



Water Joint Programming Initiative Submission

2016 EC Stakeholders' Consultation on the Horizon 2020 Societal Challenge 2

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Note: *This contribution can be published as the Water JPI Submission.*

The Water Joint Programming Initiative (JPI) welcomes this opportunity to provide feedback on the proposed strategic directions of the Societal Challenge 2 Work Programme (WP) 2018-2020.

While the Water JPI is very strongly & intrinsically linked to Societal Challenge 5, Research, Development & Innovation (RDI) needs covered under Societal Challenge 2 are also of key relevance to the Water JPI, as indicated in the name: "Food Security, sustainable agriculture and forestry, marine and maritime and **inland water research** and the bioeconomy". The Water JPI is aiming to tackle the ambitious grand challenge of "Achieving sustainable water systems for a sustainable economy in Europe and abroad".

This strong synergy between water and agriculture was recently reflected in the close collaboration between the FACCE and the Water JPIs in the successful preparation of the **WaterWorks2015** ERANet COFUND under the Societal Challenge 5 2015 Call, addressing the challenges of:

- ⇒ Ensuring the provision of water resources for the agricultural, forestry and freshwater aquaculture sector in a context of global climate change and consumers' demands for more ecologically friendly products;
- ⇒ Protecting humans against health risks if additional water sources, such as reuse, are made available; as well as
- ⇒ The more sustainable growth of the agriculture, forestry and freshwater aquaculture sectors whilst paving the way towards job creation in all these economic areas.

Water is vital and essential for smart, sustainable and inclusive growth. Better results and optimisation of public funds are obtained through the alignment of water research agendas and programmes at European and international level.



Open Question 1:

What are the challenges in the areas covered by Societal Challenge 2 that require urgent action under the Work Programme 2018-2020?

Water plays a central role in most of the current challenges identified in the areas of Challenge 2 "Food Security, sustainable agriculture and forestry, marine and maritime and **inland water research** and the bioeconomy". Water is a cross-sectoral domain, as it remains central for several thematic areas, namely climate change, agriculture, food production and security, ecosystem sustainability and biodiversity, or urban area development.

Water RDI development in the past 5-10 years (being a focus area in Horizon 2020 Work Programmes 2014–2015 and a priority in most Member States) has led to a significant development of the Water economic sector in Europe. **Therefore, a stronger focus on the Inland Water Research aspect of the Societal Challenge 2 and not only as a "cross-cutting area" would be critical in order to ensure coherence, decrease the risk of fragmentation (across all the Societal Challenges) and maximise impacts.**

The foresight document used as the fundamental basis for providing this feedback and identifying possible RDI topics for the Horizon 2020 Societal Challenge 2 Work Programme is the Water JPI Strategic Research and Innovation Agenda (SRIA)¹.

The Water JPI covers a wide range of water challenges, focusing on ecosystems, citizens, industry, the bio-economy and closing the water cycle gap (sustainable water management), which are all of key relevance to the areas covered by Societal Challenge 2, in particular:

- Food Security;
- Sustainable agriculture and forestry;
- Inland water research; and
- Bioeconomy.

The Water JPI SRIA has been produced by Research and Innovation Funding Programmes representing 88% of the European National Public investments in these topics. This wide representation of programmes and topics leads to priority setting in different thematic areas.

Considering the identified remaining challenges, Horizon 2020 Work Programme 2018-2020 should cover the different scales (see [Table 1](#)).

¹ The Water JPI SRIA version 1.0 was released in October 2014, following the endorsement by the Water JPI Governing Board - http://www.waterjpi.eu/images/SRIA/WATER%20JPI%20%20SRIA%201.0_2014.pdf. The version 2.0 has been approved by the Water JPI Governing Board in April 2016.

