Digital Single Market for Water Services Action Plan -Update

1. Introduction

The ICT4WATER cluster was established in 2012 at the initiative of the European Commission DG CNECT. It is a community of EU funded projects aiming to boost the digital transformation of the water sector, scoping at a more efficient and sustainable use of water resources. It started with five sister projects, all targeting digital water innovation, boosted in the following years by more EU projects joining the community. Today, there are over 60 EU-funded projects participating in the cluster.

The ICT4WATER cluster aims to foster collaborations between the member projects, to act as a hub for innovative activities related to digital water, creating synergies, organizing and participating at major exhibitions and scientific events, and disseminating results through major channels, ultimately contributing to EC strategic views and policies.

In 2018, the ICT4WATER published Digital Single Market for Water Services Action Plan, detailing its mission, reflecting the status and needs for a digital water transition at the time. Specifically, this Action Plan proposed actions relating to technology, market, business, awareness and possible regulation (policies) in the area of ICT supporting the water domain and its interactions.

The digital landscape, as well as the related digital transition for all sectors (including the water sector), is a domain that changes fast, with new cutting edge innovative technologies being introduced, deployed and implemented continually, while the needs and requirements for the industry, the economy and the society at large, are also changing.

The impacts of climate change, as well as the need for mitigation and adaptation measures, the Green Deal targets, unpredicted global situations (e.g. the COVID-19 pandemic, the recent energy crisis), all affect the context, future direction and vision of digital water transition and services.

Hence the need to update the original Digital Single Market for Water Services Action Plan (published in 2018), taking into account and reflecting the technological innovations and progress made in the last five years, the gaps (old and new), the needs and the (new) requirements.

This document details the revised Digital Water Services Action Plan. The document is structured as follows: Section 2 presents an overview at higher level of the changing landscape for Digital Water, which triggered the need for the update. Section 3 presents the main changes in the structure of the ICT4WATER cluster and the related Action Plan. Section 4 includes the revised Digital Single Market for Water Services Action Plan.

2. Digital Water Transition- A changing landscape

The ICT4WATER cluster was created in 2012 and published the initial Digital Water Action Plan in 2018. This document reflects the gaps and needs for digital water in the period 2013-2018. These can be summarised as follows:

The gaps and needs in the domain of Digital Water can be summarised as follows:

- Decision Support Systems (DSS) and strategic/operational “optimal” management of water systems were a main topic for research and innovation actions.
- The development of Smart Water applications, with the introduction of sensors for real time management, with emphasis on the implementation of computational models and tools
- Standardisation/Interoperability, which was a major issue, because the water sector was lagging behind other critical infrastructure sectors.

- Research and innovation actions for ICT and water were focused almost solely on the water sector alone, i.e., the interactions with other sectors (e.g. energy, agriculture) were (very) limited, as well as cross-sector research projects.
- In short: The two key words on which most EU funded projects were focusing were: “smart” and “optimal”.

In the last few years the situation for ICT and water, as well as the future trends have considerably changed:

- Broader aspects are now relevant and prominent for ICT and Water, such as links with Green Deal policies, across sector synergies (e.g. with the energy sector) and ecosystem/biodiversity issues.
- New themes and topics have been linked to the ICT and water sector, such as Circular Economy, resilience to climate change, citizen science, social awareness, interactions with water users.
- European Common Data Spaces are being promoted and created (also for water). This gives rise to new related challenges, such as Data Management structures, data models, data management tools, cybersecurity, blockchain, ethics, legal issues (e.g. GDPR considerations) and data governance.
- Smart Cities actions, Digital Twins, (Internet of Things) IoT ecosystems, Artificial Intelligence (AI) methodologies, AI credibility and robustness issues are becoming mainstream and prevalent, giving rise also to related secondary topics (e.g. explainable AI-XAI, digital image processing, autonomous supervised/unsupervised systems).
- Virtual Reality (VR) and Augmented Reality (AR) tools and applications have started to be introduced in the water sector, as well with Serious Gaming (SG) for interaction with stakeholders, training and decision making.
- Supercomputers and new IT architectures emerging (e.g. cloud services, federated systems, edge computing, quantum computing)
- In short: Currently and for the coming years, the emphasis is on “Intelligent” , “Holistic” , “Across” (themes and sectors), “Co-creation”/”Interaction” (with stakeholders) and “Virtual”.

