THE FUTURE NEEDS OF HUMAN CAPITAL DEVELOPMENT IN SUPPORT OF A WATER-SMART SOCIETY

Prologue

Water Europe (WE) is the recognized voice and promotor of water-related innovation and RTD in Europe. WE is a value-based multi-stakeholder association that represents the whole diversity of the innovative water ecosystem. WE was initiated by the European Commission as a European Technology Platform in 2004. All WE activities are guided by its Water Vision and the ambition to achieve a Water-Smart Society.

The Water Europe White Papers are aimed at informing readers about complex water-related topics in a concise and targeted way and presenting WE's vision and philosophy on the matter. They present evidence-based opinions on multiple water-related challenges and on ways to overcome them.

WE White Papers are produced as part of the WE Collaboration Programme by the WE Vision Leadership Teams and the WE Working Groups. They target a wide variety of potential audiences, including the EU institutions, international organisations, the water industry, water users and water-related strategic stakeholders, the economic sectors, as well as media, analysts, regulatory and governing bodies, citizens and society at large.

Durk Krol
Water Europe Executive Director

Executive Summary

With 75% of all jobs depending on water, the importance of this natural resource goes far beyond the traditional water sector, the utilities' services, and water-dependent jobs mindset. The workers' individual capabilities are an asset which is influenced by the development and needs of not only the associated sector but also the world we live in. Moreover, the COVID-19 pandemic has demonstrated the urgency of increasing strategic and smart investments in human development around Europe.

Therefore, our Working Group focuses on **Human Capital** – the knowledge, skills, competencies, and attributes embodied in individuals that facilitate the creation of personal, social and economic wellbeing.

Three **key-findings** of this white paper demonstrate the pivotal the role of the **Human Element** as we move towards the Water-Smart Society:

1. Skilled labour is a key to success of the Water-Smart Society.

- **Reskilling programmes** are crucial for advanced training of unskilled labour which is being displaced by digitalisation in the water sector.
- **Lifelong Learning programmes** can foster adoption of innovations in the water sector.
- **Sectoral talent attraction strategy** is necessary, because waves in the economy are releasing labour from various engineering sectors that can be attracted to water.

2. Water educators must update study programmes to include emerging water specialisations that connect learning, research and practice.

- Digital water and cybersecurity.
- Circular economy.
- Nature-based solutions.
- Cities and basins of the future.

3. Social innovation in Living Labs requires strong competencies: problem solving, strategic planning, negotiation, etc. These can be acquired from capacity building projects and mentorship programmes.

Reinvigorating the human capital is indispensable to building a Water-Smart Society and contributing to achieving the EU Green Deal goals. There is room for a lot of improvements to strengthen the link between the workforce and the European priorities using the available tools in the European water sector.

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Introduction

The term 'human capital' is defined by the OECD as follows: the knowledge, skills, competencies and attributes embodied in individuals that facilitate the creation of personal, social and economic wellbeing[1]. The workers' individual capabilities are an asset which is influenced by the development and needs of not only the associated sector but also the world we live in.

The human capital in the European water sector is tailored according to employment, which mainly falls under the rubric of water-dependent jobs, so they are represented by three main functional categories: i) water resources management, including integrated water resources management (IWRM) and ecosystem restoration and remediation; ii) building, operating and maintaining water infrastructure; and iii) the provision of water-related services, including water supply, sanitation and wastewater management[2]. However, this structure is no longer sufficiently harmonised with the efforts aimed at forging a Water-Smart Society, transitioning to a circular economy, and emphasising the water-food-health nexus and the role of nature-based solutions. Furthermore, recurrent flooding and droughts bring new challenges that must be solved or faced. In addition, digitalisation and virtual developments are providing new innovative opportunities for the water sector, including developing working conditions, and data for the governance, processes and practices. As a result, there is a need to:

- Ensure water continues to be available for citizens, farmers and industry.
- Manage the data to optimize the use of water, avoid shortages, and deal with pollution or contamination.
- Prevent, mitigate and manage the global warming events associated with water (droughts or floods).
- Recognize the true value of water, which Water Europe is working on.
- Break down the traditional silo thinking in the water sector.
- Start relying on inclusive thinking and harnessing available innovative skills.
- Address the human capital development future needs to support this context.

Moreover, the COVID-19 pandemic has demonstrated the urgency of increasing strategic and smart investments in human development around Europe.

The European Commission works towards linking the physical and digital world for water solutions, tackling the societal challenges of water availability, water quality and climate-change-related impacts, while the water industry is undergoing a digital revolution.

Water utilities and industries play a pivotal role in securing the value of water, and bear a societal responsibility in the future climate-proofing of the entire water system. The shift of water utilities towards digital water technologies creates exciting and paradigm-shifting opportunities.

Many gaps and challenges can be addressed while all these efforts are being made, so we need to work together to fill these gaps and upgrade the human capital in the water sector to match the next development level. For instance, the water industry generally expects graduates to be more attuned to the changing needs of the industry. The weak or non-existent dialogue among science, society, private and governance in curricula planning needs to be improved.

Additional human capital issues like aging and labour migration are strategic issues throughout Europe. Also, the lack of technically trained staff is another issue in the water sector. We are competing with many others for the right personnel, thus attracting and retaining personnel is and will become an even greater challenge in the water sector.

The persistence of the gender gap represents a great challenge at the European level due to the existence of some barriers to women's access to skills development, especially digital skills[3]. This is particularly evident in the decision-making positions. Efforts are urgently needed to address gender-based stereotypes and discrimination, thus, implementing Gender Equality Strategy 2020-2025 is key to guaranteeing inclusion, diversity and equality[4].