Table 1 – Identified challenges for Societal Challenge 2

Scale	Identified RDI challenges for WP 2018 – 2020
Global challenges needing integrated approaches	<p>Water and Energy and Food production and security NEXUS</p> <p>Health and water quality: Identification and assessment of new diseases / toxins / pollutants, new exposures and related risks, new resistance</p> <p>Adaptation and Mitigation measures for Global changes (climate and water, ecosystem services)</p> <p>Migration / Demography / water access/ urban sprawl / varied condition and location (geographical and climate conditions) – Increased pressure on Water Quantity & Quality – Link with Smart Cities & Communities as well as Smart Farming (Cross-compliance & Greening the CAP should be a key driver)</p>
Large scale (National, Regional)	<p>Sustainable management of water resources, facing multiple water risks (floods, pollution, biological risks, over-abstraction vs conflict of uses, ...)</p> <p><u>Water in circular economy</u> New concepts for reusing water (not only irrigation), New ways to use recirculated water, Legal and economic aspects of recycling water (ownership, who will be beneficiaries), for extracting and valorise the resources contained in wastewater and wastewater processes (nutrients, energy...)</p> <p>Sustainable groundwater resource management vs. ground / subsoil uses and growth challenges (vs. mining, fracking, over-abstraction, recharge, salinization, groundwater ecosystems services...)</p>
Regional	<p>Data collection-Quality control of data and credibility from different stakeholders communities (Building/Furthering Citizen Observatories)</p> <p>Maintaining ecosystem services sustainability (cf. Water JPI SRIA Theme 1)</p>
Local – catchment level	<p>Moving from centralized supply and sanitation systems to decentralized systems (rural areas, developing countries)</p> <p>Resilience and vulnerability assessment of water resources (both environmental and socio-economic approaches)</p> <p>Assessment of local and global effects on water catchments for an improved management of flood and drought risks using early warning systems linked with climate services, environmental sensors, upscaling / downscaling of environmental models...)</p>
Cross-cutting issues	<p>Data collection (measurements, sensors, ICT devices for transfer) and data mining / Big data technologies for assessing the reliability and credibility of the collected data and for interpreting these data for decision-making</p> <p>Social acceptance of scientific findings (citizen science)</p> <p>Governance & acceptance of innovation, which should include testing facilities, demonstration projects, roadshow for local</p>

Scale	Identified RDI challenges for WP 2018 – 2020
	acceptance removing barriers in general (see below)

For these topics, RDI funds should be provided at the whole RDI chain: from fundamental knowledge development to Innovation demonstration (in terms of methodologies and technologies), with new challenges, such as:

- **Developing, under the European Research Council (ERC)**, cross-disciplinary approaches as this is requested for assessing the complex water challenges (see [Figure 1](#)) - How you do this with an ERC built on bottom up concept should be considered.
- **Integrating academic research / applied research / innovation development & demonstration for complex situation** (e.g. detection of new pollutants by new environmental chemistry technologies, biosensors development, risk modelling for acute and chronic risks of single substances and cocktails in environmental conditions, remediation / treatment technologies for emerging pollutants of concern ...).
- **Adaptation to change** (Barriers to adaptation/ Barrier to innovation/ Barrier to Market/ Barrier to Policy -see answer to [Open Question 3](#)).
- **Demonstration pilot from small to large-scale** to accelerate the uptake of the innovations by the different end-users.
- **Addressing the science-policy gap** (environment policy, cooperation and aid policies...).

Horizontal Water RDI Needs and their relevance

(based on the results of the various consultation exercises)

		THEMES 1-5				
		Theme 1: Improving Ecosystem Sustainability and Human Well-being	Theme 2: Developing Safe Water Systems for Citizens	Theme 3: Promoting Competitiveness in the Water Industry	Theme 4: Implementing a Water-wise- Bio-based Economy	Theme 5: Closing the Water Cycle Gap
HORIZONTAL RDI NEEDS	Ecosystems' ecological status, resilience, services & restoration	Very relevant	Somewhat relevant	Somewhat relevant	Somewhat relevant	Relevant
	Pollutants: risks and remediation	Somewhat relevant	Very relevant	Relevant	Relevant	Somewhat relevant
	Water and energy	Somewhat relevant	Somewhat relevant	Very relevant	Somewhat relevant	Relevant
	Water and agriculture	Somewhat relevant	Somewhat relevant	Somewhat relevant	Very relevant	Relevant
	Water and citizens	Somewhat relevant	Relevant	Somewhat relevant	Somewhat relevant	Very relevant
	Water and climate	Relevant	Relevant	Somewhat relevant	Somewhat relevant	Relevant
	Water data (monitoring, citizen participative sciences)	Relevant	Relevant	Relevant	Relevant	Very relevant
	Sensors, technologies and smart systems	Relevant	Relevant	Very relevant	Relevant	Relevant
	Governance and acceptance, removing barriers (legislation, funding schemes, governance, acceptance)	Somewhat relevant	Somewhat relevant	Very relevant	Relevant	Very relevant
	Developing new tools combining in situ and remote sensing data: models	Somewhat relevant	Somewhat relevant	Somewhat relevant	Very relevant	Very relevant
	Integration of water policies in the EU	Relevant	Relevant	Relevant	Relevant	Relevant

Figure 1: Horizontal Water RDI needs and their relevance to the Water JPI SRIA themes - as identified in the Water JPI SRIA 2.0

Open Question 2:

What are the desired output and long term-impacts that could be foreseen for Societal Challenge 2? Which innovation aspects would be needed to respond to our societal needs and market development within the next 5-7 years?

As mentioned above, a strong focus on **Inland Water Research** as a **Key Priority Area** is necessary to maximise the impact of such a critical and vital research domain, which is **key and a fundamental basis** to any activities relating to food security; sustainable agriculture and forestry and the bioeconomy.

