DIGIWATER

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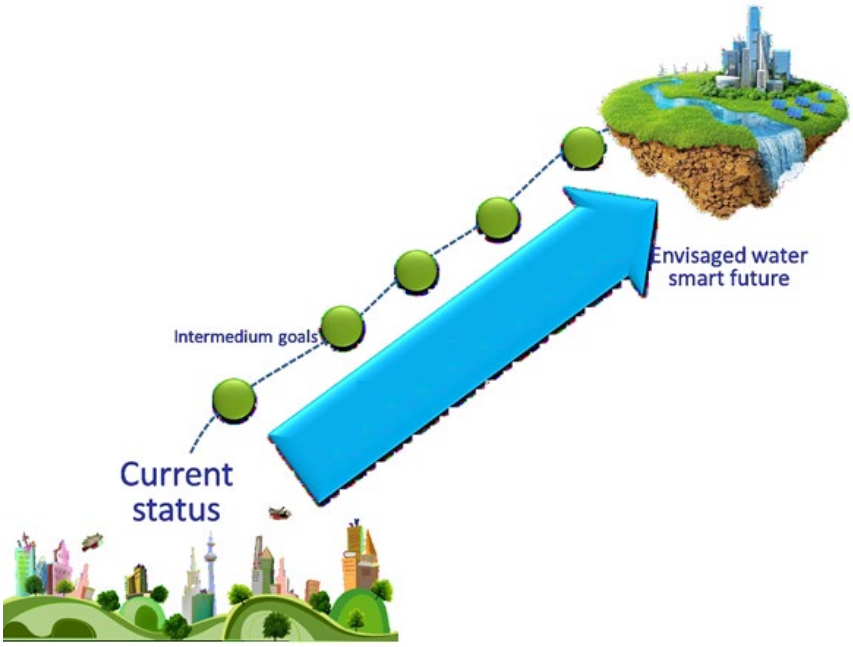
R1.3 DIGITAL WATER ROADMAP FOR EDUCATION, RESEARCH AND INNOVATION



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EXECUTIVE SUMMARY

"**Digital water**" is an important concept that underlies the vision of Water Europe, based on the projected development of a world in which networks that interconnect the control and monitoring systems of water-related processes, sensors, transducers, generate large amounts of data. The ***DIGIWATER*** project aims to develop new, innovative and multidisciplinary approaches to teaching and learning through the use of multidisciplinary curricula integrated with digital learning tools and virtual facilities such as shared labs / software with access to Cloud systems and Problem-Based Learning. Better training of graduates will stimulate the entrepreneurial spirit and skills of higher education and company staff who use innovation camps and facilitate the exchange, flow and co-creation of knowledge by creating stakeholder courses that integrate learning, academic, corporate and professional development for external specialists.

DIGIWATER focuses on how to achieve these goals by better training tomorrow's decision makers, innovators and engineers, using collaboration between universities and SMEs.

The current status of digital water transformation in academia, government and business is considered to be at a moderate level. There is a need for better training of specialists in the field of water, as well as candidates for positions in this field. Advanced monitoring technologies and smart equipment are largely needed to transform data into a digital format.

Thus, in order to increase the digital transformation of water in these sectors, the involvement of the educational sector is very important. The following actions are considered priorities:

- Increasing the level of staff training in support of digital water transformation in general seems to be higher in the Academy and Enterprise sectors.
- It is necessary to develop a strategic water education plan, modifying the curriculum from primary, secondary and college education. Within the study disciplines, water and information technology should be interconnected, thus achieving transition to the transformation of water digitization.
- Development of guides of good practices and behaviors in the field of water based on the development of new databases and new methodologies for their use starting from universities and their laboratories. Development of data platforms of processes that can be used in education, thus involving the education sector in the real issue of water systems.
- Use of geographic information systems, simulation tools and sensors in teaching issues. Completing the curriculum with topics that include new virtual reality technologies and artificial intelligence applied in the field of water.
- Involvement of students in EU funded projects such as Citizen Science by Students with a focus on the water sector.
- Inclusion in projects of separate work packages regarding education for the water sector

- Initiating discussions in schools and universities with pupils and students mainly, using global and digital area to attract the students and to transmit the information within educational systems.