The question is: How to respond properly to challenges, empower the human capital in the current situation, and structure a strong human capital agenda for a Water-Smart Society?

The answers may vary across the water sector. That is why this white paper provides a roadmap on addressing and fulfilling the future needs of human capital development in the European water sector. We start out by highlighting the issue, we then link the human capital to different concepts in the water sector, and we end by recommending the incorporation of certain tools into the water sector.

The objective of WG HC is to support and accelerate the innovative water sector through the creation of a human capital agenda. This white paper elaborates on this objective. The WG will collect the relevant knowledge and set up and promote collaborations

on human capital, with the aim of supporting the technical innovations and the creation of a Water-Smart Society. We believe that the development the water sector's human capital approach can promote connections not only between the sector's different parts, but also with other sectors. It can create and support cross-border cooperation in many fields of expertise.

Driven by these ambitions, we will be able to overcome the technical and environmental challenges facing the water sector, thanks to increased knowledge and practical programmes and trainings.

Problem statement: European Skills Framework

The summer of 2021 witnessed the impact of global warming across Europe, ranging from a lack of water to too much water, and from flooding to wildfires. Water is becoming either a precious and scarce resource or an element that needs to be managed. The quality of the water is also deteriorating fast, potable water is becoming a challenge, and irrigation levels are increasing.

We live in a time of transition, in which the EU Green Deal, digital readiness and a Water-Smart Society are the main focus. Thus, there is a need to upgrade the current structures.

All these changes represent a wakeup call to an industry that has been asleep for many decades. The human skills needed to face these new challenges are lacking, both in terms of the number of people and types of expertise. We need to start investing in the human capital approach, so as to enable the workforce to participate fully in this environment and to manage them successfully in the labour market[5]. If nothing is done, Europe won't be able to guarantee access to water nor its quality; nor will it be able to act and protect its population against flooding. It will be limited to reacting.

With regard to the European water sector, we need to adapt to this transitional environment, provide the required level of skills and competences to the labour force, look for new skills and expertise to tackle the fast-evolving deteriorating situation and, finally, sustain these steps by adopting, with agility and pragmatism, the right skills strategies.

We are therefore not only dealing with policy agendas and changed skill needs, but also with organizational structures, decades of 'business as usual', lack of interest from the European Commission and financial stakeholders, different generations of employees, and their abilities and ambitions on the labour market.

In short, we are dealing here with the human factor in a context of work in a more complex system. Despite welcome initiatives from the European institutions and water-related stakeholders, such as the Climate Pact, Europe does not fully understand the need for human capital in the water sector, nor the challenge water is facing.

Since 75% of all jobs depend in some way on water, the importance of the water sector extends far beyond the traditional water sector, the utility services and the water-dependent jobs mindset[2]. This is why we need to start considering the full value chain, taking a more inclusive approach at all levels, and emphasising the role of citizen engagement. Specifically, we have to invest in the human factors involved in meeting the following future needs:

- Digitalisation skills to address the quality and data management and better govern water issues
- Innovation to increase the water sector's efficiency
- Mitigation of global warming and environmental issues, and crisis anticipation
- Diversity to create new ways of thinking
- Social and innovative solutions to maximize impacts
- Life-long learning to acquire the right experience
- Skills and knowledge to realize the value of water in a changing society[6].

Is the water sector ready to adapt and meet the future human capital needs? To answer this question, we need to assess the current situation of the water sector's human capital. The few assessments that have been carried out have unfortunately been overly general[1].

Nonetheless, we can still identify many human capital problems that arise in the water sector and call for solutions. These include a conservative and aging workforce; organizations that are fragmented and small, and guided by security rather than innovation; weak employer branding, lacking in competitive attributes: financial resources, profile, bureaucratic, slow, dusty organizations, which therefore do not offer ambitious and challenging career paths[7].

Many questions are now on the table: What does this current environment mean for the major transformation fields of the sector? What are the specific requirements for the upgrading of the workforce? How to start incorporating the digital tools and innovative thinking in current human capital strategies?

We tailored this white paper to answer this main question: What are the future needs of the human capital in the water sector that have to be met to make the required transitions, create a sustainable human capital agenda, and overcome the current challenges related to climate, water and society?

We can of course continue on the current path, and everything will seem fine, until we realize that it is too late. Water is a basic need in Maslow's pyramid: can we afford to be too late in responding to all the current water challenges?

The water sector desperately needs a new and tailored workforce to handle tomorrow's water challenges: a multi-disciplinary approach to mindset, skills, knowledge and network. But where to start?

Work in the water sector

In terms of jobs and employment, few statistics reflect the current reality of work in the water sector. They tend to simplify the core situation (often due to their objectives, measurement methods and conceptual frameworks), resulting in partial coverage, insufficient details, and an incomplete analysis of complex topics. One of the greatest challenges is the gathering of data and information concerning informal, part-time and/or unpaid work. Another challenge lies in identifying the level of 'water dependence' of any given job.

To understand the perspectives of young water professionals and of water organizations in the assessments of the needs/expectations associated with working in the water sector, the WG HC carried out **two tailored surveys in April** 2021. The aim was to define a sustainable skills agenda for a Water-Smart Society and to reach out to both young water professionals and water organizations. The responses to each survey vary significantly, as the number of young water professional respondents was 55 while those from water organizations amounted to 15, including 5 from SMEs. This gap demonstrates not only what we mentioned earlier in this paper, but also the difference in interest between these two stakeholders. We need to mention here that there are additional stakeholders in the complex environment of the water sector, thus we can summarize them as following:

- Water organizations
- People working in water (in different generations)
- People in education, before the start of their work
- General public and policy makers.