Based on the five Water JPI Strategic Research and Innovation Agenda themes (**Improving Ecosystem Sustainability and Human Well-being, Developing Safe Water Systems for Citizens, Promoting Competitiveness in the Water Industry, Implementing a Water-wise Bio-based Economy, and Closing the Water Cycle Gap – Improving Sustainable Water Resources Management**), expected impacts have been identified (see [Appendix 1](#) for full details).

The most important are summarised in [Table 2](#).

Table 2 – Expected impacts of the Water JPI SRIA RDI needs

Impacts	
Social	<ul style="list-style-type: none"> • More environmentally-friendly sustainable farming operations, which will ensure compatibility between current land use activities and the envisaged deployment of the bio-based economy; • Increased access to water resource with water abstraction and consumption not limiting other societal uses of water; • Understanding and decreasing the combined environmental risks from agriculture, forestry and freshwater aquaculture to human health (environmental exposure from water uses and food); • Protecting humans against health risks if additional water sources, such as reuse, are made available; • More water available for all uses, particularly in areas of low-quality water, water scarcity and drought vulnerability • Safeguarding natural resources and biodiversity for future generations
Economic	<ul style="list-style-type: none"> • Increased productivity of agriculture, forestry and aquaculture sectors if appropriate measures (aimed at reducing soil and water pollution and at enhancing resource efficiency) are taken; • Increased resilience of agriculture and forestry systems and landscape management in a context of highly variable water availability due to climate trends, climate variability and extreme events (floods and droughts); • Creation of more employment opportunities and wealth by the implementation of a water-wise bio-based economy. • Improving productivity in some economic sectors enhancing natural resource efficiency while reducing impacts on environment • Savings natural resources by better understanding of water – energy –

	food nexus
Technological	<ul style="list-style-type: none"> • Innovative technologies for more sustainable agricultural and forestry practices; • Development of blue biotechnology in freshwater aquaculture; • Innovative water use systems and practices, including precision irrigation technologies (e.g. models, sensors, ICT); • Innovative technologies for the treatment, testing and reuse of wastewater in the agriculture, forestry and freshwater aquaculture sectors; • Innovative technologies for the monitoring of surface and groundwater bodies for effective integrated water management (including water abstraction) in agriculture, forestry and freshwater aquaculture sectors. • Developing new tools (e.g. early warning systems,) for monitoring and reducing impacts to environmental resources • Innovative technologies for more sustainable economic sector practices (low cost and practical technologies for treating wastewater and producing resources safe to reuse , performance and resilience of utilities to floods and extreme events, blue biotechnologies in freshwater aquaculture, ...)
Environmental	<ul style="list-style-type: none"> • Better use and protection of European natural resources; • Improved environmental water quality of the receiving waters as a result of actions targeting pollution from agriculture, forestry and aquaculture sectors; • Improved soils quality while reducing pollution; • Optimisation of the Water – Energy nexus (e.g. improving energy efficiency) in the agriculture, forestry and aquaculture sectors. • Better understanding of water resources and related ecosystems • Reducing impacts of pollution, floods and extreme events on water bodies, water ecosystems and food chain • More environmental friendly operations of different economic sectors • Preventing loss of biodiversity and degradation of landscape quality
Policy	<ul style="list-style-type: none"> • Better implementation of: <ul style="list-style-type: none"> ○ EU Regulations & Policies, in particular: 7th Environment Action Programme; Water Blueprints; Water Framework Directive; Nitrates Directive; "Towards a Circular Economy" Communication; Roadmap to a Resource Efficient Europe; Bio-economy Strategy; Priority Recommendations from the EC Lead Market Initiative for Bio-based Products; "Maximisation of water reuse in the EU (a new EU instrument)" Roadmap; Common Agricultural Policy (CAP); EU Climate Change Adaptation Strategy; Soil Thematic Strategy; ○ UN Sustainable Development Goals (SDGs), especially: SDG 2: "End hunger, achieve food security and improved nutrition and promote sustainable agriculture", SDG 6 "Ensure availability and sustainable management of water and sanitation for all", SDG 9 "Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation" and SDG 12 "Ensure



	sustainable consumption and production patterns". <ul style="list-style-type: none">• Development of new policies based on scientific evidence
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To achieve these impacts, there is a need for coordination and strengthened cooperation between different public research initiatives and programmes (JPIs, Horizon 2020, COST actions, COPERNICUS / GEOSS).

It is critical that the scoping exercise carried out under the Societal Challenge 2 for preparing the upcoming WP2018-2020, refers to and uses the foresight exercises carried out under the Water & FACCE JPIs (i.e. Water JPI SRIA and FACCE JPI SRA), as a basis for identifying key challenges to be addressed.

The integration of the water economic sector at an early stage of the RDI programme creation (co-creation) and planning is seen as a major way to achieve a higher impact.

