DIGIWATER

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R1.1 REPORT ON STAKEHOLDERS AND NEEDS ANALYSIS

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Contents

1. INTRODUCTION

1.1 General

Water is an irreplaceable resource and has a global value because of the role it plays in improving the economy, society and the environment. The European Commission works towards linking the physical and digital world for water solutions tackling the societal challenges of water availability, quality and climate-change-related impacts, while the water industry goes through a digital revolution.

"Digital Water[1]" is an important concept underpinning the Water Europe Vision, based on the predicted development of a world where all people, "things" and processes are connected through the "Internet of Everything", leading to capillary networks and sensors, meters and monitoring of the water system all the way along to the individual user, as such generating large amounts of valuable data for innovative Decision Support and Governance Systems. "Digital Water" is now seen not as an 'option' but as an 'imperative'.

The DIGIWATER project aims:

a) 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 of labs/software with access in cloud systems and Problem Based Learning,

b) To stimulate entrepreneurship and entrepreneurial skills of higher education teaching staff and company staff using Innovation Camps, and,

c) To 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 of six universities and six SMEs from Belgium, Cyprus, Germany, Norway, Romania and Turkey.

Seven Target Groups (TGs) will benefit from the results and the outcomes of the project; the future water professionals (TG1), the water professionals (TG2), the water educators (TG3), the technology entrepreneurs (TG4), the local communities, (TG5), the water industry (TG6) and the European community at large (TG7). TG1, TG2, TG3 and TG4 will be involved into direct project activities and development, TG5 will actively participate in processes for the co-creation of regional policy initiatives via innovative camps, and TG6 and TG7 will be reached via dissemination and exploitation activities.

[1] International Water Association, 2019
https://iwa-network.org/publications/digital-water/

1.2 Objectives

The Project comprises of seven Work Packages (WPs) as follows:

- WP1: Digital Water Needs Analysis
- WP2: Digital Water Curriculum
- WP3: Digital Water Living Lab
- WP4: Internal Quality Assurance
- WP5: External Evaluation
- WP6: Dissemination and Exploitation of results
- WP7: Project Management

WP1 provides a base for the project implementation by carrying out a detailed needs analysis on digitalization in the water industry, reviewing state-of-the-art in digital water and looking for best practices in this area. Specifically, WP1 aims to examine how digitalisation is transforming the water sector and to provide an overview of the current state of digital in the water sector. The objectives of WP1, which will provide inputs to WP2-WP6, are:

i. To analyze and document information about project stakeholders' interest in digital water by sector (academia, enterprises, government and society), their involvement in the project, interdependencies, influence and potential impact on project success.
ii. To plan stakeholder engagement.
iii. Specify and quantify stakeholders' needs in digital water.

The aforementioned objectives of WP1 are to be achieved through the implementation of the following three tasks:

The present document concerns the implementation of Task 1.1 and is comprised from the following sub-tasks:

1. Task 1.1: Stakeholders' online survey
2. Task 1.2: Online workshop conduction
3. Task 1.3: Finding summarization in a Roadmap document

The present document concerns the implementation of Task 1.1 and is comprised from the following sub-tasks:

a) Description of the methodology used for building up the online survey.
b) Summarization of the key findings of the survey which contains information about project stakeholders' interests in digital water, their involvement in the project, interdependencies, and influence and potential impact on project success.

c) Determination of the stakeholders' needs in digital water, according to the survey's results.

The survey covers stakeholders from four different sectors, i.e., Academia, Enterprises, Government and Society.

2. METHODOLOGICAL APPROACH

2.1 Online Survey

Prior to the development of the online survey, relevant meetings were conducted between the WP leader, the Task Leader and the rest of the consortium, to discuss and develop a common approach towards meeting the Task's objectives. The meetings were held online (as a response to the Covid-19 restrictions) through the Microsoft Teams platform and took place on January 15th, January 22nd and January 27th.

The methodological approach agreed to be followed was as follows:

- IACO and University of Cyprus would structure the online survey content and distribute it to the other partners for comments and input
- Internal revision of the online survey
- Each Digiwater partner country resource person would draft a stakeholders' list (Academia, Enterprise, Government, Society) that would receive an invitation to participate in the online survey
- IACO would compile the list and distributed the final version of the online survey
- IACO would collect and analyze the online survey results

Following the partners' consensus on the methodological approach, extensive literature review was conducted and the questionnaire was shaped. The questions included in the survey, were such that (a) could yield to the desired relevant information required to feed the subsequent tasks of the project, and (b) could get generic demographic information on the respondents.

The online survey was ensured to be GDPR compliant.

The online survey's format was developed by the University of Cyprus using Google Forms[2]. Google Forms is a cloud-based questionnaire and survey solution, which is included in the web-based Google Docs Editors suite offered by Google. A Google Form is composed of a title, description and a list of questions. Google Forms allow different types of questions, from full-text answers to checkboxes and ratings.

The questionnaire was elaborated using mainly multiple choice, linear scale and checkbox grid questions aiming to the facilitation of a quantitative analysis of the results.

The questionnaire aimed to collect information from four stakeholder groups; Academia, Government, Enterprises and Society.

[2] https://www.google.com/forms/about/

Table 1 shows the questions that were common for all the sectors, while Tables 2-5 show the questions that were formed separately for each stakeholder group.

The full online survey as distributed to the different stakeholders is presented in Annex I.