Increasing the level of cooperation between different sectors has an important role in achieving the digital process of water transformation. This can be achieved through free access to environmental data as well as by sharing data and their availability. The actions required are the following:

- Development of a common environmental data collection platform, which can be managed by a public-private consortium.
- Establish anonymous sharing data systems to avoid conflicts with data confidentiality requirements, by selecting representative data samples. A data taxonomy and a priority of the first data sets for sharing must be defined.
- Defining requirements for data sharing at product, manufacturer, brand level. Development of data platforms as a result of local initiatives that can then be connected to national and even industrial level platforms.
- Defining a legal framework for data sharing.
- Develop funding mechanisms to enable the creation of open databases with free access for citizens.
- Establish well-defined data governance procedures
- Communicating open data policies and providing incentives, promoting business model prototypes based on Data sharing.
- Identify use cases involving cross – domain objectives and datasets.
- Generalize the publication of standardized APIs for data access, identification of data sources and data markets, collaborate with open data experts between sectors.

Planning and implementing an efficient digital transformation strategy will lead to benefits for each sector of activity. The actions designed in this case are:

- Creating a secure, multi-user data sharing platforms.
- Development of goal-oriented guides, integration of IT skills with the hydraulic ones at the level of education.
- Promoting Living Lab demonstrations and laboratories to increase confidence and trust.
- Promoting the use of digital solutions as a cost-effective strategy, the need for a cost-benefit approach to encourage digital adoption.

1. INTRODUCTION

It may be said, without doubt, that "water is life". It is a prerequisite for human, animal and plant life, as well as an indispensable resource for the economy. At the same time, water plays a fundamental role in the climate regulation cycle. The EC works towards linking the physical and digital world forwater solutions tackling the societal challenges of water availability, quality, and climate-change-relatedimpacts, while the water industry goes through a digital revolution.

"Digital water" is an important concept that underlies the vision of Water Europe, based on the projected development of a world in which networks that interconnect control and monitoring systems of processes related to water, sensors, transducers, generate large amounts of data. This data, when used by innovative artificial intelligence systems, canhelp make decisions that could have a significant impact at all levels of government, from the level of control of simple processes to the level of governance at European level. Thus, "digital water" is now seen not as an "option", but as an "imperative".

DIGIWATER project aims to develop new, innovative, and multidisciplinary approaches to teaching and learning by using multidisciplinary curricula integrated with digital learning tools and virtual facilities like sharing labs/software with access to cloud systems and Problem Based Learning. Better graduate training will stimulate entrepreneurship and entrepreneurial skills of higher education teaching staff and company staff using Innovation Camps and will facilitate the exchange, flow, and co-creation of knowledge by creating inter-stakeholder courses integrating academic, corporate learning, and professional development for external specialists.

DIGIWATER focuses on how to achieve these goals through better preparation of the decision-makers, the innovators and engineers of tomorrow, by utilizing the collaboration between universities and SMEs.

2. STAKEHOLDERS ONLINE-SURVEY

The first step in analysing the **current state of the water sector** and **how digitalization is transforming this sector** was to initiate a consultation of project participants to provide an overview of the current state of digital in the water sector.

Information on the interests of project stakeholders in the field of digital water by sectors Academia,Enterprises,Governmentand Society - was analysed and documented.

The information collected from stakeholder groups referred to the **current state of digital transformation**, **interests, cooperation and interdependence**, the **needs generated by the concept of "digital water"** and the **anticipated benefits of "digital water".**

ACADEMIA

The Academic sector considers that the currently, the presence of **digital transformation**information in its water-related curriculums seems to be mostly moderate while in research, the interest is high.

It is considered that the **digital skills** mismatch between water curricula and the needs of the water industry is on a level moderate to significant, tilting towards moderate. Staff training in managing cybersecurity and water digitization issues is generally low.

The **tools and technologies** used mainly in universities are represented by Simulation tools, Sensors and Geographic Information Systems, Remoting sensing and the Interaction between different tools. The Augmented and virtual reality technologies are rarely used in the field of Academia, currently.

There is a great interest of the Academic sector for the **modernization of current curricula** by incorporating new teaching materials, in order to better train future specialists in the field of water.