The updated Digital Single Market for Water Services Action Plan takes into account all these challenges and future trends and includes them in specific actions.

3. Main changes in the Digital Single Market for Water Services Action Plan update

Apart from the changes in directions and topics mentioned in the previous section, the ICT4WATER cluster changed also its structure and Action groups as follows:
The previous Water Action Plan was implemented with the cluster is being organised in seven Action Groups (AG).
There were four technology-oriented Groups:

A. *Interoperability and Standardization (I&S)*
B. *Data Sharing (DS)*
C. *Smart Water (SW)*
D. *Cyber-security (CS)*

There were also three other groups working on

E. *Actor Awareness (AW)*
F. *Policy (PO)*
G. *Business models (BM)*

With the current updated Water Action Plan, the AGs have been re-organised. There are now only 6 AGs, with:

- The I&S and DS groups merging in a single AG,
- The SW group expanding to new topics, to include Artificial Intelligence in a more prominent role
- The CS group becoming broader, to encompass physical and cyber threats/hazards (including resilience to climate change hazards)

- The AW group also becoming broader to encompass VR, AR, SG, citizen science and stakeholder co-creation/interaction topics and actions.

Consequently, the new structure and thematic topics for the Action Groups of the ICT4WATER cluster and the Actions included in the updated Water Action Plan are:

A. Enabling Data Sharing (including interoperability and Data sharing/exchanging)
B. Intelligent and Smart Systems (including AI, data analytics, smart sensors, DSS)
C. Critical Infrastructure Protection (Physical and Cyber Threats)
D. Actor Engagement and Co-creation (including AR, VR, Serious Gaming and Citizen Science)
E. Policies
F. Business models

Another change in the way the ICT4WATER cluster operates and implements actions, is the increasing clustering among sister projects funded under the same call (e.g. the DW2020 cluster), which leads to combined outcomes from multiple related projects and increases the efficiency and impact of the ICT4WATER cluster and the pathways for the implementation of the actions of the Digital Water Action Plan.

4. Updated Digital Water Action Plan (2023-2033) - 10 years

This section presents in detail the updated Water Services Action Plan, with specific topics, actions, activities and timeline.

***Please note**: Under the same action, timelines of activities are shown separately only if the differ from each other. Otherwise, if they are concurrent there is only a single timeline for all the activities under the same action.*

#	Action	Activities	Timetable	Implementation Instruments
		Enabling data sharing		
DS_1	Development and extension of smart data models	**Activity 1** Elaborate an open, accessible space to share different data models to represent water and cross-domain information. **Activity 2** Develop a repository of data to upload scientific and industrial water-related data for further reuse, interlink, etc. **Activity 3** Develop and publish open interfaces to consume and access both data models and datasets related to water and cross-domain. **Activity 4** Promote and accelerate the development of smart data models and datasets at cross-domain.	2023-2026	• Smart Data model repository • Establishing synergies with water related domains (e.g. energy, agriculture, industry, climate change, biodiversity, health). • Dedicated research and innovation actions (Water Data Spaces) • H2020 and following Funding Schemas • Current funded activities • European, National, Regional Funding schemas
DS_2	Demonstrate value of Data Sharing in the water sector through successful examples	**Activity 1** Collect examples of successful experiences related to water and cross domain **Activity 2**	2023-2026	• Dedicated research and innovation actions (Water Data Spaces) • H2020 and following Funding Schemas • Current funded activities