Open Question 3:

In the areas covered by Societal Challenge 2, which gaps (scientific and technological, innovation, markets, policy, societal) and potential game-changers, including the role of the public and private sectors in accelerating changes, need to be taken into account?

In the Water area, barriers to be removed are numerous: Barriers to adaptation/ Barrier to innovation/ Barrier to Market uptake and development / Barrier to Policy implementation. These questions were addressed by the Water JPI when mapping RDI in Europe² and outside Europe³.

At the policy level, Water is an intensively regulated sector. This can be both a barrier and a trigger, according to the specific question addressed. Key barriers to successful implementation identified in the first set of River Basin Management Plans were:

- The governance arrangements that were put in place. New governance structures considering all levels (local, regional, national, river basin when applicable) and administrative arrangements for the implementation of the second cycle of RBMPs.
- The fragmentation of the water sector with multiple operators, applying different standards.
- The public procurement rules which may also make support to innovation in the real world more complicated. In many cases investors and owners of assets and systems are public. They have to play a key role in innovation development and support for implementation.
- The huge financial investments⁴ for implementing the best available technologies; Water management often involves and relies on long life assets, which may be difficult to adapt significantly over time without rebuilding;
- The challenge to recover the cost of water services and provide people an incentive to use the available water services wisely.

For removing **barriers to innovation and market uptake**, several solutions should be developed:

- ⇒ Exploring regulatory, governance, education (i.e. technical vocational education and training (TVET)) and management conditions that contribute to removing barriers to innovation and to strengthening the competitiveness of European industries.
- ⇒ Exploring approaches to closing the gap (reducing the time) between the initial demonstration of research-related innovations and their first appearance on the market.
- ⇒ Developing indicators measuring the social value of innovations in the water sector.
- ⇒ Developing management models for new technological solutions to support sustainable operations, maintenance and market uptake.
- ⇒ Favouring knowledge transfer from other scientific fields regarding key lessons in the marketing and commercialisation of products. Supporting the transfer of relevant results from other scientific fields for their application in the water RDI domain.
- ⇒ Understanding the requirements driving society's adoption and acceptance of innovations by integrating technical and social science and humanities research and innovation, by involving

² Mapping RDI in Europe -

http://www.waterjpi.eu/index.php?option=com_content&view=article&id=127&Itemid=694

³ Mapping water RDI activities run by partners outside Europe -

<http://www.waterjpi.eu/images/documents/2016/WP%205%201%20Final%20Report%20-%2030-04-2014%20without%20SWOT.pdf>

⁴ World Economic Forum, 2013 Green Investment Report -

http://www3.weforum.org/docs/WEF_GreenInvestment_Report_2013.pdf

stakeholders at the appropriate levels and scales of participation and by enabling large-scale socio-technical experimentation.

- ⇒ Identifying opportunities for the creation of new financial mechanisms for an innovative water sector.

As cross-cutting issues, the financial support to RDI (Opportunities for public-public and public-private partnerships; lack of targeted financial instruments), the lack of good showcases and testing facilities and the need for improving coordination with other national and European RDI Programmes are also mentioned.

Game changers:

- a) See [Table 1](#), in particular the picture at Global scale (migration vs demography vs. sustainable water resources management, vs. food production and security vs. evolution in the future due to global changes...).
- b) Cross-compliance to EU policies: the Water Framework policies but also some other thematic policies such the CAP (cf. greening the CAP – 2014 EU Court of Auditors recommendations): Agriculture is suffering from climate change but is also contributing to climate change.

As recognised by UN (see SDG 6 / Target 6 - “By 2030, expand international cooperation and capacity-building support to developing countries in water- and sanitation-related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies”), these global challenges will request more international cooperation, including in the RDI area. This will require specific cooperation instruments which will permit funding cooperation with well-established RDI countries and developing countries.

The first Work Programme of Societal Challenge 5 in Horizon 2020 identified a Focus Area on Water and offered opportunities to find solutions to the remaining RDI challenges in this area. Despite the important efforts, a lot still needs to be done on the Water Challenges identified by the Water JPI, but also key stakeholders such as the European Innovation Partnership on Water (EIP Water)⁵ or the Water Supply & Sanitation Technological Platform (WssTP)⁶.

Despite policy and research-driven efforts at the national, European and international levels, water resources are still under relative pressure in numerous regions. Water crises have been identified in 2015 by the World Economic Forum⁷ (nearly 900 experts took part in the Global Risk Perception Survey) as the TOP 1 risk in terms of impacts on economy and society for the upcoming years. According to the European Environment Agency (EEA⁸), pressure will increase in the years to come. Immediate action is therefore necessary to address existing and emerging challenges in the field of water resources. Competition for water among different uses has turned this resource into a limiting factor for societal wellbeing, and in some areas for economic development (e.g. for the agriculture sector, including its energy production contribution).