Most of the respondents indicated that the vocational schools provide the right skills for the future. They also commented on the importance of bridging the gap between academia and the actual working environment, by breaking down the traditional practices and conventional methods and adopting more interactive and data-driven methods.

The role of higher education in providing the right skills for the future was controversial. All the respondents from the water organizations thought that higher education provides these skills, while only 65% of young professionals agreed.
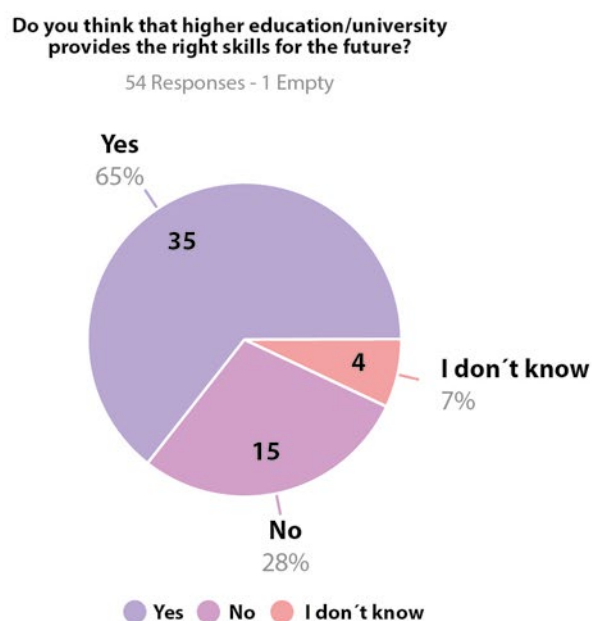

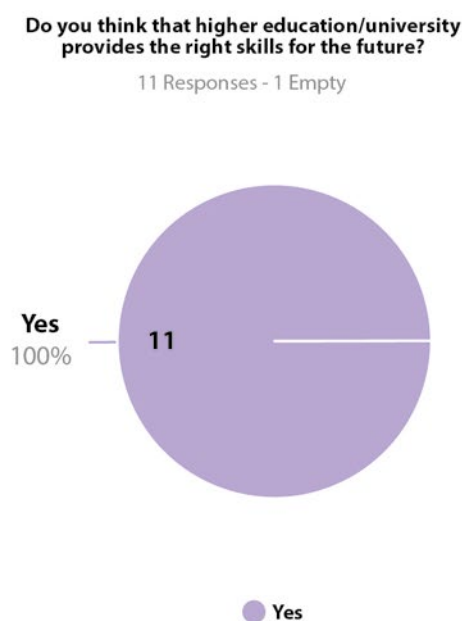**Figure (1).** Responses from young water professionals.

Figure (2). Responses from water organizations

What are you expecting in term of background from potential colleagues?
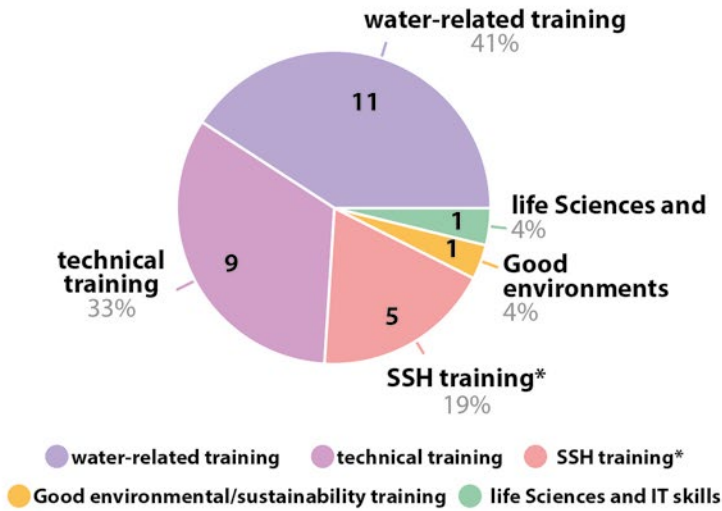
27 Responses

water-related training 41% — 11
technical training 33% — 9
SSH training* 19% — 5
life Sciences and 4% — 1
Good environments 4% — 1

- water-related training
- technical training
- SSH training*
- Good environmental/sustainability training
- life Sciences and IT skills

Growth opportunities

54 Responses - 1 Empty

★★★★☆

3.69 — Avg. Response
54 — Responses

Data	Response	%
★★★★★	19	35%
★★★★☆	18	33%
★★★☆☆	6	11%
★★☆☆☆	3	6%
★☆☆☆☆	8	15%

Figure (3). Responses from water organizations.

Figure (4). Responses from young water professionals.

Regarding the opportunity of working in the water sector for young water professionals, the respondents indicated that they are eager to work in the sector, but also desire to migrate from it and work in another sector; their reasons include the sector's low salaries, differences between reality and expectations, and the sector's current condition in certain countries. Also, the young water professionals aspire to working in an international project or abroad for a while, as a way to obtain different and wider perspectives about water issues around the world. This aim matches the responses of the water organizations, most of which referred to the international focus in their work.

Would you like to have the opportunity to work abroad for a while?