Table 1: Common Questions for all the stakeholder groups

Question	Type of Question
Which is your entity's country of establishment?	Multiple choice
Which of the following sectors represents better your entity?	Multiple choice
What is your function in your entity?	Multiple choice/Text
What are your main activities/responsibilities within your entity?	Text
How would you rate the current digital water transformation status of your entity?	Linear
How would you rate the current digital water transformation status of your entity regarding the level of training of the personnel in supporting the digital water transformation in general?	Linear
How would you rate the current digital water transformation status of your entity regarding the level of training of the personnel in supporting the digital water transformation with regards to cybersecurity?	Linear
Which of the following tools/technologies does your entity use for achieving digital water transformation?	Multiple choice
How would you rate the current level of your entity's cooperation with the following sectors?	Linear
How would you rate the current level of interdependency of your entity with the following sectors, in achieving digital water transformation?	Linear
Which stakeholder groups do you consider of having the most crucial role in achieving the digital water transformation?	Checkbox grid
While the digital water transformation is not an easy task, how significant are the following barriers for the digitalisation of the water industry?	Checkbox grid
How significant do you consider the following benefits of the water industry's digital transformation to your entity?	Checkbox grid
Which of the following digital water applications/outcomes do you consider as a priority for your entity?	Checkbox grid
Do you have any other comments/suggestions?	Text

Table 2: Questions formed for the Academia sector

Question	Type of Question
How would you rate the current digital transformation status of your entity's water related curriculum/curricula?	Linear
The water industry generally expects that graduates are better equipped for the changing needs of the industry. How would you rate the digital skills mismatch between your entity's water curricula and the industry needs?	Linear
How would you rate the current digital water transformation status of your entity in the field of research?	Linear
How well do you think your entity prepares new water specialists in digital water aspects for entering the water industry?	Linear
Will your entity be interested (or planning) on upgrading current curricula upon consultation with the water industry, in order to incorporate new teaching material such as digital water tools and technologies, equipment of the students (e.g., open-source software, hardware etc.), for better preparing the future water specialists?	Linear

Table 3: Questions formed for the Government sector

Question	Type of Question
How would you rate the preparedness of the newly recruited water specialists for the changing needs of the water industry?	Linear
The government sector has a key role in digital water transformation, as it holds and manages numerous water-related databases, e.g., for monitoring results, other measurements, etc. How feasible is in your opinion the transformation of data into an easily accessible and use friendly digital format?	Linear

Table 4: Questions formed for the Enterprises sector

Question	Type of Question
How would you rate the preparedness of the newly recruited water specialists for the changing needs of the water industry?	Linear

Table 5: Questions formed for the Society sector

Question	Type of Question
How significant do you consider the following benefits of the water industry's digital transformation to the society in general?	Checkbox grid
How feasible in your opinion is for the society to adapt to digital water transformation?	Linear
Which of the following do you consider as the most efficient ways to encourage the digital culture among the society your entity represents?	Multiple choice

2.2 Stakeholders Identification

The following tables show the stakeholders contacted per sector, as were indicated by the partner resource persons of each country, to which an invitation to participate in the online questionnaire was sent.

Academia

Country	Stakeholder Name & website address	Main activities/responsibilities
Belgium	KU Leuven – Department of Chemical Engineering www.kuleuven.be	Academic research on biological wastewater treatment processes, active sludge sedimentation and filtration, monitoring, modelling, and membrane bioreactors.
	UCLL www.ucll.be	Applied research on energy and climate change.
	Vives www.vives.be	Applied research on water sciences
Cyprus	University of Cyprus https://www.ucy.ac.cy/en/	Teaching & Research
	Cyprus Institute https://www.cyi.ac.cy/	Teaching & Research
Germany	Universität Koblenz · Landau - Präsidialamt Mainz Fachbereich 3: Mathematik / Naturwissenschaften https://www.uni-koblenz-landau.de/de	Teaching & research
	Bauhausuniversität Weimar https://www.uni-weimar.de/en/university/start/	Civil Engineering, Architecture and Urbanism
	TU Kaiserslautern https://www.bauing.uni-kl.de/en/home/	Department of Civil Engineering Water Infrastructure Resources
	University of Applied Sciences and Arts https://www.th-owl.de/umwelt/	Department Environmental Engineering and Applied Computer Sciences
Norway	Norwegian University of Life Sciences www.NMBU.no	Teaching & research
	Norwegian University of Science and Technology www.NTNU.no	Teaching & research
Romania	University of Craiova www.ucv.ro	Education and research Research topic: Modelling and control of wastewater treatment processes
	Faculty of Automation, Computers and Electronics, University of Craiova www.ace.ucv.ro	Education and research Research topic: Modelling and control of wastewater treatment processes
	Faculty of Automation and Computers, Technical University of Cluj-Napoca www.ac.utcluj.ro	Education and research Research topic: Modelling and control of wastewater treatment processes
	Faculty of Chemistry and Chemical Engineering, Babes-Bolyai Universiy – Cluj-Napoca http://www.chem.ubbcluj.ro/	Education and research Research topic: Modelling and control of wastewater treatment processes
	Faculty of Science and Environment,	Education and research

	"Dunarea de Jos" University of Galati, http://www.sciences.ugal.ro/	Research topic: Modelling and control of wastewater treatment processes
Turkey	Fırat University https://abs.firat.edu.tr/hhasar	Environmental Engineering
	Süleyman Demirel University https://w3.sdu.edu.tr/personel/02369/prof-dr-nevzat-ozgu-yigit	Environmental Engineering
	Akdeniz University http://aves.akdeniz.edu.tr/aperendeci/	Environmental Engineering

Enterprises

Country	Stakeholder Name & website address	Main activities/responsibilities
Belgium	Aquafin www.aquafin.be	Aquafin is the Flemish wastewater collection and treatment company
	De Watergroep www.dewatergroep.be	Flemish drinking water company
	POM Antwerpen www.pomantwerpen.be	Provincial development company
Cyprus	ALA Planning http://www.alaplanning.com/ALA/	Planning, Transport & Environment Consultants
	Nicolaides & Associates https://www.nanda.com.cy/	Civil & Environmental Consultants
	Dion. Toumazis & Associates LLC https://www.diontoumazis.com/newsite/	Architects and Consulting Engineers
	Mekel Ltd https://mekel.com.cy/	Water and wastewater treatment
	CSP Joint Venture	Infrastructure Support Provider of the British Bases
Germany	OWL Umweltanalytik GmbH https://www.owlumwelt.de/	Laboratory for wastewater testing
	HDO Druckguß und Oberflächentechnik GmbH https://hdo-gmbh.com/de/	Die casting Mechanical processing Surface treatment Surface finishing
	HBICON GmbH https://www.hbicon.de/index.php	Laboratory for wastewater testing
	Xylem Analytics Germany GmbH & Xylem Analytics Germany Sales GmbH & Co. KG https://www.wtw.com/de/	Manufacturer for online measurement technology in the water industry
	Hach Company https://de.hach.com/	Manufacturer for online measurement technology in the water industry
	PFI https://www.pfi.de/	Group of engineering companies Experts in the field of water, wastewater and sludge
	ifs http://www.ifs-hannover.de/j150/	Engineering company for urban hydrology Advice and planning in the field of water/urban water management