⁵ <http://www.eip-water.eu/innovating-water-featured-horizon-2020-publication>

⁶ <http://wsstp.eu/wp-content/uploads/sites/102/2013/11/SRA2010.pdf>

⁷ <http://reports.weforum.org/global-risks-2015/part-1-global-risks-2015/introduction/>

⁸ <http://www.eea.europa.eu/publications/european-waters-assessment-2012>



Since the early 2000s, concerns about water have been included in the UN Millennium Development Goals. Target 10 of Goal 7⁹ was dedicated to “*halve, by 2015, the proportion of people without sustainable access to safe drinking water and basic sanitation*”. Given the scope of the challenge, the decade 2005-2015 was even proclaimed International Decade for Action 'Water for Life'. Within the new post-2015 development agenda, the place of water-related issues has been further strengthened. Indeed, water is at stake not only in **Goal 6 to “Ensure availability and sustainable management of water and sanitation for all”**, divided into seven specific targets, but in almost all of the **17 SDGs**¹⁰. Other SDGs are also of particular relevance to water challenges¹¹: SDG 1 (No poverty)¹², SDG 3 (Health)¹³, SDG 7 (affordable and clean energy)¹⁴, SDG 11 (Sustainable cities and communities)¹⁵, SDG 12 (Responsible consumption and production)¹⁶, SDG 13 (Combat climate change and its impacts)¹⁷, SDG 14 (Life below water)¹⁸ and SDG 15 (Life on land)¹⁹.

The Water JPI SRIA is the foresight document for Water RDI in Europe and Beyond Europe. The revision process has allowed the inclusion of new RDI needs related to water challenges. The Water JPI SRIA builds on the review of more than 200 foresight documents, as well as the SRAs from other JPIs and relevant EU initiatives. Therefore it represents the agreed vision of RDI needs for over 88% of the EU Funding organisations and ministries.

Some new priorities emerged recently:

- The links between growth, migration and sustainability and resilience of natural resources and infrastructures;
- The fulfilment of basic human needs as represented in the UN Sustainable Development Goals, in which the water resources are playing a major role; Some of these UN SDGs have very short terms (2020, 2030) which could change priority settings;
- Sustainable Economy and circular economy: some developments occurred recently, but fragmentation remains between the different pillars (from new technologies to treat to risk evaluation for ensuring safe water reuse and governance of resources in the context of global changes).

In all above-listed priorities, the value of water resources should be recognised and assessed. The sustainable management of water resources in all regions of the world (considering the specific local challenges) will be of major importance. The global dimension of these priorities will require international RDI cooperation and as already mentioned specific cooperation instruments with all interested parties.

⁹ Ten goals emerged from the Millennium Declaration, the 7th being “Ensure Environmental Sustainability”.

¹⁰ <https://sustainabledevelopment.un.org/sdgs>

¹¹ [World Water Development report 2015](#)

¹² Especially target 1.4 of [Goal 1](#) - “End poverty in all its forms everywhere”

¹³ Especially targets 3.3 and 3.9 of [Goal 3](#) - “Ensure healthy lives and promote well-being for all at all ages”

¹⁴ Especially target 7.3 of [Goal 7](#) - “by 2030, double the global rate of improvement in energy efficiency”

¹⁵ Especially target 11.5 of [Goal 11](#) - “Make cities and human settlements inclusive, safe, resilient and sustainable”

¹⁶ Especially targets 12.2 and 12.4 of [Goal 12](#) - “Ensure sustainable consumption and production patterns”

¹⁷ Especially target 13.1 of [Goal 13](#) - “Take urgent action to combat climate change and its impacts”

¹⁸ [Goal 14](#) - “Conserve and sustainably use the oceans, seas and marine resources for sustainable development”

¹⁹ Especially targets 15.1, 15.3 and 15.8 of [Goal 15](#) - “Ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, ...”

Open Question 4:

Which of the areas covered by Societal Challenge 2 could benefit from integration of horizontal aspects such as the social sciences and humanities, responsible research and innovation, gender aspects, and climate and sustainable development?

Water is vital for life, cleaning, flushing, food production and manufacture of many industrial products. Water challenges are huge (e.g. fast growing world population, pollution from multiple origins and global climate changes). Therefore providing every citizen with access to an adequate supply of safe water, meeting every economic sector's water needs, and delivering water quality with a reduction of energy needs and without conflict of uses requires increased research and innovation efforts. In particular it requires contribution from a new type of science that links disciplines, knowledge systems and societal partners to support more sustainable water resources management and the implementation of water-related policies in a changing world. Within this context, social sciences and humanities do not have a peripheral role, as the previously mentioned **new type of research is directed towards an inclusiveness policy, where all relevant stakeholders work in a mutual symbiosis for a more efficient implementation of water policies.**

A more coordinated and consistent approach in international water RDI cooperation not only helps to build a greater critical mass needed to provide an effective response to major societal challenges, but it also enables Europe to participate more effectively in agenda setting in International water fora and to convey consistent messages. It also allows the development of accurate solutions for special regional conditions, valorising local knowledge and smart innovation while building capacities and skills for a more efficient policy implementation.