54 Responses - 1 Empty
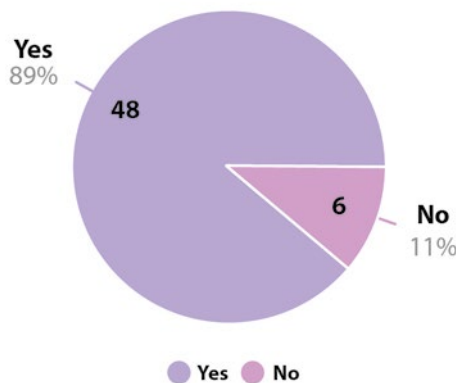
Yes 89% — 48
No 11% — 6

- Yes
- No

Figure (5). Responses from young water professionals.

The desired career path of young water professionals was in water management projects, while only 17% showed an interest in pursuing a purely managerial path. This matches the responses from the water organizations, which are looking for experts and project managers. Indeed, the responses from the water organizations indicated that they are mostly looking for colleagues

with water and technical backgrounds with 1-3 years' experience. Also, the organizations proposed a salary range which falls short of the expectations of the young water professionals.

Finally, all the young water professionals pointed out that they are aware of the need to develop their skills and adapt them for the future, in response to technological and societal developments. This skill development can be realised through professional traineeships and lifelong learning. On the other hand, many responses from the water organizations showed that they encourage the evolution of their employees through their own trainings and programmes, and they also have set up investment programmes for in-house skills over the next 5 years. The question is whether this meets the needs.

The promotion of dialogue between young water professionals and water organizations is highly recommended, as a means of sharing ideas and needs, and bridging expectation gaps. This could be done through surveys similar to these, but also by means of events, initiatives, and social media platforms.

The water sector is exposed to the constant development brought on by technical and digital innovation, and all the stakeholders are aware of this fact. However, the adaptation effort is still inadequate because it is not sufficiently focused nor inclusive.

The survey responses offer a good illustration of silo thinking. We need to start changing this and move toward a comprehensive approach. To this end, we recommend investing in human capital. It is the way to move the water sector forward and build a Water-Smart Society.

On another note, the young today show a determination to participate in developing the current situation in the water sector, and have a say in building the future they will live in. For example, **Youth for the Rhine**, which is a youth initiative to encourage the young to think about and address Europe's major societal issues: climate change adaptation and the various water, food and energy questions. This initiative was presented to the WG HC meeting at the 2021 Water Knowledge Europe Spring edition, as a way to help convey the voices of the young and expressing their views on building a Water-Smart Society. The key questions here are: How to harness such initiatives and incorporate them in the water sector? And how can they really contribute to the development of a stronger and more empowered future water employees?

Digitalisation of the water sector

Digitalisation of the Water Sector: Human Capital is key to success

Digitalisation will be central to meeting the revised EU and national legislations (surveillance of new substances and increased treatment efficiencies). Increased digitalisation, including cybersecurity, is an important tool in meeting these requirements affordably[7].

The uptake of digital technology by the existing EU R&D&I is weak and slow. There is a need to prepare future specialists who are ready to implement and utilise the innovations. This should start by orienting the university curricula towards the new priorities: holistic water ecosystem for the digitalisation of the urban water sector, internet services in the water sector, protection of water infrastructure against cyber threats, etc.

Innovations in the water domain are fragmented. A joint effort from companies, academia, and government (triple helix) is required to facilitate the uptake of digital innovations in operational environments. A strengthening of the education to prepare the future employees for the digitalising world is needed. Stakeholders are today not adequately active/cooperative, when seeking innovative digital solutions. A closer interaction within the triple helix can improve this.

The rapidly increasing and vast amounts of data in various water sectors give rise to a plethora of opportunities, not only to increase a system's quality, but also to provide more integrated, cost-efficient and secure services to the end-users and population. The rising demand and competition for water puts a strain on resources and poses a growing risk to the economy, communities and ecosystems. At the same time, rapid urbanization, climate change and population growth further increase the risk of both droughts and floods. Therefore, it is vital to find solutions to protect and manage this most precious, yet scarce resource. However, many water managers act without adequately reliable or objective information, rely on incomplete data, and lack key technologies. Although promising conceptual and technological solutions to water systems security and resilience are available, further work is required to bring them together in an overarching management framework that strengthens the capacities of water utilities to efficiently manage the infrastructure.

Rising adoption of internet-enabled devices and services will drive utilities and industries to meet end-user requirements and business expectations. Global 5G technology is expected to witness significant growth over 2020-2024.

Cybersecurity in critical water infrastructure: Human Factor

The main risk associated with the rapid progress of digitalisation is that the current design of the water industry does not include security as a primary concern, while technological advances expose the sector to ever higher risk.