		Make examples visible for the water community involving ICT4WATER cluster members an relevant successful cases. **Activity 3** Promote and reinforce the link to other related domains (energy) in terms of sharing data.		• European, National, Regional Funding schemas • Water-Oriented Living Labs successful models and experiences.
DS_3	Identify and overcome barriers for data sharing	**Activity 1** Survey and mapping of data sharing with other sectors **Activity 2** Analysis of barriers caused by data sharing at cross-domain, national and multi-national level. **Activity 3** Learn and share experiences with other related domains in terms of data sharing barriers.	2025-2028	• Link to other AGs • H2020 and following Funding Schemas • Current funded activities • European, National, Regional Funding schemas
DS_4	Extend and expand water interoperability and standardization	**Activity 1** Contribute to existing water and cross-domain standards at multi-level scale (interoperability mechanisms, ontologies, monitoring tools, context-brokers, etc.) **Activity 2** Engagement and reinforce collaboration with EU and worldwide standardization bodies on water standardization (e.g. ETSI, OGC, ISO, etc)	2023-2033	• Cross-European Water standardization • Associations, working groups • H2020 and following Funding Schemas • Current funded activities • European, National, Regional Funding schemas • Utilisation of Water-Oriented Living Labs to test multi-sectoral interoperability and standardisation.
DS_5	Towards the establishment, consolidation and expansion of water-climate data spaces	**Activity 1** Establishing mechanism for water data governance and accessibility at EU/International	2025-2033	• Associations/ working groups • H2020 and following Funding Schemas • Current funded activities

		level (collaboration with Policy AG). **<u>Activity 2</u>** Ensuring water data sovereignty and provenance for sustaining further reuse and maintenance (collaboration with CIP AG). **<u>Activity 3</u>** Collaboration with water and data-space associations to consolidate the establishment and expansion of water dataspace.		• European, National, Regional Funding schemas • Water associations • Data-Space Associations • Dedicated research and innovation actions.
DS_6	Sharing of climate models scenarios and predictions and use for the digital water sector, as needed (e.g. for adaptation to climate change and resilience projects	**<u>Activity 1</u>** Introducing a data sharing mechanism/space to make recent climate model predictions that relate to future water availability and derived quantities (through climate scenarios), which is very important.	2023-2033 (Bi-annual update)	• Internal AG activity • Current funded activities • Water associations • Data Space associations *Comment/Necessity: We still see 10+ year old climate model generalizations being used for policy/decision making, even though climate science is advancing rapidly. This is a risk for the water industry.*

#	Action	Activities	Timeline	Instruments
		Intelligent and smart systems		
ISS_1	Deployment of IoT enablers and data models for smart sensors and data collection	**Activity 1** Utilisation of IoT platforms (e.g. FIWARE) and context brokers **<u>Activity 2</u>** Promote the development of IoT compatible water data models **<u>Activity 3</u>** Create and promote a library of IoT data models in public domain (e.g. FIWARE)	2023-2026	• HE and following Funding Schemas • Current funded activities • Synergies among currently funded projects • Synergies with data sharing AG
ISS_2	Use of AI techniques for big data	**Activity 1**	2023-2027	• HE and following Funding

	analytics for the water sector	Promote the use of advanced AI techniques for data analytics and decision making (e.g. deep reinforcement learning) **<u>Activity 2</u>** Create a library and repository of AI models and algorithms related to water (as reference applications, with the objective promoting implementation at other utilities and by SMEs/developers)	2027-2033	Schemas ● Current funded activities ● Synergies among currently funded projects ● Cross-synergies with other sectors
ISS_3	Digital twins for real/near time operational management of water systems	**<u>Activity 1</u>** Promote the developments of digital twins for various types of water systems, including predictive twins for designing and training (e.g. longer-term developments and stress scenarios) **<u>Activity 2</u>** Promote the use of advanced and innovative visualisation techniques for water system management **<u>Activity 3</u>** Promote the development and use of *virtual sensors,* i.e., calibration through AI for the detection of pollutants and other dangerous substances in water bodies through other metrics (e.g. temperature, pressure etc.)	2023-2027	● *Activity 1 will need to align with a collaboration between the ISS and AEC AGs, because of the complementarity with AEC_1* ● HE and following Funding Schemas ● Current funded activities ● Synergies among currently funded projects ● Water-Oriented Living Labs as field test for digital twins
ISS_4	Improve efficiency and circularity in water use and re-use	**<u>Activity 1</u>** Continue supporting and boosting smart city, smart agriculture and smart water/waste water system techniques and practices **<u>Activity 2</u>** Create synergies with smart activities in other domains (e.g. agriculture and energy) to	2023-2027	● HE and following Funding Schemas ● Current funded activities ● Synergies among currently funded projects ● Synergies with other sectors ● National funding schemes