		Research and development with a focus on rainwater treatment Hydrometric measuring and testing services Development of specialist software and individual IT solutions
	Enviplan https://www.enviplan.de/	Enviplan® Microflotation worldwide plant construction operation management waters therapy
	Berliner Wasserbetriebe https://www.bwb.de/en/index.php	The largest water supply and wastewater disposal company in Germany
	Ifak https://www.ifak.eu/en	Institute for Automation and Communication
Norway	Oslo water services Vann og avløp - Oslo kommune	Utility owner
	BergenWater, https://www.bergen.kommune.no/english	Utility owner
	Asker and Bærum Water http://www.abvann.no/	Utility owner
	Glitre water works https://www.glitre.no/	Utility owner
	Trondheim water works https://www.trondheim.kommune.no/	Utility owner
Romania	CV WATER SA ROMANIA https://cv-water.ro/en/	Water treatment plants for underground water. Wastewater treatment plants
	ROMINSERV S.R.L. Petromidia Branch https://rominserv.kmginternational.com/en/homepage	Industrial maintenance, technical upgrade and technological development
	LIBERTY TUBULAR PRODUCTS ROMANIA https://libertysteelgroup.com/ro/company/liberty-tubular-products-galati/?lang=en	Leading supplier of longitudinally welded pipes
	STARBAG SRL https://www.strabag.ro/	Building Construction & Civil Engineering, Transportation, Infrastructure
	Biogest Wastewater Treatment https://biogest.de/	Development, conception, planning, delivery and plant construction of environmental technology for water management
	Passavant Energy & Environment https://www.passavant-ee.com/	Technologies and processes in municipal wastewater, sludge, water and industrial wastewater treatment
Turkey	Ceyka http://www.ceyka.com.tr/en	Membrane system installations, chemicals supplier
	Esli https://esli.com.tr/en	Membrane systems manufacturer

	Ekosistem Engineering https://www.ekosistemltd.com/en	Wastewater treatment plant construction general contractor
	Coskun Treatment Systems https://www.coskunaritma.com/en-US/HomePage	Wastewater treatment system installations and package membrane bioreactor system builder
	ASM Treatment http://asmaritma.com.tr/	Treatment systems general contractor

Government

Country	Stakeholder Name & website address	Main activities/responsibilities
Belgium	VMM www.vmm.be	Agency of the Flemish government responsible for water, air and environmental management and monitoring.
	De Vlaamse Waterweg www.vlaamsewaterweg.be	Governmental organization responsible for the management and valorization of navigable waterways in Flanders
	VLARIO www.vlario.be	Flanders knowledge center on sewer infrastructure
Cyprus	Water Development Department http://www.moa.gov.cy/moa/wdd/wdd.nsf/index_en/index_en?opendocument	State Department for the protection and rational management of water resources
	Sewerage Board of Limassol – Amathus http://www.sbla.com.cy/en/	Municipal utility organization for sewer/drainage system and wastewater treatment
	Cyprus Water Boards https://lwb.org.cy/en/	Semi-governmental organization for potable water supply
	Nicosia Sewerage Board https://www.sbn.org.cy/	Governmental organization for the design and maintenance of the sewerage system of Nicosia
Germany	Umweltbetrieb der Stadt Bielefeld Klärwerke https://www.bielefeld.de/de/rv/ds_stadtverwaltung/uwb/	Wastewater treatment plant
	Stadtwerke Paderborn GmbH https://stadtwerke-pb.de/	Paderborn municipal utility water supply
	Landesamt für Natur, Umwelt und Verbraucherschutz Nordrhein-Westfalen https://www.lanuv.nrw.de/	State Office for Nature, Environment and Consumer Protection
	Bezirksregierung Detmold https://www.bezreg-detmold.nrw.de/	District government for Paderborn

	Stadtentwässerungsbetrieb Paderborn (STEB) https://www.paderborn.de/microsite/steb/index.php	Municipal Drainage Company - Wastewater treatment plant
	Städtische Betriebe Minden https://www.minden.de/stadt_minden/de/	Wastewater treatment plant
	Kläranlage Putzhagen Gütersloh https://www.guetersloh.de/de/rathaus/fachbereiche-und-einrichtungen/tiefbau/stadtentwaesserung/klaeranlage-putzhagen.php	Wastewater treatment plant
Norway	Norwegian environment agency, https://www.environmentagency.no/	Regulator Wastewater
	Norwegian food safety authority, https://www.mattilsynet.no/language/english/	Regulator drinking water
Romania	Apa Canal SA Galati Romania https://www.apa-canal.ro/	Galaţi Water and Sewerage Administration
Turkey	Istanbul Water and Sewarage Administration iski.gov.tr	Istanbul Water and Sewerage Administration

Society

Country	Stakeholder Name & website address	Main activities/responsibilities
Belgium	City of Leuven (www.leuven.be)	City government
	City of Ghent (www.gent.be)	City government
Cyprus	Cyprus Water Association https://cwakys.com/en/	Non-profit organization that supports research & development in the field of water
	Cyprus Scientific & Technical Chamber https://www.etek.org.cy/	Technical Advisor of the State and organization of all Cypriot engineers
Germany	Hans-Schwier-Berufskolleg https://www.hsbk-ge.de/	Vocational school for the profession of wastewater technology specialist
	BEW - Das Bildungszentrum für die Ver- und Entsorgungswirtschaft gGmbH https://www.bew.de/	Training center for the utilities and waste management industry
	Bayerische Verwaltungsschule Lauingen (BVS) https://www.bvs.de/bildungszentren/bvs-bildungszentren/lauingen-donau/index.html	Training center for the utilities and waste management industry
	Kompetenzzentrum Digitale Wasserwirtschaft https://www.kompetenzzentrum-digitale-wasserwirtschaft.de/	Central contact point for aspects of digitization
	DVGW https://www.dvgw.de/english-pages/	German Technical and Scientific Association for Gas and Water the competence network for all questions related to gas and water supply in Germany