The security threats and their forms evolve with the rapid development of IT/IoT. Thus, it is important to work out a dynamic action plan than enables adaptation to threats, raises awareness, improves controls and monitoring, and provides responses (Figure 6)[8].
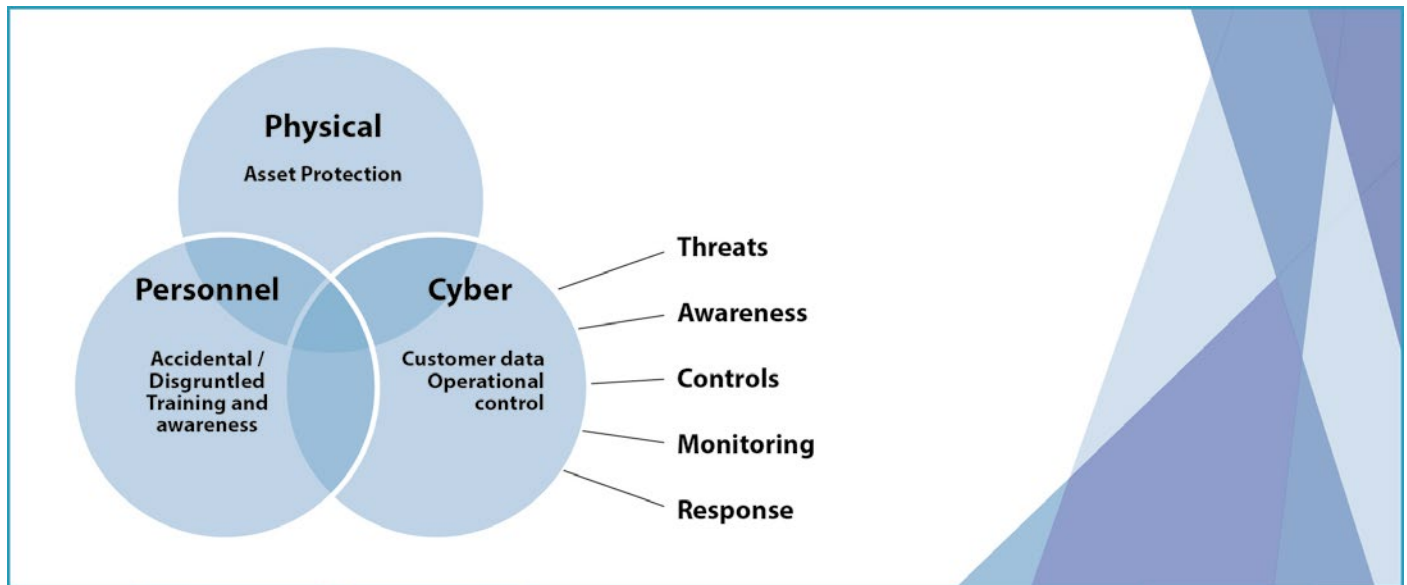

Figure (6). Holistic view of security in critical water infrastructure, presented by Jim Marshall, WaterUK at the NATO Cyberwater Workshop, 2018.

Cybersecurity presents an enduring challenge for the water sector and other critical infrastructure sectors. The scale and complexity of cyberattacks against this critical infrastructure and service are growing and the range of threat actors is widening. The threat is becoming increasingly global and asymmetric. Both state and non-state actors have access to cyber tools that may enable destructive attacks.

Several threat actors, including terrorists, hacktivists, criminals and foreign intelligence services, can use cyberspace as a means to exploit vulnerabilities and cause damage. This could manifest itself in varied ways, including through the disruption of water supply or by affecting the quality of the water supply. Technological developments have increased the attackers' reach and made their identification more difficult[9].

In the drinking water and wastewater sectors, a cyberattack could impact four different threat vectors: chemical contamination, biological contamination, physical disruption, and interference with the highly specialized computer systems controlling essential infrastructure, which are known as Supervisory Control and Data Acquisition (SCADA) systems[10].

The lack of awareness of the threats and consequences of cyberattacks are the main concern in the water industry. A proper preparedness would significantly increase the prevention, detection, and rapid recovery after a cyberattack of a water utility. Several partners are working on process stability and security-relevant for cyberattacks [11].

Digital water education

The pandemic has accentuated the digital skills gap that already existed, and new inequalities are emerging as many people do not have the required level of digital skills, or are in workplaces or schools lagging in digitalisation.

The new curricula must include modern approaches in teaching and learning, such as curiosity-driven education, collaborative mentoring and remote co-supervision, and utilize digital tools for group creativity and promoting virtual mobility.

Zoom, Teams, Google Meet, and Skype became the most popular platforms used by educators. While these make it easy and efficient to conduct live video teaching from home, an increasing number of educators and their students express what they term 'Zoom fatigue'.

The pandemic hit the internationalisation first. An early survey report showed that almost two-thirds of institutions saw their outgoing student mobility impacted. For short-term mobility, such as Erasmus+, some institutions have already cancelled short-

term mobility in the next semester or even academic year, and others are envisioning hybrid or blended approaches. So far, neither virtual mobilities nor the virtual international classroom, while technically feasible, have become common practice in higher education and training.

As a result, **SMARTEN** (Serious Games for Digital Readiness of Water Education) was launched on 18 March 2021, during the Water Knowledge Europe 2021 Spring Edition. SMARTEN is a strategic partnership programme of Erasmus+ between the following partners: Norges Milio-og Biovitenskaplige Universitet (Norway – coordinator), Univerzitet U Nisu (Serbia), Panepistimio Thessalias (Greece) and H2O-People / European Junior Water Programme (the Netherlands), and Water Europe as associated partner. This project proposes innovative practices based on serious games in education, while addressing the subject-specific of water, in line with European environmental and climate goals. The serious games concept has proved its efficiency in the educational sector, mainly in the engineering domain.

Moreover, the WG HC held its **'Human Capital: Collaboration in Digital space' workshop** on 28 June 2021, during Water Innovation Europe. This online event was rich in interactive features, under the umbrella of digital collaboration for a more engaging and seamless experience, with the aspiration of offering an experience comparable to live events.

Mentimeter was the first digital tool used to get to know the attendees, and the results revealed their varied backgrounds, age groups and experience levels. Dr. Paul Nunesdea, co-founder of the Digital Collaboration Academy, briefed workshop participants on online facilitation as a key need in virtual environments. Next on the agenda was a discussion on leadership in the water sector, in which GroupMap was used as a tool to facilitate brainstorming which revealed the different needs and perspectives on this concept. An exercise on the water nexus with Dr. Chrysi Laspidou was also performed using Mentimeter, revealing that the agriculture sector is the main water consumer globally as well as a key contributor to climate change.