		promote circularity **Activity 3** Promote public private partnership to leverage risks and opportunities		• Water-Oriented Living Labs to support the adoption of circular and systemic innovations.
ISS_5	Taking into account uncertainties (and deep uncertainty) for climate change adaptation for the water sector	**Activity 1** Promote the development and use of uncertainty simulation techniques (e.g. probabilistic, long-term etc) for DSS for the water sector and methods under deep uncertainty. **Activity 2** Seek and promote the synergies with stakeholders in the formulation and simulation of uncertainties due to climate change, but also to other types of extreme events (e.g. pandemics) and take them into account in DSS for climate change adaptation.	2023-2033	• HE and following Funding Schemas • Synergies among AG • Synergies with CLIMA projects and initiatives • Synergies with MISSION calls/actions • Synergies with Water4All partnership

#	Action	Activities	Timeline	Instruments
Critical Infrastructure Protection (Physical and Cyber Threats)				
CIP_1	Enable Risk-Informed Decision Making through Enhanced Situational Awareness	**Activity 1** Link Water CI data to relevant data-sharing initiatives at European level (within and across CI sectors) and applying the knowledge shared to influence policies and processes.	2023-2025	• Promote in the framework of standardisation bodies and related entities (BDVA) Relevant instruments in Horizon Europe Cluster 4
CIP_2	Increase awareness about the water sector as a key player in Critical Infrastructure protection policies to ensure water-aware input to future CI policies	**Activity 1** Provide informed input to public consultations based on the collected insight from Water industry	2023-2033	• Internal AG activity (survey, contributions to public consultations). • EU Water ISAC (?) - see explanation below on CIP_7
CIP_3	Explore, promote and conduct collaborative work to build common frameworks together with other sectors (energy, trading, industry, transport, telecommunications...)	**Activity 1** Establish and nurture collaboration with other clusters (e.g. the ECSI) and define common activities (STOP-IT is co-founder of ECSI)	2023-2025	• Cross European Industry clusters • Horizon Europe and following Funding Schemas

CIP_4	Horizon scanning type exercise to assess the state of critical infrastructure protection and point towards new emerging threats (linked to digitalisation in the water sector).	**Activity 1** Live mapping of threats and exposure of CIs with a focus on emerging threats (e.g., AI-driven attacks, ransomware…), but also possible over-dependence on digital technologies as a potential failure mechanism.	2023 – annual update	• Horizon Europe and following Funding Schemas • Current funded activities • European, National, Regional Funding schemas •
CIP_5	Improve critical infrastructure security and resilience by advancing research and development solutions	**Activity 1** Create and maintain a repository of the solutions on CI protection created by the ICT4 water projects	2023 – biannual update	• Horizon Europe and following Funding Schemas • Current funded activities • European, National, Regional Funding schemas •
CIP_6	Analyse infrastructure dependencies, interdependencies, and associated cascading effects	**Activity 1** Ongoing effort connected to the collaboration activities established with other entities	2026-2033	• *This action will depend on contributions new projects (related to resilience) might provide.* • Horizon Europe and following Funding Schemas • Current funded activities • European, National, Regional Funding schemas
CIP_7	Strengthen coordinated development and delivery across ICT4Water (and ECSI) projects of technical assistance, training, and education.	**Activity 1** Provide regular input on the cluster projects into the AG meetings and establish collaboration spaces to provide bi-directional information flows (use cases, goals, approaches, solutions)	2023-2033	• Internal AG and cluster activity • EU Water ISAC, (inked with the USA water ISAC). The aim is to share knowledge, experiences, best practices on the topic of cybersecurity among water operators.

#	Action	Activities	Timeline	Instruments
		Actor engagement and co-creation		
AEC_1	Promotion and development of Digital techniques (Serious Gaming, Augmented reality, Virtual reality) for stakeholder engagement, education and policy making for the water sector	**Activity 1** Promotion and utilisation of Serious Gaming (Digital) for education, stakeholder engagement and policy making **Activity 2**	2023-2026	• *All activities related to AEC_1 will need to align with the ISS_3 Activity 1*

