations rated *European Environment*, *National Strategies* and *H2020 Societal Challenges* very similarly in relation to their relevance. On the other hand, *Competiveness/Entrepreneurship* and *European Policy* are ranked last. This is a great example of the unavoidable incompatibilities that are generated when trying to create a healthy balance between Basic and Applied Research, Innovation and Transfer of Knowledge. At the same time that organisations do not hesitate do point out *Progress in Science*, they also rank *Return of Investment* and *Societal Wellness* at the same level. However, it is yet to be understood the lower attention given to *Competiveness/Entrepreneurship* and *European Policy*, as they represent two valid instruments not only for the cooperativity between the public and private sectors, but also in the construction of a unified strategy in Europe.

Focusing our attention in the water domain, Seppo Rekolainen, Director of Freshwater Centre of the Finnish Environment Institute (SYKE), stated that "while scientists are producing new information about the status of waters and how to improve it", "many scientists also see that the objectives are too challenging". This last statement brings up the topic of how the timelines work for *Basic Research* when compared to *Applied Research*, for example. For Durk Krol, making available funding sources will maximise "the potential to bring innovative solutions to the market". Thus, coordination of efforts will guarantee an efficient approach from fundamental research to application and satisfy the wider demand for innovation. Laura Burke addressed that at the EPA "we communicate our research as clearly as possible to a wide range of audiences, while ensuring the basic science is not compromised." Communication and dissemination actions are of particular importance to get end-users, SMEs and other stakeholders not only in the definition of national research programmes, but also getting them involved with research progress (see Marina Villegas and Seppo Rekolainen interviews).

As Marina Villegas summarises, to provide effective solutions one needs to set "ambitious global strategies based on the definition of real and urgent needs and challenges, as well as offering the most appropriate instruments to tackle them. In these days there is a clear need to develop business opportunities" and to ensure the "seamless integration of the elements of the knowledge value chain (research, development and innovation)".

Collaboration between the public and private sectors

The unbalance between participating public and private organisations in a ratio of 5:1 reflects not only the emphasis of the RDI sector on higher education institutions or other public research organisations, but also the much needed involvement of the private sector for the continuous progress of research in Europe. For example, the "Thematic Priorities" questionnaire was answered by over 75% of public research organisations and only 15% by private organisations.

It is generally recognised that public investment in RDI attracts private investment, and how concerted efforts between the two sectors will contribute to a sustained growth and elevated competitiveness of the European Research Area (ERA). Quoting Robert Schroeder "public investments can be an important driver and means of leveraging private investments".

Marina Villegas stated, in the context of a favourable environment for innovation and companies/enterprises fomented by the public and private sectors, that "new policies in research at national level to foster collaboration between Academia and Industry" should be developed, as well as the promotion of "spin-off companies from research results" or "new efficient and problem-oriented RDI and instruments within the national programmes".

This should be in line with scientific excellence, both at the human resources and innovation level. The mobility schemes and fellowships in various programmes funded by the participating organisations will be crucial for the development of synergies between member states and institutions, and above all, to raise the level of European scientists in general. These aspects can be confirmed by analysing Figure 15, Figure 19 or Figure 20, for example.

An important factor contributing for an effective synergy between the private and public sectors is stated by Robert Schroeder in that "many of the public funding opportunities require co-financing. (…) Initiatives such as the EIP on Water create perspectives for private investors, providing a view where policy development and public funding will go in the coming years." However, the room for improvement is vast, and one needs to continue "working on further incentives to connect private investors and public investment". This is reinforced by Seppo Rekolainen, as it was acknowledged that "we can see a good start between industry and research, but there is a lot more to do".

Jean-Philippe Torterotot, also mentioned that "at local level, development of multi-stakeholder RDI consortia, such as the competitiveness clusters in France, allow for more intensive and long term public-private collaboration and co-funding." Adapting this to the water domain, "such clusters need to involve both technology providers, utility operators, engineering and the respective RDI teams on the private side, and scientific institutes, education, operators and local authorities on the public side".

As Seppo Rekolainen also addressed, "water problems cannot be solved without a holistic approach". There are positive signs of this cooperative and unified vision, as indicated by Figure 14 in the "Governmental Strategies" questionnaire. Herein, it was described the stakeholders cooperation with governmental organisations, and it is evident the share that companies, non-profit private organisations and environmental groups are acquiring in this context. In the "Funding Schemes" questionnaire, Figure 17 describes the type of institutions eligible for funding in Water RDI. Interestingly, the ratio of funding organisations supporting public institutions compared to the private entities is less than 2:1. This is noteworthy given the fact that only 2 of the enquired funding organisations have access to national private funds.