In the area of **cooperation**, the conclusion was that cooperation between academia and the government and society was moderate, whilecooperation with enterprises was moderate to low. In this case, the conclusion regarding the issue at hand would be that overlap between the academic sector with the other sectors is mainly moderate.

The most important role in **achieving the digital transformation of water** is played by the government, followed by technology providers and end-users. The academic community, as well as consultants, have the least influence in achieving the digital transformation of water. Utility owners, employees, and employers have a medium role in achieving the goal of digitization.

The academic sector considers as the **most significant barrier in digitalization**, the lack of funding and the lack of specialized human resources, followed by the hardware/software and network

deficiencies. The lack of protection against cyberterrorism and the dependency on other sectors is considered to be the least of the barriers.

The **level of training of new water specialists** is considered to be rathermoderate than well-trained, but there are a number of assessments that revealthat new water specialists are in the not well trained category.

The most **important outcomes of the digitalization** of the water industry are advanced monitoring technologies and intelligent equipment. The integrated water management tools seem to be also important, while the least important outcomes are the advanced e-learning tools and the industry engagement.

"Effective monitoring and data collection" is the **most important benefit of water industry's digital transformation**. In contrast, "Increased entity reputation" is believed to be the least important benefit.

GOVERNMENT

The **current digital water transformation** status in the Government sector, according to the majority of the participants, is moderate. The level of training of the personnel in supporting digital water transformation in general and in regards to cybersecurity is also moderate.

The level of **cooperation** between government and enterprises is moderate or even low, and with the academic sector, this cooperation is largely moderate. As for cooperation with society, it is moderate to low.

Concerning the level of **interdependency** with the Enterprises, which is moderate, and the same trend applies to the Government. On the other hand, this level is below moderate in regards to Society.

The communities have the most crucial role in **achieving the digital water transformation**, together with employees, utility owners, and the government. The end-users seem to be having the least crucial role.

The lack of funding and the current management policies coupled with the issue of specialized human resources isconsidered **to be the most important barrier** according to the stakeholders of the Government sector. The least important barrier is assumed to be the hardware, software, and network deficiencies.

The **level of preparedness** of the newly recruited water specialists for the changing needs of the water industry is considered to be moderately prepared, by the majority of the participants.

The government sector has a key role to play in **the digital transformation of water**, as it owns and manages numerous water-related databases for monitoring results and other measurements. In this process of transformation, it is absolutely necessary that all data and information regarding water be available in a digital format that can be easily accessedand is easy to use. The conclusion was that data

format transformation is feasible or moderately feasible. Few opinions have argued that this is not very feasible but neither has anyone agreed it be very feasible.

The **most important result of the digitization of the water industry** is considered as the possibility of saving data in a database that is easy to use and access. End-user engagement is much less important.

The **most important benefits of the water's industry digital transformation** are "Securing the water quality" and "Effective monitoring and data collection".

ENTERPRISES

Most participants in the Enterprise sector consider that **the current state of digital water transformation** is moderate and staff training is generally high. In terms of cybersecurity, it is considered that the level of training of staff in supporting the digital transformation of water is moderate. There are few opinions that affirm that the training in this field couldbe of a higher level.

The Enterprises' **cooperation** with other sectors seems to be quite low. In addition, their interdependency with the Government is moderate to very low, with the Academic sector mainly moderate to low, and with the Society, it is mostly low. Most Enterprise sector participants believe that government plays the most important role in the digital transformation of water, followed by technology providers and academia. Consultants are considered to have the least crucial role.

The **most significant barriers to the digital transformation of water** are considered by participants in the Enterprise sector as lack of funding, data limitationsand hardware/software and network deficiencies. Most Enterprise professionals consider that the lack of specialized human resources is not an important barrier.

Most of the participants in the Enterprise sector consider that specialists recruited in the field of water have a moderate **degree of preparing** and very few believe that they are well trained or not at all prepared. It is worth mentioning that none of the participants believe that the specialists recruited in the water are very well prepared.

The **most important outcome of digitization** in the water industry for the Enterprise sector is an accessible and easy-to-use database and integrated water-related process management tools. Advanced monitoring technologies and end-user involvement seem to be the least important outcome.

The majority of Enterprise sector participants consider that "Better quality of services" is **the most important benefit**, followed by "Improving productivity and efficiency" and "Easier data exchange". The least important benefit according to their answers is "higher profitability".