		Promotion and adoption of augmented reality for education and engagement **Activity 3** Promotion and deployment Virtual reality for citizen awareness, stakeholder engagement and training **Activity 4** Development of Augmented Reality applications for the maintenance of the water infrastructure	2023-2027 2023-2028 2026-2033	● HE and following Funding Schemas ● Current funded activities ● Synergies among currently funded projects ● Synergies with smart and intelligent systems AG ● Stakeholders engagement based on the Water-Oriented Living Labs approach.
AEC_2	Raise awareness and involve stakeholders in the design of digital solutions for the water sector , considering cross-actor interactions (managing authorities, decision makers, water professionals, entrepreneurs, managers, operators, consumers, citizens, etc.).	**Activity 1** Promote and boost the active participation of stakeholders and citizens in the development of digital solutions for the water sector **Activity 2** Engage stakeholders from other sectors (e.g. energy, agriculture, navigation, biodiversity, health) for the design and validation of digital solutions (nexus activities) **Activity 3** Efficient use of social media for raising awareness for digital water, climate change adaptation, health and climate risks and water use and consumption.	2023-2026 2026-2033 2026-2033	● HE and following Funding Schemas ● Current funded activities ● Synergies among currently funded projects ● Cross-synergies with other sectors ● Water-Oriented Living Labs for inclusive decision-making process
AEC_3	Involve actively citizens in data collection (citizen science initiatives), citizen observatories and crowd sourcing for the water sector	**Activity 1** Promote citizen science projects for data collection and validation for the water sector, with a focus on the benefit for citizens **Activity 2** Promote the use of crowdsourcing	2023-2027 2025-2033	● HE and following Funding Schemas ● Current funded activities ● Links with existing citizen science observatories for the water domain. ● Water-Oriented Living

		techniques (including social media crawling) for data collection to use in alerts and emergencies of water hazards (e.g. flooding, pollution of water sources etc).		Labs for citizens inclusive engagement. .

#	Action	Activities	Timeline	Instruments
		Policies		
POL_1	Upgrade policies to enhance real time, accurate, water monitoring and measurements through digital solutions and smart sensors	**Activity 1:** Promote with the EC the inclusion of mandatory real time water quality monitoring (through smart sensors and digital solutions) to directives and legislation, so as to improve the quality of water bodies and contribute to zero pollution targets, especially for storm water systems and combined sewer overflow. Today smart water quality monitoring is not mandatory in legislation and directives. **Activity 2:** Promote with the EC the introduction of mandatory real time measurements through smart sensors to all other types of water related data (e.g. water quantity, water levels, water consumption etc). **Activity 3** Establish guidelines and policies for the deployment of forecasting systems based on real time monitoring and sensors, to make it easier for the stakeholders to implement the technologies and smart solutions.	2023-2026 2023-2026 2026-2033	• DGs • Review water directives including ICT experts. • Dedicated Research and Innovation actions • Utilisation of Digital Twins for Water-Oriented Living Labs
POL_2	Technical standards and legislation related to digital water	**Activity 1** Investigate and work on the applicability and legally binding nature of specific technical standards, mainly due to the revision of old and obsolete standards. Clarifications are needed in this domain.	2023-2033	• DGs • International Standardisation organisations • European, National, Regional Funding schemas

POL_3	Water security regulations	**Activity 1** Work and investigate ways to include water security as whole to EU regulations, linking also with relevant EU directives. Sectoral regulation or guidance specific for water distribution networks and water bodies should be introduced to integrate the aspects of water security which are currently treated by generic regulations, taking into account the role of different actors, the coordination of different plans and how the different actors involved will reconcile different and even contradictory needs. **Activity 2:** To promote further security regarding food, energy, water and health in the light of growing geopolitical instability.	2026-2033	• DGs • Review water directives including ICT experts. • Dedicated Research and Innovation actions • WE Water-Smart Society values and principles • Synergy and exchange of experience with the Water4All Partnership
POL_4	Data sharing, public data and privacy management policies	**Activity 1:** Continue upgrading legislation providing common sets of terms and conditions to be used, in coordination with the actions related to the European Data Spaces. Provide a policy framework to include open data clauses in contracts between local authorities and operators. Furthermore, identify potential privacy risks and propose privacy---preserving solutions (at the technical and policy levels) to facilitate data sharing. There is still reluctance in the water sector to data sharing. **Activity 2:** Promote legislation to enhance data exchange and data sharing across relevant sectors (e.g. energy, agriculture etc) through policies and legislation **Activity 3** Reduction of legislative fragmentation and	2023-2026 2023-2026	• Cross European Data-Water Associations working group. • DGs • Stimulate water private sector investments • European, National, Regional Funding schemas • Water-Oriented Living Labs to test the impact of changes in the policy framework • *Comment: the actions for Activity*