On another context, the fact that 16 funding organisations from 11 different countries affirmed that on average 32% of Water RDI research projects have an effective cooperation with industries or companies represents another positive sign. An area where improvement may be needed is the cooperation between funded Water RDI infrastructures and companies or industry, which was at 12,5%, considering the participating funding organisations.

To finalise this part of the discussion, it is important to recall Seppo Rekolainen, when he stated that we "still have a big challenge with the science policy interface, although we have seen some nice examples where decision makers have been inside the research projects already when they were designed".

Technology / knowledge transfer

The concerns regarding *Technology Transfer* and *Innovation* are corroborated by the fact that only 3 governmental organisations (out of 19) affirmed to have a technology transfer office/working group in the water domain in connection to companies or industry. The low representation may be partially explained by the profile of the respondents, more involved in research development or policy definition. Nevertheless, Marina Villegas enhanced the importance of promoting the "knowledge flow from science to technology". On the same topic, Robert Schroeder listed "regulation, legislation, public procurement rules, opportunities for public-public and public-private partnerships, targeted financial instruments, and lack of testing facilities" as barriers that have been hindering innovation and technology/knowledge transfer in Europe.

Jean-Philippe Torterotot, besides stressing some of the barriers aforementioned, added that "water is an intensively regulated sector. This can be both a barrier and a trigger, according to the specific question that is addressed. (…) Water management often involves and relies on long life assets, which may be difficult to adapt significantly over time without rebuilding. Regulation, pressures and societal needs may evolve quicker than the life cycle of such assets." It was also reinforced the need for "dialogue and interaction between RDI, decision making and management". There is an emphasis on the requirement for "mutual knowledge and understanding" and "explicit collaboration and interaction frameworks recognising the respective needs and stakes". As an example, Jean-Philippe Torterotot mentioned that "time scales for scientific and operational activities are quite different, and this must be taken on board for fruitful collaboration".

Transnational and International cooperation & Europe and the World

Cooperation is at the core of the ERA. Transnational and International cooperation is of fundamental importance in the maximisation of resources, and the water domain in particular is, according to Dirk Krul "a very local issue and the water sector is consequently very fragmented". However, as he added, "since the launch of the WssTP in 2004 the European scientific and technological cooperation on water has strongly increased. Today we see a great deal of cooperation going on".

Although the scenario is quite promising, only 38% of the responding governmental organisations (7) indicated to directly manage international cooperation, balancing between multilateral and bilateral relations as the basis of their management system (only one organisation claimed to base the management of its cooperation activities exclusively via bilateral cooperation). Out of these 7 organisations, only 2 respondents accredited the management of international cooperation in the definition of their programmes.

One should not be discouraged by this figure but, as Marina Villegas acknowledge in her interview "there is still plenty of work to be done to coordinate the agendas and the activities of the European countries.".

As for funding organisations, and based on the data supplied by the questionnaires, about 61% support transnational cooperation in Water RDI at a multilateral level, with less emphasis given to bilateral or even a mixed mode (50:50 between multilateral and bilateral). This cooperation increases on the part of performing organisations, with about 80% mentioned participating in international cooperation in Water RDI.

In addition, performing organisations qualify the opportunities available relatively to fostering international cooperation quite variably, ranging from *Very Good* to *Poor* in very similar numbers.

Overall, the results described above clearly indicate the importance given to international cooperation and the awareness to the fact that water challenges are a trans-boundary issue that cannot be addressed at restricted levels. However, considering the weight governmental organisations have in the establishment of stronger networks of research, and the desired increase of the participation of all the actors in collaborative work, this is an area that needs to be analysed carefully.

The majority of the organisations that participated in the questionnaire (44 out of 48 organisations from 10 countries) affirmed to cooperate with stakeholders. In Figure 29, it is described the number of performing organisations and the type of stakeholders involved. Expectedly, there is an uniform distribution between *Governmental*, *Local Authorities*, *Universities* and *Companies* with over 80% of performing organisations holding cooperation with this type of stakeholders. It is also positive the levels of cooperation with *Non-Profit Private Organisations*, and *Environmental Groups* at 45% and 41%, respectively.