Also note that social impacts for each of the themes are elaborated in [Appendix 1](#), and it is noteworthy to highlight

- i. the protection of public health and the environment,
- ii. the protection of water utilities and urban water systems,
- iii. the public awareness of the importance of reutilisation of wastewaters,
- iv. water quality and availability in a climate change era, susceptible to extreme events and with a continuous population growth.

The expected impacts of the RDI needs identified under the Theme *Implementing a waterwise bioeconomy* are of particular relevance, in this context:

- ⇒ More environmentally-friendly sustainable farming operations, which will ensure compatibility between current land use activities and the envisaged deployment of the bio-based economy;
- ⇒ Increased access to water resource with water abstraction and consumption not limiting other societal uses of water;
- ⇒ Understanding and decreasing the combined environmental risks from agriculture, forestry and freshwater aquaculture to human health (environmental exposure from water uses and food);
- ⇒ Protecting humans against health risks if additional water sources, such as reuse, are made available;
- ⇒ Greater awareness of water-reuse opportunities, and of the cost (including energy) of treatment and supply.

Closed Question 1:

Agriculture is a crucial sector when it comes to tackling major challenges such as food security, safeguarding natural resources, protecting climate as well as the development of food/non-food industries and rural areas. A number of cross-cutting issues are suggested to implement a broad research agenda which takes into account the numerous challenges as well as the diversity and different needs of the agricultural sector. Please categorise the following list of issues according to their relevance for delivering innovations in agriculture and rural areas (1= low relevance; 2= relevant; 3 = highly relevant):

Issues	Relevance
Focus on "systems approaches", i.e. taking into account dynamic interactions of the different components of systems and value chains (e.g. agro-ecosystems, food value chain) at various temporal and spatial scales.	3
Focus on "smart" innovations, i.e. delivering tailor-made solutions and capitalising on specificities of local conditions (e.g. taking advantage of novel ICT driven tools)	3
Promote co-creation of knowledge as well as new mechanisms and models of knowledge exchange (i.e. partnerships between science, farming, other businesses, consumers)	3
Promote Open data to drive knowledge creation, management and sharing	2
Foster science-policy and science- societal interfaces at all stages of the research and innovation cycle (agenda setting, activity implementation, outreach activities)	3
Foster international cooperation	2

Closed Question 2:

What is the most pressing marine challenge to be addressed through research and innovation in the next Work Programme:

- a) Upscaling and commercialising innovations from marine products and services?
- b) Preventing and reducing marine litter?
- c) **Investigating and managing land-sea interactions?**
- d) Studying the carbon cycle in coastal regions?
- e) Analysing ocean circulation changes and other changes such as caused by acidification on fisheries and aquaculture?
- f) Providing food security – fisheries/aquaculture aspects?

Closed Question 3:

Food and nutrition security is about building sustainable 'Food systems', which include the entire 'value chain' from inputs (land, soil, water), to primary production (agriculture, aquaculture & fisheries), harvesting, storage, processing, packaging, distribution, waste streams, to consumer intake – and back. Food and nutrition security goes beyond the production of sufficient food for all, but also respond to the need to provide safe and nutritious food for healthy and sustainable diets. Please rank each of these food and nutrition security priorities in order of importance with respect to future research and innovation needs:

- Priority-1** Reducing hunger and malnutrition, addressing food safety and diet-related illnesses, and helping citizens adopt sustainable diets and healthy lives.

- Priority-2** Building a climate and global change-resilient primary production system.

- Priority-3** Boosting innovation and investment, while empowering communities.

- Priority-4** Implementing sustainability and circular economy principles across the whole food system.



Appendix 1 – Expected Impacts of Water JPI SRIA (per theme)

Theme 1: Improving Ecosystem sustainability and Human well-being

Social:

Contribute to:

- Safeguarding natural resources for future generations;
- Better protection of public health and the environment from effects of extreme weather events;
- Identifying, proposing and prioritising measures to help societies adapt and react to current and future pressures.

Economic:

Contribute to:

- Addressing market failures (integration of externalities in policy-making), by assessing & comparing the preservation, adaptation and restoration costs;
- Better decision and policy making processes, as well as economic impacts, by developing monetary and non-monetary (e.g. managerial) methods of valuation.

Technological:

Contribute to:

- Development of new tools in ecological engineering and Early Warning Systems (EWSs), including sensors, web services, numerical codes and ecological restoration technology; Increased availability and relevance of data and decision making products, in particular for extreme weather events.