3. SURVEY CONCLUSIONS

The current digital water transformation status of the Academia, the Government and the Enterprises sector, according to the participants, is considered to be at a moderate level. The level of training of the personnel in supporting the digital water transformation in general seems to be higher in the Academia and the Enterprise sectors. Geographic Information Systems, Simulations tools and Sensors are the most widely used tools, in contrast to Virtual reality technologies and Artificial Intelligence, which are almost not used.

The level of interdependency and the cooperation between the various sectors, there is a consent as it being moderate to low, and it is believed that the **Government and the Technology Providers** as having the most crucial role in achieving the digital water transformation process.

The lack of funding is the most important barrier for all the sectors, followed by the lack of specialized human resources in the Academia sector, the current management policies in the Government sector, and the hardware/software and network deficiencies and data limitations in the Enterprise sector.

The survey has highlighted the need for better preparing the newly recruited water specialists for entering the water industry, as well as the need for an accessible and user-friendly database in the Government and the Enterprise sector. Advanced monitoring technologies and intelligent equipment are mostly needed by the Academia sector. It is worth mentioning that the majority of Government stakeholders answered that transformation of data into a digital format is feasible.

Each sector believes it will benefit from the digitalisation in a different way as the survey has shown, and the fact that the academics are interested in upgrading their current curricula, which will lead to better preparing the future water specialists for entering the water industry, is also an important factor towards a successful digital transformation.

4. "WATER DIGITALISATION"WORKSHOP

The second step in the analysis of digital water transformation was represented by the organization of a workshop that brought together specialists from all sectors concerned, with the role of conducting an idea debate to identify factors that block or aid the digital transformation of water.The brainstorming phase was structured into 5 segments following the subjects: People, Organisations, Technology, Data, and Governance& Policy.

Discussions in the workshop led to the identification of more than 100 factors that block or slow down digitization in the water sector or that accelerate digitization. From these, a number of 5 priority factors were chosen, based on the participants' vote. Ideas on possible actions were collected for all these priority factors.

The Anchors & Engines retrospective was used to identify blocking or slowing down digitalisation factors in the water sector or speeding it up. It allowed to create take away actions for the next sprint to ensure that the project can meet the stakeholders' needs.

The context in which the workshop participants discussed and developed ideas for "motors and anchors" related to water digitization, was started by the following examples:

1. **Engines**

- Open participation, fair rules of conduct and common standards to promote trust and privacy.
- Open data marketplaces create entrepreneurial opportunities and level the playing field for industrial data sharing.
- Boosting AI/ML technique for unlocking new levels of efficiency.
- New professional opportunities tied to digital skills or monetization of shared personal data.
- New business models like the valorisation or monetisation of data assets.

2. **Anchors**

- General uncertainty around data policies and challenge of coordination across countries / cultures / languages.
- Lacking methodologies for data sharing and interoperability as well asclear guidelines to determine the market value of data assets.
- Barriers to scale beyond POCs including privacy, interoperability, security, and quality.

- Data driven transformation needed across products, processes, platforms, partnerships and people.
- Needs of market rapidly evolving and large portion of workforce need reskilling/upskilling.

5. FRAMEWORK: SMART WATER VS WATER SMART

The vision - Being a smart water society and economy - is a process of transformation guided by set strategic social, economic, governance, environmental, and technical objectives.

Pressures - Growing demand for water from economic activities and increasing water stress.

Challenge - need for alternative water resources of various qualities for multiple users, optimal use and reuse, etc.

Opportunities - Generate value from and through water and to extract value water.

Part of the solution -Smartening the water industry - it is about taking an existing processes and adding a layer of technologies that allow for better data collection and increased automation.

Smart water addresses the technologies deployed to support the implementation of a strategic agenda and advance towards a water smarter economy & society.

In a water smart economy and society, information from smart water technologies isconverted todata-driven decisions that help optimize resources, minimize climate impacts, and enhance health and safety.

6. AN EUROPEAN-GOVERNED DATA SHARING SPACE*

Data has to be considered as the new currency underpinning a new data economy. The data must be shared in a common space, at the European level and must be accessible. Achieving this space for sharing large volumes of data requires iterative implementation strategies.