There are a set of countries with which governmental and performing institutions appear to collaborate the most in Water RDI. Some numbers from the questionnaires are referenced below, for the sake of one being guided throughout this discussion.

- About 32% of governmental organisations mention within Europe the United Kingdom, Spain, France, Germany and The Netherlands. Outside Europe, Brazil is the most mentioned country followed by other 10 other different countries with equal frequency. About 75% of all mentioned non-European collaborations target developed countries, while the remaining 25% target developing countries,
- Considering specifically cooperation in Water RDI fellowships/mobility schemes, about 10% of funding organisations mentioned cooperating most with the United Kingdom, followed by Russia, France, Poland and Spain. As for the non-European countries, about 14% of respondents the USA was the mostly referenced, followed by China, Tunisia, Brazil and Japan. Here we see a balanced cooperation in regards to developed and developing countries (50-50%);
- About 69% of performing organisations appointed the United Kingdom, Spain, France, The Netherlands, Germany and Sweden in Europe. Outside Europe, about 58% performing organisations appointed the USA, Canada Brazil and China. At this international level, we note that we have 39 mentions to collaborations with developing countries (about 60%) and 26 mentions to developed countries (about 40%).

Overall, countries classified in Class 5 and Class 4 (see Table 3), should have the most references for collaboration considering their status. Italy, Belgium, Poland, Switzerland and Turkey are not mentioned as frequently as their Class 5 and Class 4 counterparts, so there is room for the establishment of new networks with these countries.

Continued efforts must be developed by the member states to increase European standards in Water RDI. Although Europe presently leads in publications and patents, if one considers normalised values to GDP or population, Europe is still behind Australia, Canada and Japan. Per GDP, Europe is only close to the leaders in Q1 and Q2, curiously the most commonly referred themes by the organisations that participated in the questionnaires.

A remarkable change of the relative positions of developing and emerging countries is expected in the near future on Water RDI. Assuming a similar growth for the next 15 years, in 2028 China will match Europe's

number of publications, whereas the USA will produce 60% of the European publications. Australia and Canada, at this pace, will become leaders in the Water domain. Regarding the number of patents China will produce on average 1.7 times the number of patents of Europe (Europe will be far behind the USA, Japan and China on Q3- *Water Industry*).

Evaluation of Water RDI

About 60% of responding governmental organisations (8 organisations) admitted to directly manage activities of evaluation and selection of funding activities (projects, mobility, fellowships, infrastructures) in Water RDI.

Among funding organisations, about 91% of respondents indicated funding Water RDI through competitive funding. Considering that only one of them reported to also fund Water RDI activities through non-competitive funding, one can conclude that the great majority of funding organisations use competitive funding as their sole funding mechanism, increasing selectivity and competitiveness among applicants. Also, and regardless of the type of funding activities, the main system used is through open calls.

This type of funding scheme truly sets a standard for research excellence, however, some fragilities were detected in this general practice. For instance, only 32% governmental organisations have access to a systematic national and/or international list of reviewers/pool of experts in the field. This rate is increased when one considers funding organisations, but only about 48% admitted having access to a list of National Experts or International Experts. As to the types of evaluation panels used in the evaluation of different activities, it was found that Fellowships/Mobility Schemes are more prone to be evaluated by national panels, whereas Infrastructures rely more on international or mixed panels. In the evaluation of projects, we have about 63% of funding organisations indicating the use of international/mixed panels. Nonetheless, about 37% only use national panels, which is not the best practice from an international standpoint.

The main nature of the calls for *Water RDI Projects* cover all scientific domains (7 organisations, 30%), and priority topics on Water RDI (5 organisations, 22%). Periodicity of call varies, with only about 35% of respondents mentioning annual calls.

In ex-post evaluations, the outputs of Water RDI funded activities monitored or evaluated by 15 responding funding organisations (65%) through Scientific Committees or Evaluation Panels are *Reports* (100%), *Papers* (47%), and *Workshops or Conferences* (53%).

These numbers serve as a guideline and should be analysed by all actors. The evaluation of applications is a crucial instrument in this collaborative effort, and working towards reaching the highest of standards is mandatory.

The role of Water JPI and the alignment of national strategies at a European level

As defined by the EC, the objective of joint programming is to "increase the value of relevant national and EU RDI funding by concerted and joint planning, implementation and evaluation of national research programmes".