Environmental:

Contribute to:

- Better assessment and evaluation approaches of ecosystem services concept;
- Better understanding of aquatic ecosystems;
- Achieving sustainable resource uses;
- Improved water management and availability of good water quality, in particular in the case of extreme weather events.

Policy:

Relevant to the:

- EU Regulations & Policies, in particular: 7th Environment Action Programme; EU Water Blueprint; Water Framework Directive; Marine Strategy Framework Directive; Floods Directive; Water Scarcity & Drought Strategy; EC Guidance on Ecological Flows (Eflow); EU Climate Change Adaptation Strategy; Habitats & Birds Directive; EU Biodiversity Strategy; International Convention on Biodiversity, Natura2000;

UN Sustainable Development Goals (SDGs), especially: SDG 6 “ensure availability and sustainable management of water and sanitation for all”, SDG 2 “End hunger, achieve food security and improved nutrition and promote sustainable agriculture”, SDG 14 “Conserve and sustainably use the oceans, seas and marine resources for sustainable development” and SDG 15 “Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss”.

Theme 2: Developing safe water systems for citizens

Social:

Contribute to:

- The protection of human health through the provision of safe water;
- The protection of water utilities assets;
- Alleviating the water challenges inside and outside Europe, where most of the global population increasingly lives in urban areas.

Economic:

Contribute to:

- Improved management of urban water systems;
- Improved water supply and sanitation, including the replacement of ageing infrastructures to guarantee supply, reduce leakage rates and protect water quality.

Technological:

Contribute to:

- Technological innovation in terms of chemical/physical and biological tools (e.g. detection & analyses of pollutants and decision-support systems) to detect and prevent chemical & biological risks and extreme events;
- Technological and methological innovations to improve the performance and resilience to floods and extreme events of urban water systems.

Environmental:

Contribute to:

- Reducing the risks associated with emerging pollutants and accidents related to water infrastructure status or management;
- Reducing the impacts of floods and extreme events (e.g. storm water retention ponds or water treatment plants);
- Reducing the impacts of pollutants on water bodies, ecosystems and food chain.

Policy:

Relevant to

- EU Regulations & Policies, in particular: 7th Environment Action Programme; Water Blueprints; Water Framework Directive; Drinking Water Directive; Floods Directive; Water Scarcity & Drought Strategy; **Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) Regulation**; Environmental Quality Standards Directive; Priority Substances Directive; Urban Wastewater Treatment Directive; EU Climate Change Adaptation Strategy; Common Agricultural Policy (CAP);
- UN Sustainable Development Goals (SDGs), especially: SDG 6 *“Ensure availability and sustainable management of water and sanitation for all”*.

Theme 3: Promoting competitiveness in the water industry

Social:

Contribute to

- Better human health as a result of access to better water quality;
- More water resources available for societal uses, particularly in areas of low-quality water, water scarcity and drought vulnerability;
- Increased society's acceptance of reused wastewater.

Economic:

Contribute to:

- Better understanding of the water–energy nexus and savings made in energy costs; Supporting the development of major business opportunities inside and outside Europe, laying the foundations for sustained economic growth and industrial leadership;
- Sustaining the competitive advantage of Europe;
- Supporting the reduction of innovation time to market.
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Technological:

Contribute to:

- Increased availability of reused wastewater for agricultural and industrial uses;
- Increased groundwater storage;
- Sustaining the current European leadership in water treatment for urban and industrial purposes.

Environmental

Contribute to:

- Improving the status of water bodies in quantitative and qualitative terms;
- More efficient use of our natural resources.

Policy:

Relevant to the:

- EU Regulations & Policies, in particular: 7th Environment Action Programme; Water Blueprint; Water Framework Directive; Drinking Water Directive; Floods Directive; Water Scarcity & Drought Strategy; "Towards a Circular Economy" Communication; Roadmap to a Resource Efficient Europe; Thematic Strategy on the Urban Environment; Green Infrastructure Strategy; "For a European Industrial Renaissance" Communication, **Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) Regulation**; Environmental Quality Standards Directive; Priority Substances Directive; Urban Wastewater Treatment Directive; Water Reuse Roadmap, EU Climate Change Adaptation Strategy; Common Agricultural Policy (CAP);
- UN Sustainable Development Goals (SDGs), especially: SDG 6 "*Ensure availability and sustainable management of water and sanitation for all*", and SDG 9: "*Build resilient infrastructure, promote sustainable industrialization and foster innovation*".