		establishment of clear water governance bodies. Water is a fragmented domain where decision-making legislative responsibilities in some cases are overlapped or unclear. This needs to change **Activity 4:** Promote a legislative framework for the application of INSPIRE[1] Directive for Geospatial data generated in public services, which are common property, in line with the European Data Spaces.	2026-2033 2026-2033	*3 will be re-discussed before it starts, according to the conditions at the time.*
POL_5	Policies for co-creation, citizen science and crowd sourcing	**Activity 1:** Promote long-term continuity and more relevant research activity for co-creation, in all domains of the water sector for the development of digital solutions. Promote also through policies continuity for citizen science and crowd sourcing for data generation and validation.	2026-2033	• DGs • Dedicated Innovation Actions and CSAs, especially about the validation of data collected through citizen science • Synergies with the Water4All partnership on science-policy interface.
POL_6	Integrate digital water components into water eGovernance (new or existing urban plans; emergency plans; infrastructures plans; etc.)	**Activity 1:** Develop and deploy data-intensive services for evidence-informed policy-making Initiatives by promoting the usage of effective data management infrastructures including hybrid approaches supporting (i.e. for Water Security Plans-see also POL3). **Activity 2:** Develop and deploy smart water solution to improve management of governance complexity, uncertainty, divergent economic and political interests and cultural discourses.	2023-2026 2026-2033	• Dedicated Innovation Actions and CSAs • Stimulate water private sector investments • European, National, Regional Funding schemas • WE VLTs and digital WGs Cluster

#	Action	Activities	Timeline	Instruments

[1] http://inspire.ec.europa.eu/

		Business models		
BM_1	Further developing digital water business models for different applications and approaches (Smart Cities, Smart Agriculture, Smart Industry, Smart Water resources management)	**Activity 1**: *Monitoring (beyond the projects) effectiveness of business models and market uptake of digital solutions developed within ICT4water cluster projects*. **Activity 2**: Promote research and application of Digital Tools for the creation of a digital assets economy in agriculture and the use of water for irrigation **Activity 3**: Development and promotion of green business models for digital water, for investments linked to the Green Deal and climate change adaptation (links also with the Policies AG).	2023-2033 2023-2033 2025-2033	• Data-Water Association/ICT4Water cluster working group • Sector investments • Innovation actions • Water-Oriented Living Labs as real-life environments to develop and test effective business models for the deployment of digital solutions.
BM_2	Continue developing and applying tools for assessing the maturity, costs and benefits of digital water, (including social and environmental aspects) deployments including performance benchmarking (continuation of previous actions) *-Identify, monitoring and assess main drivers and overcome barriers for market update*	**Activity 1** Identify, monitoring and assess main drivers and overcome barriers for market update **Activity 2** Continue the development of key performance metrics and benchmarking frameworks for the assessment of digitalisation levels, based on SDGs and the work done within the ICT4WATER cluster so far. **Activity 3:** Continue developing an open access benchmarking tool for assessing digital water implementation status. Develop a process for future updates to the tool and self-assessment process. **Activity 4**: Promote benchmarking and interrelated comparison across water and wastewater operators of smart technologies, considering	2023-2028 2023-2028 2028-2033 2028-2033	• HE Funding Schemas • Dedicated Research and Innovation actions • Stimulate water private sector investments • European, National, Regional Funding schemes • Water-Oriented Living Labs as real-life environments to test, validate and assess the market uptake of digital solutions

		multiple types of water bodies (urban, agriculture, freshwater and transitional waters)		
BM_3	Analysis and monitoring of digitalisation plans and tenders in Europe	**Activity 1** Monitoring and analysing Next Generation EU funds, EU taxonomy, Innovation/ Green Public Procurement	2023-2033	● Industry 4.0/ 5.0 Investments ● Water-Oriented Living Labs as real-life environments to test, validate and assess the market uptake of digital solutions