Naomi Timmer concluded the event with a mini workshop on Deep Democracy that was performed on Howspace. This concept of Deep Democracy supports creating a workspace that depends on co-creation and co-responsibility to ensure the inclusion of all the team members, leaving no one behind.

This event generated a sense of excitement in the participants, many of whom expressed an interest and appreciation of the present and future value of these types of online tools and forums.

Transformation towards a Circular-Skilled Water Sector

The European water sector sees itself as an important player in the concept of circularity, which is a key pillar in realising the EU Green Deal and a Water-Smart Society. Accordingly, many efforts and resources are being invested to create the proper environment for this concept to flourish and evolve, including the development of relevant policies and programmes, the scaling up the associated strategies, and the promotion of cooperation between different sectors on the European level. Several innovative approaches are interlinked with this concept, aimed at shifting the water sector into a water-smart sector and creating vital synergies, including 'valuing' water – that is, building an understanding of the value of water – and industrial symbiosis (IS). While leveraging on this vision, we need to draw attention to the fact that the path to a Water-Smart Society is closely connected to the human capital development in the water sector.

Although ambitious frameworks and models are planned to be implemented in both valuing water and industrial symbiosis, and involve a strong focus on the human capital, which is still unprepared for such a transition, the main question is: What are the future demands and needs to support the human skills in building a circular Water-Smart Society?

The assessment of these demands and needs depends on cross-sectoral developments in IS and in valuing water.

The required developments in IS will come from deepening the understanding of IS beyond the use of recycled products and transformed materials, to include transaction services (product, network, private and public) between sectors and local organizations, and offering new market solutions, and business and cooperation models (for reducing production costs, creating new jobs, and including external customers)[12]. Stakeholder engagement represents a key component of this process. It should therefore start with the sustainable development in the targeted region, providing guidance to local and regional authorities and promoting public dialogue processes, to ensure regional action plans as well as interregional learning and capacity building[12]. Data management could significantly support these actions, by providing tools for product customization and upgrading decision and management tools. Lifelong learning could provide a great support in this aspect.

Understanding the value of water requires that we broaden our perspective on water. We need to see it not only as a source of life, but also as an essential component to economic prosperity and business development, because water is key in designing

the circular economy and building a Water-Smart Society. Capturing the true value of water needs a new innovative and collaborative environment that is able to convey this value to all stakeholders on all levels.

The European Junior Water Programme (EJWP) worked on providing new narratives about the value of water, and its final results were presented in the **'New Narratives about the Value of Water'** workshop, which took place on 28 June 2021, during the Water Innovation Europe Week. Apart from the EJWP attendees, three speakers participated: Oriana Romano from the OECD, Gonzalo Delacámara from Water Europe, and Naomi Timmer from H_2O-People. Multiple new narratives were presented, all highlighting the need to start an intergenerational dialogue on the value of water.

The workshop kicked off with the 'Unveiling the Value of Water' presentation by EJWP2, which is the result of their first project in the two-year EJWP journey. The idea behind the narrative they created is not only to illustrate how wine and water are interlinked, but also the complexity of the importance of awareness about the value of water, irrigation as the main consumer for water, and the varied needs of water between regions. EJWP2 used the storytelling concept as a tool to present their ideas, which increased the added-value of the presentation.

Next on the agenda was the 'Water in Our Daily Life' video by EJWP1 participants, which showed those of our daily activities that contribute not only to a higher consumption of water but also to water contamination. The video featured the daily routine of three EJWP1 participants, in which they linked our daily activities with water consumption. Following this video, a brief discussion between EJWP1 participants took place about actions needed to recognize and embrace the value of water in our society.

This type of environment, which illustrates the value of water and engages young water professionals, meets the fundamental need to provide a more optimistic approach in valuing water; it is an environment in which we focus on solutions rather than problems, while duly taking the complexity of the situation into consideration.

Many challenging demands and needs in the human dimension should be highlighted within this context of circularity. These require an effort to focus on human and institutional capacity development, on knowledge sharing and technology transfer, and on practical intelligence in the water and water-related sectors. With this in mind, we suggest the following initiatives be taken:

- New education and training programmes to 'upskill' the workforce in the future digital water sector.
- Awareness actions on IS and valuing water, aimed at water management authorities.
- Creation of smart skill-building tools for the water and water-related sectors, to facilitate replicability and applicability of water-related technological solutions and facilitate capacity development.
- Talent building programmes on KETs and FETs for water in a circular economy.
- Awareness-raising actions on social perceptions of the value of water.
- Establishing new knowledge bases, innovative solutions in management, and building associated business models.

Harnessing the potential of augmented collaboration tools is highly recommended in the transformation towards a circular-skilled water sector. They provide a suitable environment for collaborating, transferring and exchanging knowledge (practical and theoretical), sharing used and underused ideas in a versatile manner between different stakeholders, and providing technical and organizational learning ecosystems.

Assessing the Human Capital in the Nature-based Solution Approach

What is the link between a nature-based solution approach, human capital and a Water-Smart Society? To answer this question, we need first to present the concept of nature-based solutions (NbS): these are actions to protect, sustainably manage, and restore natural and modified ecosystems that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits[13]. This approach of focusing on sustainability and resilience, offers key inputs to the structure of a Water-Smart Society, by providing an opportunity to integrate economic recovery with management of water risks, as well as with biodiversity restoration in a climate-friendly environment. It also provides an opportunity for additional creation of green jobs and cross-sectoral collaboration[14]. The question now is how does one reflect all these ideas through the use of the human capital approach?