	DWA Deutsche Vereinigung für Wasserwirtschaft, Abwasser und Abfall e.V. https://de.dwa.de/de/	German Association for Water, Wastewater and Waste registered association
Norway	Norwegian Water, https://www.norskvann.no/index.php/om-norsk-vann/information-in-english	Membership organization mainly consisting with utility owners
	Council for water and wastewater co-operation in the inner Oslo fjord, http://www.indre-oslofjord.no/om-fagraadet	Stakeholder organization managing the basin and the recipient quality
Romania	Control Systems, Computers and Electrical Engineering Society from Galati	Non-profit organization that supports research & development in the field of control systems, computers and electrical engineering
Turkey	Fatih Coker	Plant Manager at ISTAC
	Mevlut Fatih Peker	Project and Business Development Manager at İSTAÇ
	Hakan Ertik	Environmental Engineer at ISKI

3. KEY FINDINGS OF THE ONLINE SURVEY

3.1 Introduction

The online survey invitation was circulated during March 18th 2021, and a duration of up until March 25th 2021 was provided to the various stakeholders identified by the partners of each country. The main findings of the survey are comprehensively analyzed in this chapter.

It is noted that the participation of the stakeholders that were representing the Society sector, was limited. Therefore, the sample was too small to be analysed and the Society sector is excluded from the following findings.

3.2 General Findings

The answered questionnaire was successfully submitted by 38 participants from six countries and four sectors. The pie chart in the Diagram 1 shows the percentage of the participation per country. Cyprus is the country with the biggest participation (42,1%), while Germany is the country with the lowest participation (5,3%).

A percentage of about 34,2% of the participants represent the Academia sector, while the Society is represented only by a percentage of 5,3% (see Diagram 2).

The majority of the participants in the Academia sector were academic staff, whereas the other sectors were represented by project managers, engineers, hydrologists and consultants.