Theme 4: Implementing a Water-wise bio-based economy

Social:

Contribute to:

- More environmentally-friendly sustainable farming operations, which will ensure compatibility between current land use activities and the envisaged deployment of the bio-based economy;
- Increased access to water resource with water abstraction and consumption not limiting other societal uses of water;
- Understanding and decreasing the combined environmental risks from agriculture, forestry and freshwater aquaculture to human health (environmental exposure from water uses and food);
- Protecting humans against health risks if additional water sources, such as reuse, are made available;
- Greater awareness of water-reuse opportunities, and of the cost (including energy) of treatment and supply.

Economic:

Contribute to:

- Increased productivity of agriculture, forestry and aquaculture sectors if appropriate measures (aimed at reducing soil and water pollution and at enhancing resource efficiency) are taken;
- Increased resilience of agriculture and forestry systems and landscape management in a context of highly variable water availability due to climate trends, climate variability and extreme events (floods and droughts);
- Creation of more employment opportunities and wealth by the implementation of a water-wise bio-based economy.

Technological:

Contribute to:

- Innovative technologies for more sustainable agricultural and forestry practices;
- Development of blue biotechnology in freshwater aquaculture;
- Innovative water use systems and practices, including precision irrigation technologies (e.g. models, sensors, ICT);
- Innovative technologies for the treatment, testing and reuse of wastewater in the agriculture, forestry and freshwater aquaculture sectors;
- Innovative technologies for the monitoring of surface and groundwater bodies for effective integrated water management (including water abstraction) in agriculture, forestry and freshwater aquaculture sectors.

Environmental:

Contribute to:

- Better use and protection of European natural resources;
- Improved environmental water quality of the receiving waters as a result of actions targeting pollution from agriculture, forestry and aquaculture sectors;
- Improved soils quality while reducing pollution;
- Optimisation of the Water – Energy nexus (e.g. improving energy efficiency) in the agriculture, forestry and aquaculture sectors.

Policy:

Relevant to the:



- EU Regulations & Policies, in particular: 7th Environment Action Programme; Water Blueprints; Water Framework Directive; Nitrates Directive; "Towards a Circular Economy" Communication; Roadmap to a Resource Efficient Europe; Bio-economy Strategy; Priority Recommendations from the EC Lead Market Initiative for Bio-based Products; "Maximisation of water reuse in the EU (a new EU instrument)" Roadmap; Common Agricultural Policy (CAP); EU Climate Change Adaptation Strategy; Soil Thematic Strategy;
- UN Sustainable Development Goals (SDGs), especially: SDG 2: *"End hunger, achieve food security and improved nutrition and promote sustainable agriculture"*, SDG 6 *"Ensure availability and sustainable management of water and sanitation for all"*, SDG 9 *"Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation"* and SDG 12 *"Ensure sustainable consumption and production patterns"*.

Theme 5: Closing the water cycle gap – Implementing sustainable water resource management

Social:

Contribute to:

- Increased public awareness and acceptance of sustainable water resources management;
- Protecting humans against health risks if additional water sources, such as reuse, are made available;
- Greater awareness of water-reuse opportunities, and of the cost (including energy) of treatment and supply;
- New governance in close collaboration with all stakeholders, leading to shared water resources uses and a more effective implementation of water policy;
- Improved water management leading to alleviation of societal tensions, as the impacts of water crises are not equally distributed in society, and they can be a source of conflict between different water users.

Economic:

Contribute to:

- Supporting the better allocation of water resources between competing user demands, via using economic instruments such as taxes and subsidies can act as incentives for prudent water management;
- Mitigation measures and short-term solutions to overcome water scarcity (e.g. water transfers) being included in the assessment of costs related to scarcity or droughts and the assessment of economic vulnerability of users and assets.

Technological:

Contribute to:

- Improvement of the techniques for managing of water resources (aquifer recharge, Decision Support Systems (DSS), inter alia) with interoperability of databases, sensors and combined socioeconomic and physical water models;
- Development of new instruments, e.g. sensors, geo-information systems;
- Development of practical, low-cost technologies treating wastewater to produce resources safe for reuse.

Environmental:

Contribute to:

- Maintaining water quantity and quality;
- Improving the balance between water availability & demand;
- Ensuring healthy ecosystem by maintaining environmental flows;
- Preventing the loss of biodiversity and the degradation of landscape quality.

Policy:

Relevant to the:

- EU Regulations & Policies, in particular: 7th Environment Action Programme; Water Blueprints; Water Framework Directive; Groundwater Directive; Marine Strategy Framework Directive, Floods Directive; Water Scarcity & Drought Strategy; "Towards a Circular Economy" Communication; Roadmap to a Resource Efficient Europe; "Maximisation of water reuse in the EU (a new EU instrument)" Roadmap; Common Agricultural Policy (CAP);
- UN Sustainable Development Goals (SDGs), especially: SDG 6 "Ensure availability and sustainable management of water and sanitation for all", SDG 11 "Make cities inclusive,



safe, resilient and sustainable” and SDG 13: “Take urgent action to combat climate change and its impacts”.