The success of large-scale data sharing is closely linked to the concept of trust. Trust in:

- validity of the data itself;
- algorithms operating on this data;

- the entities that govern the data space;
- its favourable technologies;
- users who use this data (organizations and individuals as data producers, consumers, or intermediaries);

Expanding access to this widely shared data for applications such as Artificial Intelligence (AI) can successfully generate economic value. European-governed data sharing space can be considered as a milestone in the evolution of the European data economy

To achieve the required levels of trust, each of the following five main pillars must meet some if not all of the necessary conditions:

- **People** - to guarantee individual privacy and offer fair value or compensation of shared personal data. Reskilling and upskilling are needed to meet the evolving labour market's needs.
- **Organisations** - to rethink their strategy to place data at the centre of their value proposition.
- **Technology**-Saferexperimentationenvironmentstocatalysethematurationofrelevanttechnology behindtrustworthydata,dataaccessandalgorithms,together with Standardisation activities.
- **Data** - to embed sharing by-design methodologies and clear standard guidelines to determine market value of data assets (Free movement of Data).
- **Governance** - to adhere to the more advanced European rules, guidelines and regulations and promoteEuropean values.

Source:* ***BDVA*

7. TOP 5 PRIORITISED IDEAS. SUGGESTED ACTIONS.

Priority 1: Involve education sector

Action:

1 Include in strategic plan education - add to curriculum
   a. Primary/ Secondary till faculty??
2 Incorporate civil society - NGO's
   a. EC project to support
3 Interlink column“water” and “ICT” in education
4 Brand water - tell the narratives on digitalization in Water (movies/ stories)
   a. Water sector itself
5 Citizen science by students - joined projects
   a. EU funded
6 Create separate WPs in projects about including education
   a. EC - Water sector
7 Good behaviour / practices, using new databases and methodology to save data
   a. Universities and labs to tools
8 Develop platform data also for use in education - involve education in process
9 GO to the schools and universities to talk to them - go bottom up instead to top down
10 Use global and digital area to attract and work with the education

Priority 2: Free access to environmental data

Action:

1 Create common platform for gathering environmental data
   a. Public-Private Consortium

2 Define taxonomy of data and prioritize first data sets for sharing

3 Need legal framework requiring publishing of data

   a. Regulators

4 Develop funding mechanisms (taxes) to fund open data initiatives and provide free access to citizens/organizations

   a. Regulators

5 Anonymize data to avoid conflicts with data privacy requirements / take representative sample

6 Requirements for data sharing at product-level

   a. Brands/product manufacturers

7 Provide local initiatives/data platforms which connect to umbrella platforms at national/industry level

8 NGO-driven initiatives to drive local engagement

9 Develop social entrepreneurship / markets to enable data sharing

Priority 3: Data sharing and data availability

Action:

1 Establish well-defined data governance procedures

2 Communicating open data policies and provide incentives

3 Foster business model prototyping based on Data sharing

4 Identifying use cases involving cross-domain objectives and datasets

5 Generalize the publication of standardized APIs for data access

6 Mapping of data sources and data markets

7 Collaborate with Open Data experts across sectors

Priority 4: Data ownership is still a relevant issue

Action:

1 Find new business models and make people aware of new value propositions

   a. Utility Owner + Multi stakeholders

2 Improve cooperation and dialogue among all the stakeholders in the water data chain

   a. PPPs, EIPs and ETPs

3 Research and Innovation Funding Programme for Interdisciplinary projects

   a. EC and MS Governments

4 Create a better customers' awareness on their own needs and opportunities

   a. Technology solution providers

Priority 5: Lack of strategies for efficient digital transformation

Action:

1 Create data sharing platform: secure, multi-users

2 Make available an objective-driven guide

3 Integrate the IT and hydraulic competence (e.g. university)

4 Demonstration (e.g. living labs) to increase confidence and trust

5 Promote the use of digital solutions as cost-efficient strategy --> need of cost -benefit assessments to encourage the digital adoption (compared to current practices)

6 Awareness campaigns at all decision levels

7 Supporting approaches to choose among technologies vs the local targets

8 Increase integration between digital resources, utility management (e.g. compliance supporting)

9 Facilitate dialogue and interactions