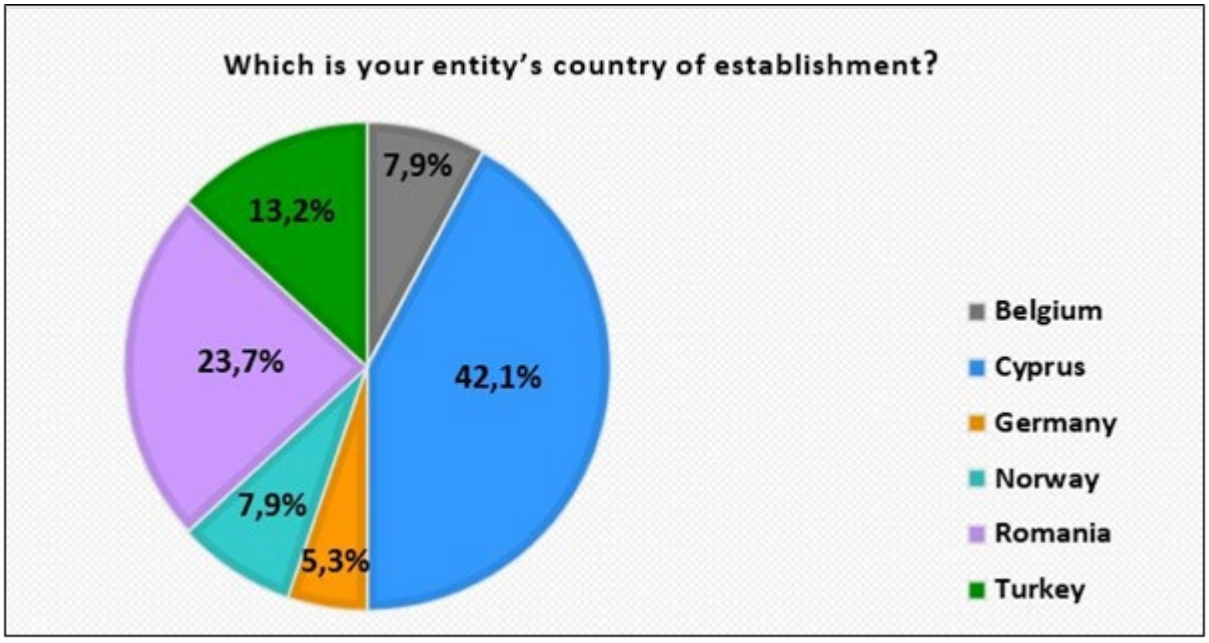


Diagram 1: Percentage of participation per country

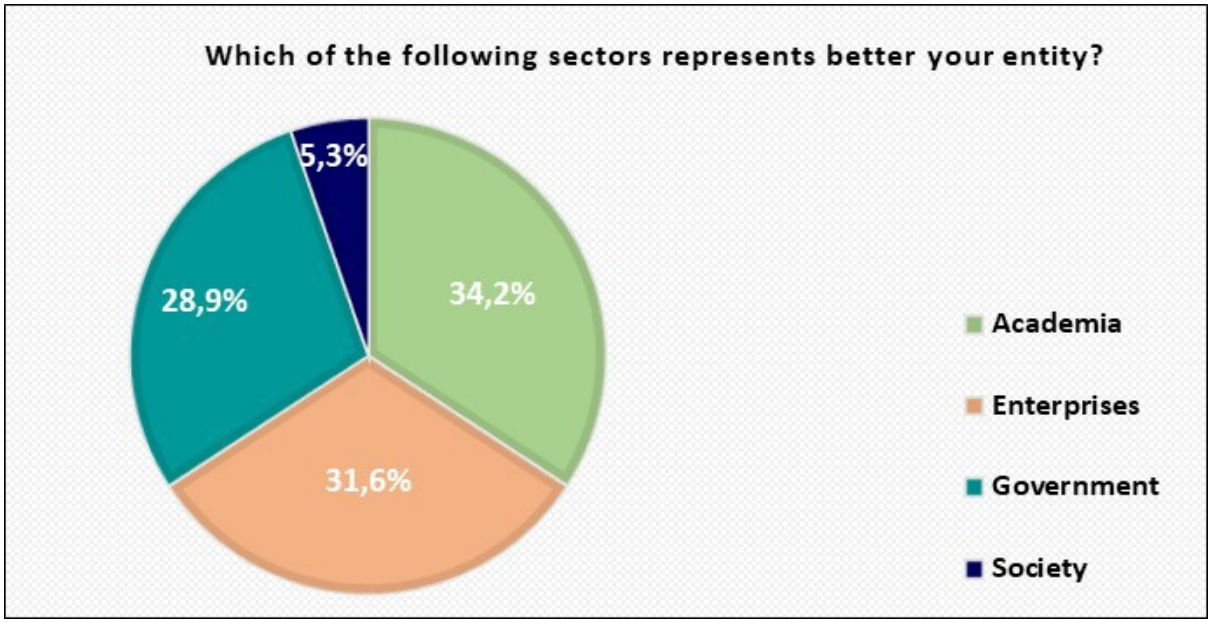


Diagram 2: Percentage of participation per sector

3.3 Current Digital Water Transformation Status

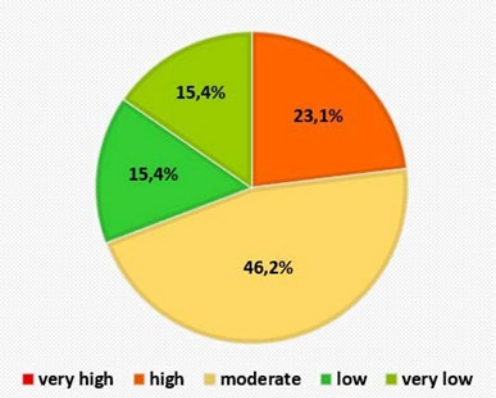
The survey included questions that were aiming to collect information and provide an overview of the current state of the digital water transformation of each sector. The questions and the findings for each sector are analysed below.

3.3.1 Academia

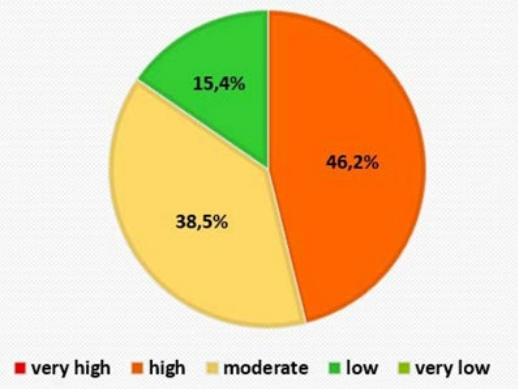
The current digital transformation status of the academia's water related curriculum among the six countries, seems to be mostly moderate (46,2%), while the digital water transformation status in the field of research is high (46,2%), as it is shown in the pie charts below.

The majority of the participants, believes that the digital skills mismatch between the water curricula and the industry needs is mainly moderately significant (46,2%) and significant (30,8%). The training of the personnel in dealing issues with regards to cybersecurity and water digitalisation in general seems to be low (46,2% and 38,5% respectively).

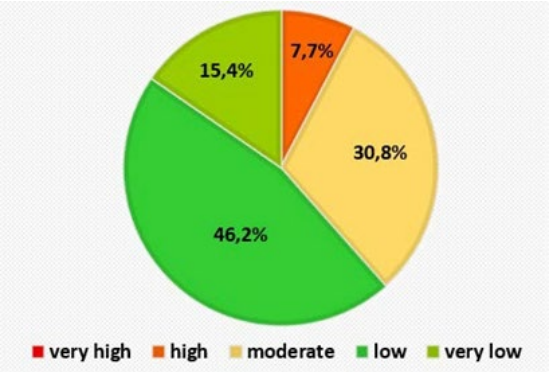
- How would you rate the current digital transformation status of your entity's water related curriculum/curricula?



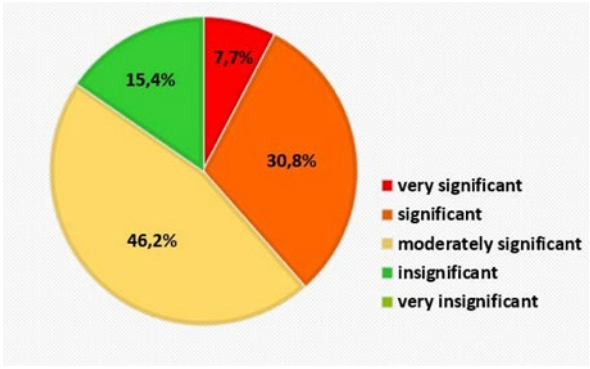
- How would you rate the current digital water transformation status of your entity in the field of research?



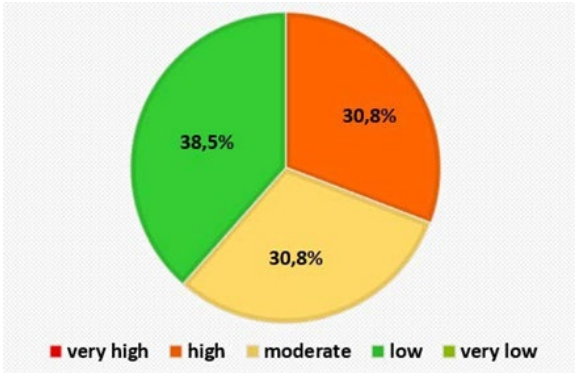
- How would you rate the current digital water transformation status of your entity regarding the level of training of the personnel in supporting the digital water transformation with regards to cybersecurity?



- The water industry generally expects that graduates are better equipped for the changing needs of the industry. How would you rate the digital skills mismatch between your entity's water curricula and the industry needs?



- How would you rate the current digital water transformation status of your entity regarding the level of training of the personnel in supporting the digital water transformation in general?



The following Diagram shows the tools and technologies that are used in the Academia sector. Simulation tools, Sensors and Geographic Information Systems are widely used in the field of Academia, followed by the use of Remoting sensing and the Interaction between different tools. The Augmented and virtual reality technologies are rarely used in the field of Academia.