To begin with, since innovation is a key component in the human capital approach related to NbS, the encouragement of the new sustainable technologies is indispensable. Another component is investment support and promotion. The water sector

needs to start supporting the new and sustainable business models, which may be associated with other sectors but contribute to protecting water resources. Funding is the main source of support, as such projects rely mainly on public funding because NbS is still an emerging approach. A part of this funding is going to be used for trainings and workshops, because NbS depends partially on local community involvement under any scenario, and this calls for certain skills.

Deploying NbS faces some challenges, including the lack of centralized and comparable data, which quantify the biodiversity and ecosystem service benefits in monetary terms[15]. Also, we lack an understanding of the extent to which NbS contributes to new job creation at a European level, or how this contribution is effected. We need to analyse the scope of this contribution: Does it happen at a rural, urban, regional or national level?

Moreover, we have to identify the exact skills pathways that individuals need to follow to become effective staff members in nature-based jobs. This will help the sector attract the talent in needs to work on NbS[16]. Specifically, this should be done by:

- Developing a better understanding of the special needs and demands of this approach.
- Determining how the career path will progress and evolve in nature-based jobs.
- Defining the particular operational scale (small business, micro enterprise, voluntary basis, etc).
- Assessing the diversity needed for this discipline, i.e., the blend of technology, multidisciplinary skills, climate literacy and an understanding of natural capital.

The nature-based jobs market is complex and still under development; there is a considerable need for further inputs and cross-sectoral collaboration and engagement in forming its roadmap.

Promoting the Human Capital Approach in the European Water Sector

In this white paper we have explored the future human capital needs and demands in certain aspects of the water sector. The exploration has demonstrated the need to set out pathways towards significant investment in human capital development on all levels (local citizens, young water professionals and others), paving the way to implement strategies related to human capital, and working on collaboration within the water sector and with other sectors. Reinvigorating the human capital is indispensable to building a Smart-Water Society and contributing to achieving the EU Green Deal. There is room for a lot of improvements to strengthen the link between the workforce and the European priorities, through the use of the available tools in the European water sector.

The first step would be to carry out relevant research for capturing the job-creating opportunities in the field of water innovation, defining a career path and progress processes, and setting up a dynamic to bring academia and the job sector closer.

The Water Oriented Living labs provide a fertile innovation ecosystem for solution developers, researchers, forward-looking water users and water governing bodies to develop the leading solutions of the future[17]. They present a key dynamic to engage different multi-stakeholders, including the local citizens. Although they require considerable and long-term investments, they provide a great opportunity to exchange expertise, knowledge and skills among different actors, and also use technology and non-technological practices.

The lack of capacity and the challenges facing the European water sector require the design of adequate training tools and innovative learning approaches, in order to promote the competencies of staff as well as strengthen institutional capacity.

The European Junior Water Programme represents a powerful example of a training that enables its participants to develop an inclusive approach to the European water sector, become acquainted with personal and cultural development skills, and exchange expertise and ideas on different water issues facing the EU. Participation in such programmes is imperative for water organizations that are looking to become key partners in the European water sector. The programmes support the development of their workforces, by acquainting them with the European water market and exposing them to European culture.

Other solutions to filling the existing gaps may include creating an enabling policy environment for collaborative frameworks between the education sector, sector employers (public, private, NGOs), trade unions and employees; developing incentives to attract and retain staff; strengthening technical and vocational training; and focusing attention on human resources capacity development in rural areas.
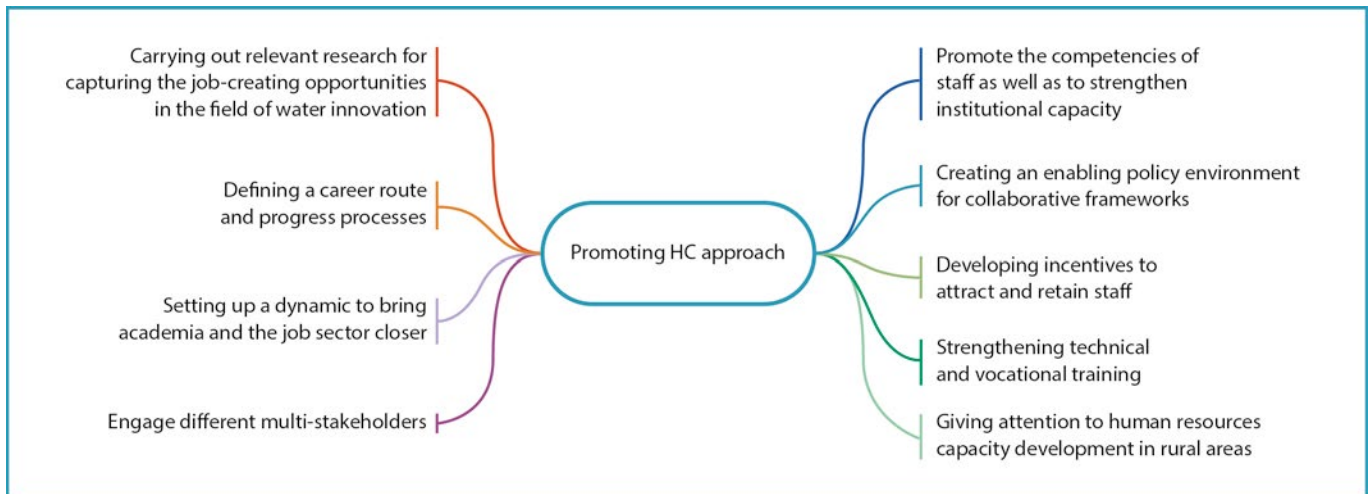
Figure (7). Promoting the HC approach in the water sector.