The importance of the role of JPIs and other initiates/instruments in the context of the European innovation and research system is already acknowledged and recognized. Results show that about 57% funding organisations admit participating in European initiatives/instruments (JPIs, ERA-NETs, etc.) related to Water RDI. Among them, about 75% specifically referred participating in the Water JPI, WatEUr CSA or activities performed by both. This figure increases in regard to performing organizations, with about 65% of respondents confirming participation in European initiatives/instruments. However, only17% of them participates in the Water JPI/WatEUr CSA.

National roadmaps on Research Infrastructures have to continue to evolve, and the ESFRI concept of infrastructure must serve as guidance in these exercises. These are important aspects to set national priorities and to earmark funds for the development of the countries and participation in joint programming initiatives and pan-European research infrastructure activities.

Across all JPIs there is an increasing emphasis upon alignment activities, most recently reinforced by the GPC, whose Alignment Working Group produced a draft report in July 2014, finalised in October 2014.

The fact that about 78% respondents, from 72 organisations in 12 countries, admitted to having strategic priorities for Water RDI is a clear indicator of a growing awareness of the importance of water in the national programmes across Europe and facilitates progress towards the alignment of research agendas and activities in partner countries, support European leadership in water science and technology, foster effective use of Europe's limited public research funds, and pave the way for efficient sharing of best practices across national programmes.

Thus, it comes as no surprise that the fragmentation of knowledge, non-rational use of all types of resources and duplication of efforts are concerns raised by the interviewees (see Annex 2).

According to Durk Krol, one barrier that may block progress in the water sector is that "water utilities are very conservative, which can partly be explained by the fact that their services have a direct potential impact on human health, but also by the fact how they are governed". It is important to stress that only about 12.5% funding organisations from 8 countries confirmed having an effective cooperation with companies or industries in *Water RDI Infrastructures* funded by their organisations. Also, addressing fragmentation Durk Krol adds that we are lacking "a single European market for water-related technologies" with different countries applying different standards. Moreover, "there is also a huge financial challenge to recover the cost of water services and provide people an incentive to use the available water services wisely."

Jean-Philippe Torterotot affirmed that "water public policies and effective water management are strongly structured and influenced by European directives, and among these by the Water Framework Directive. The WFD is a real trigger for research, depending on knowledge and methods which are produced along the implementation of the regulation". Also on WFD, Laura Burke stated that "new governance arrangements for the Water Framework Directive are being discussed."

4. Conclusions

The participation of 108 organisations must be highlighted, and the effort of the participants in providing the most accurate information has to be acknowledged. **The separation of the questionnaires by different types of actors and themes is more efficient, but there is still room for improvement**. The questionnaires should be better adapted to how SURVS works and how the data is exported into Excel files. The process of transforming the exported documents into Excel files to manage the information in a fast and user-friendly form is still laborious.

One should aim at developing mechanisms to increase the number of participating organisations and countries involved. The motivation of the targeted respondents is crucial in this type of exercise. The Water JPI electronic publication, which is under construction, will provide a solid contribution to this end.

Interestingly, **the interviews were a great asset to this Mapping Report**. The participants put considerable effort into preparing complete and far-sighted answers, which have very usefully complemented the data that was extracted from the questionnaires. The multifaceted background of the interviewees represented an added-value that should be taken into consideration in future exercises.

The effort that European countries have been developing on water RDI issues is depicted in the information compiled through the *Desk Research* maps. Countries with the highest level on water publications and/or patents are distributed across the whole European landscape, independently of their geographic and economic size. The contribution made by countries that recently joined the European Union, and the added-value provided by the EU Associated Countries to maintain Europe's leadership in Water RDI should be highlighted.

The higher increasing rate of publications of emerging and developing countries relative to Europe is not surprising among the various SRIA themes (Figure 51b). However, Europe shows a similar growth or sometimes even better numbers than other developed countries such as the USA, Japan and Canada. Nevertheless, one should note the advances made by emerging economies like China, as their efforts are not being replicated by Europe over the last 15 years. Analysis of normalised numbers (GDP and population) indicates that further work will also be required to match developed nations such as Canada, Japan or Australia.

Overall, the progress that has been made since the beginning of the Water JPI is notable. As Marina Villegas stated "the Water JPI has provided a strong contribution to meeting the objective of coordinating the agendas and the activities of the European countries in quite a short time. For the first time in Europe, we have a Strategic Agenda and an Implementation Plan. (…) We are on the right track to a clear, unified and effective strategy".