- Note: “Other” refers to Hydrological modelling and Digital learning platform

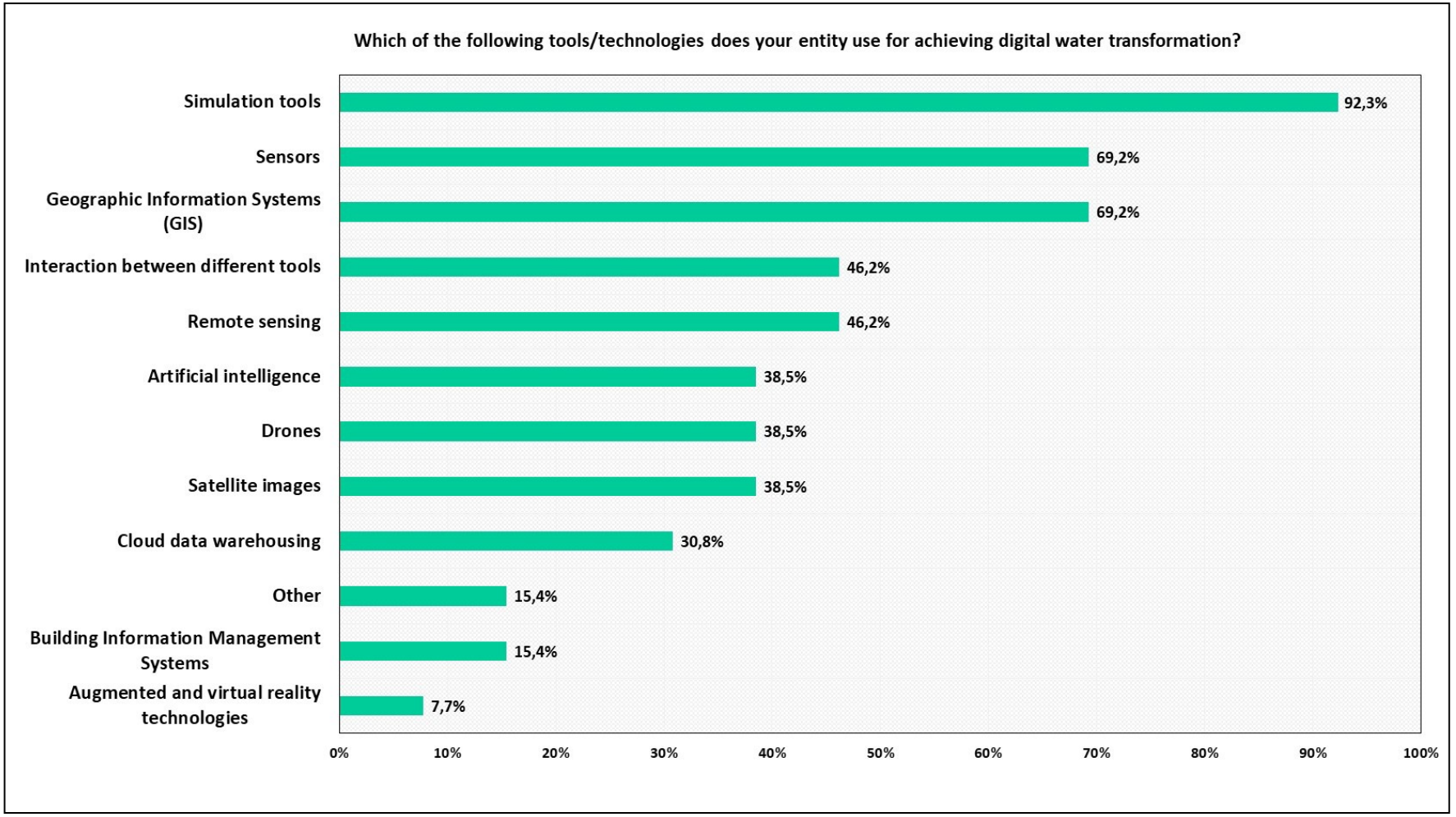
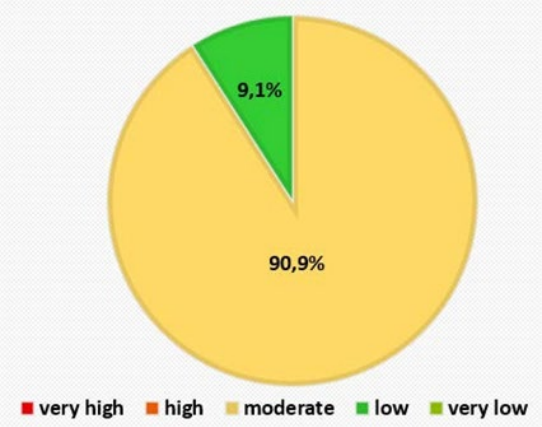


Diagram 3: Tools and technologies that are used by the Academia sector

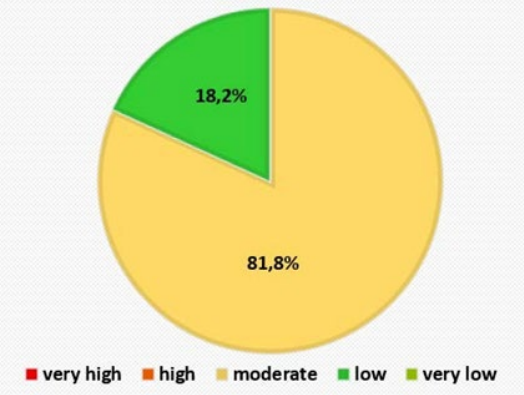
3.3.2 Government

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

- How would you rate the current digital water transformation status of your entity?



- How would you rate the current digital water transformation status of your entity regarding the level of training of the personnel in supporting the digital water transformation in general?



- How would you rate the current digital water transformation status of your entity regarding the level of training of the personnel in supporting the digital water transformation with regards to cybersecurity?