Finding and Conclusion: Solutions: Scenario's way forward

- Set up a European white book on water-related human capital. This initiative can constitute an opportunity for the European Union to make an additional contribution in tackling climate change, by identifying the key skills and knowledge that Europe needs in order to find and implement innovative solutions. The development of a Framework for Future Water Skills across Europe should be a priority. The emergence of such a framework is a multi-stakeholder process (industry, education sector, governments, skills development partners, etc.). The establishment of this framework will enable multiple water programmes and projects across Europe to operate with a common purpose, delivering on the 'European Skills Agenda for sustainable competitiveness, social fairness and resilience'.

- Support additional analysis from the JRC and EEB to include human capital research in their reports on the European water sector, and furthermore encourage the exchange of data and cooperation through its WISE platform on this topic.
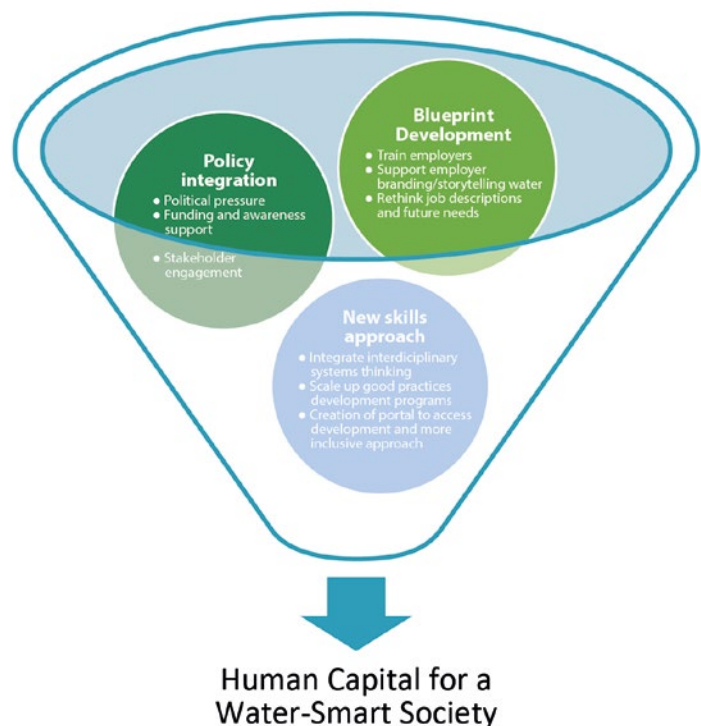

Figure (8). Roadmap action needs towards a HC approach in the water sector.

- Encourage professional training, to make sure that Europe remains a competitive and thriving economy in the water sector, and creates the right innovative solutions to achieve a Water-Smart Society.

- Encourage and support diversity to provide flexibility and dynamism to the sector and thereby increase its future competitiveness.

- Increase investment in European citizens' human capital to raise the importance of the value of water in our society. Water security will be the most important challenge in the decade ahead, and citizens play a key role in achieving a

Water-Smart Society. An integrated approach of engaging with stakeholders in collaborative networks, and linking the emerging needs and skills gaps to training and support programmes, will ensure that the interventions are mapped to identified needs, and thereby have a greater chance of being successfully adopted.

- Encourage participation of citizens in the decision-making process, particularly in Living Labs, to make sure that innovative solutions are accepted and fit in with citizens' needs and behaviour.

- Provide upscaled Blueprints for sectoral cooperation on skills at national and regional levels.

- Establishing collaborative networks facilitate cross-European learning sharing and produce valuable industry insights and research, ensuring that emerging needs and identified gaps has real relevance to employee and employer needs. Enterprise-led networks help businesses and employees to engage in, and have ownership of, active skills planning and implementation. Such networks will facilitate the adoption of common approaches across the network members and the regions of Europe.

Table of acronyms

WG HC	Working Group Human Capital
WE	Water Europe
IWRM	Integrated Water Resources Management
NbS	Nature-based Solutions
IS	Industrial Symbiosis
OECD	Organisation for Economic Cooperation and Development
EU	European Union
FETs	Future emerging technologies
KETs	Key Enabling Technologies
JRC	Joint Research Centre
EEB	European Environmental Bureau

The WE Human Capital Working Group at a glance

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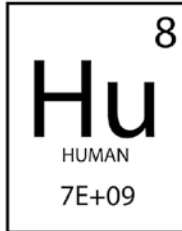
Human element
adding value to research & innovation projects

Education, reskilling and lifelong training programmes.
- Implement HEU project results in synergy with supporting programmes (Erasmus+).
- Focus on knowledge transfer, skills relevant to the water industry, and social innovation competencies.

Augmented collaboration.
- Creative facilitation and use of active collaboration tools in digital and physical space for Living Labs.

Stakeholders and youth engagement.
- Citizen engagement and multi-actor approach, active inclusion of the water industry.

Sectoral talent attraction.
- Raise water sector attractiveness and contribute to leadership programmes in the water industry.

Network-of-networks.
- Engage with unique networks of water-oriented universities, research institutes, and young water professionals from the water industry.

Social sciences and gender studies.

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Colophon

This white paper has been written for the purpose of stimulating discussion on how to improve water management. The paper does not reflect any formal standpoints, neither of the authors nor of the organizations where they work.

Notes

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Water Europe

Technology & Innovation

THE FUTURE NEEDS OF HUMAN CAPITAL DEVELOPMENT IN SUPPORT OF A WATER-SMART SOCIETY