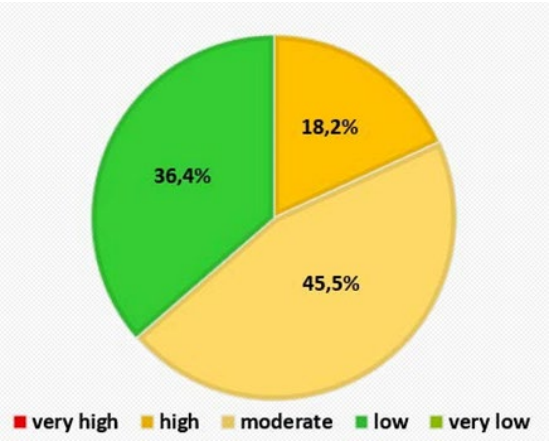


Diagram 4 shows the tools and technologies that are used in the Government sector. Sensors, Geographic Information Systems followed by digital tendering and satellite images, are the tools and technologies that are mostly used in Government. Artificial Intelligence and augmented and virtual reality technologies, are not used in this sector.

- Note: “Other” refers to Telemetric data transfer from sensors and telemetric operations

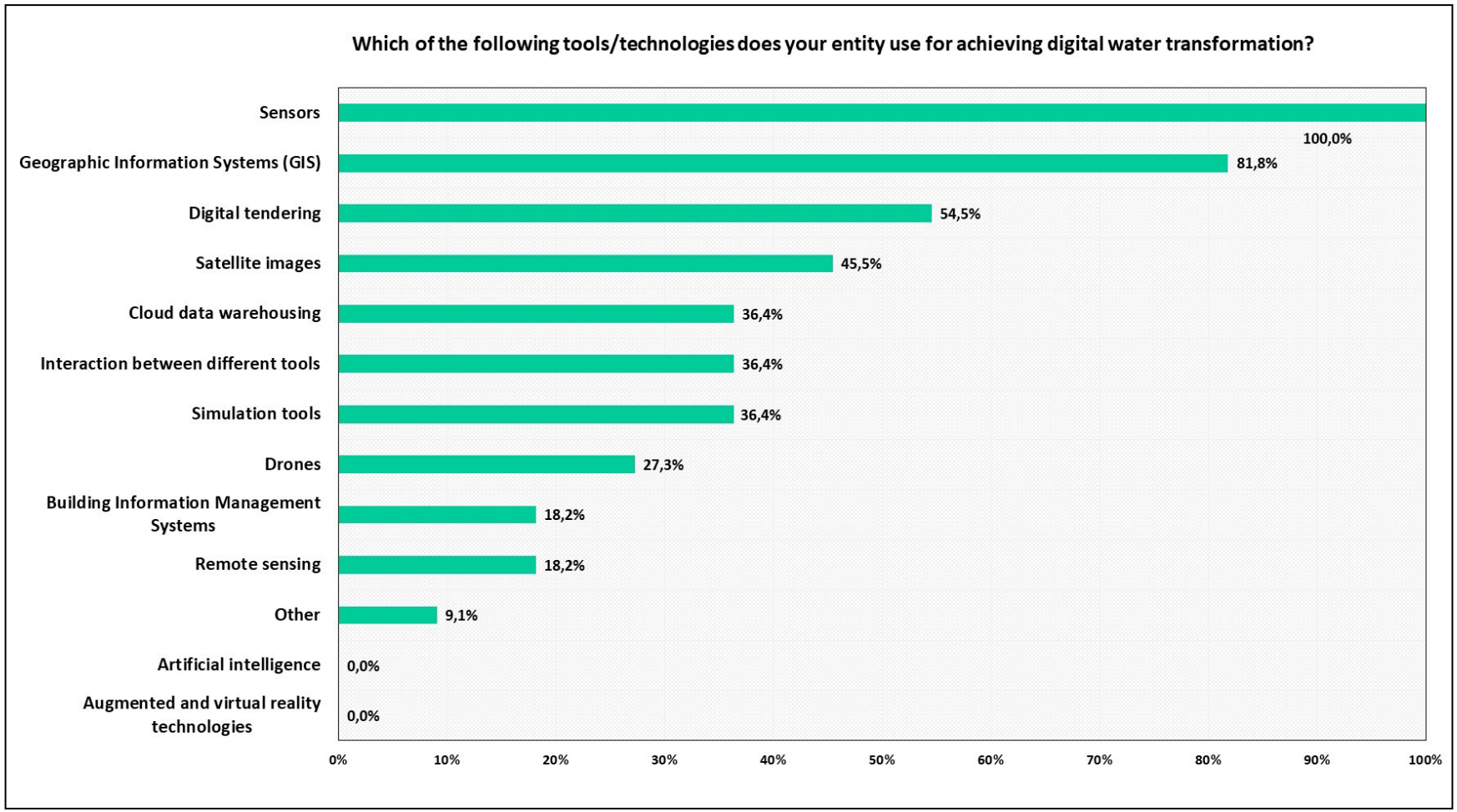
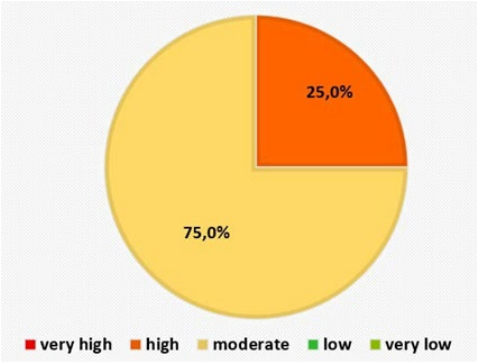


Diagram 4: Tools and technologies that are used by the Government sector

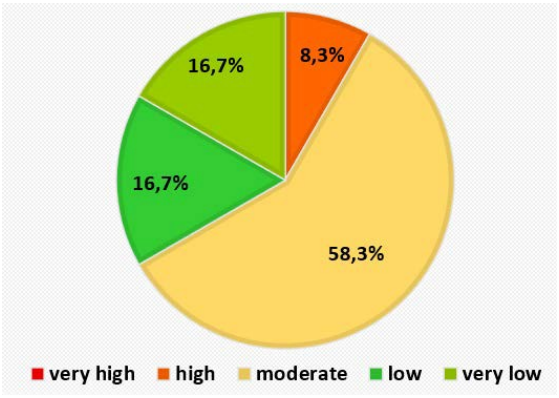
3.3.3 Enterprises

The majority of the participants from the Enterprise sector believes that the current status of the water digital transformation is moderate (75%), while the training of the personnel in general is mostly high (50%). A percentage of 58,3% of the participants answered that the level of training of the personnel in supporting the water digital transformation in regard to cybersecurity is moderate, and only a percentage of 8,3% believes that is high. The responses of the participants are shown in the following Diagrams.

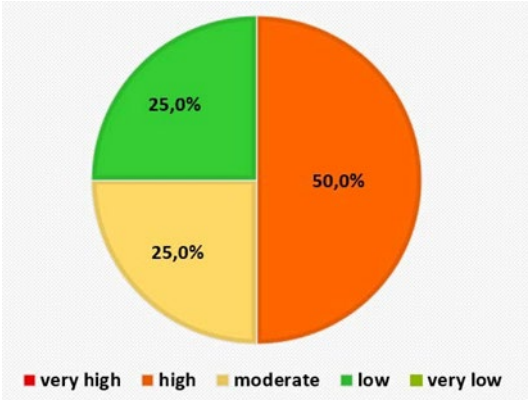
- How would you rate the current digital water transformation status of your entity?



- How would you rate the current digital water transformation status of your entity regarding the level of training of the personnel in supporting the digital water transformation in general?



- How would you rate the current digital water transformation status of your entity regarding the level of training of the personnel in supporting the digital water transformation with regards to cybersecurity?



Geographic Information Systems, simulation tools and sensors are the tools that are mostly used in the sector of the Enterprises (see Diagram 5). Likewise with the Government sector, there is no use of Artificial Intelligence and Augmented and virtual reality technologies.

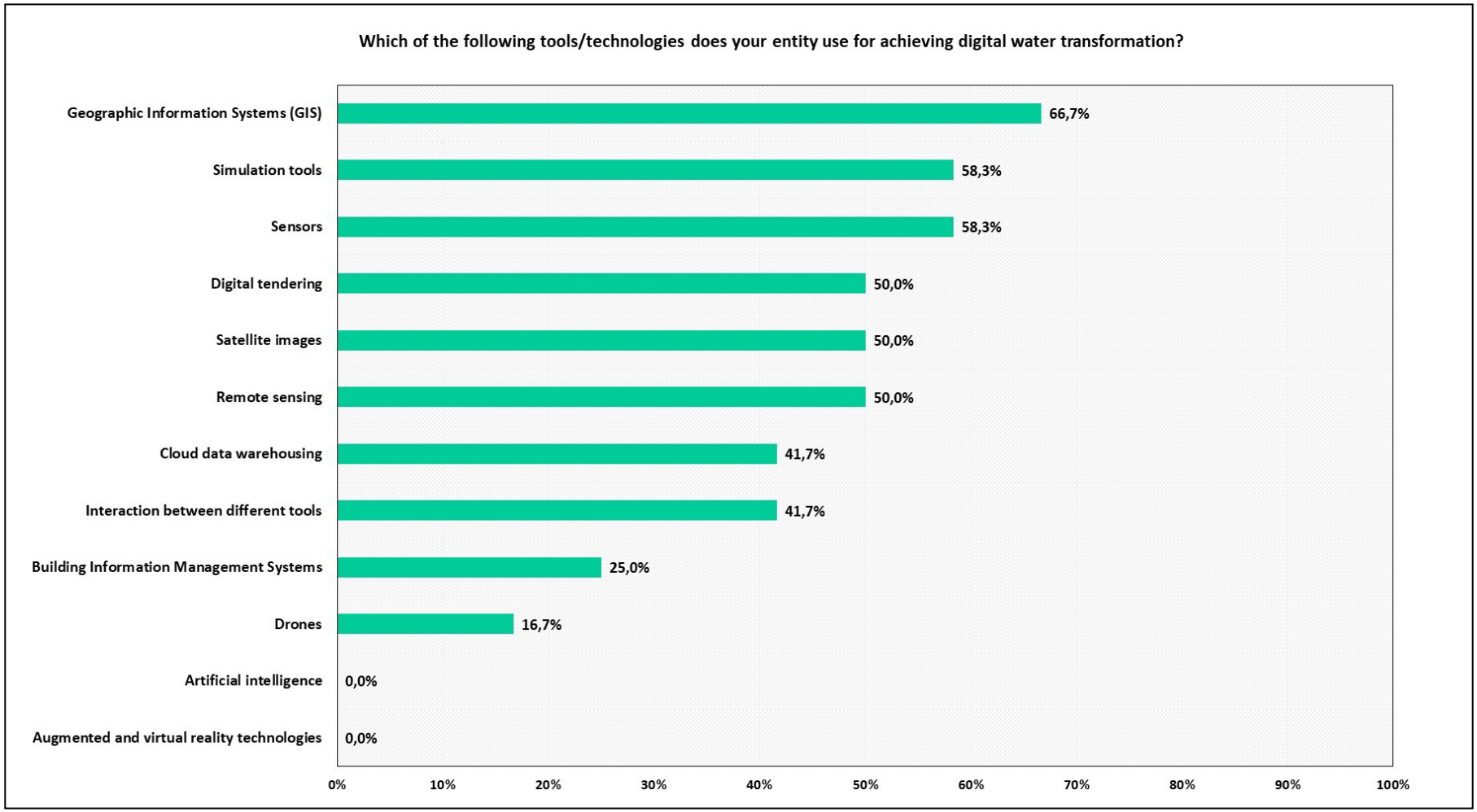


Diagram 5: Tools and technologies that are used by the Enterprise sector

3.4 Interests and Interdependency in Digital Water

Another objective of the online survey was to analyse and document information about the interests of the stakeholders in digital water, and to extract information about their interdependency and cooperation.

Due to the fact that the overall aim of the project is to upgrade the water curricula and develop teaching and learning materials that can be used in the universities, the questions with regards to stakeholder interests were focused on the Academia sector.

The findings are analysed in the following paragraphs.

3.4.1 Academia

Interests

The following Diagram, shows the results concerning the interest of the academia stakeholders on upgrading the current curricula in order to incorporate new teaching material, for better preparing the future water specialists. It is notable that 77% of the participants are interested on upgrading the current curricula, while the percentage of the participants who did not showed to be interested is low (7,7%).

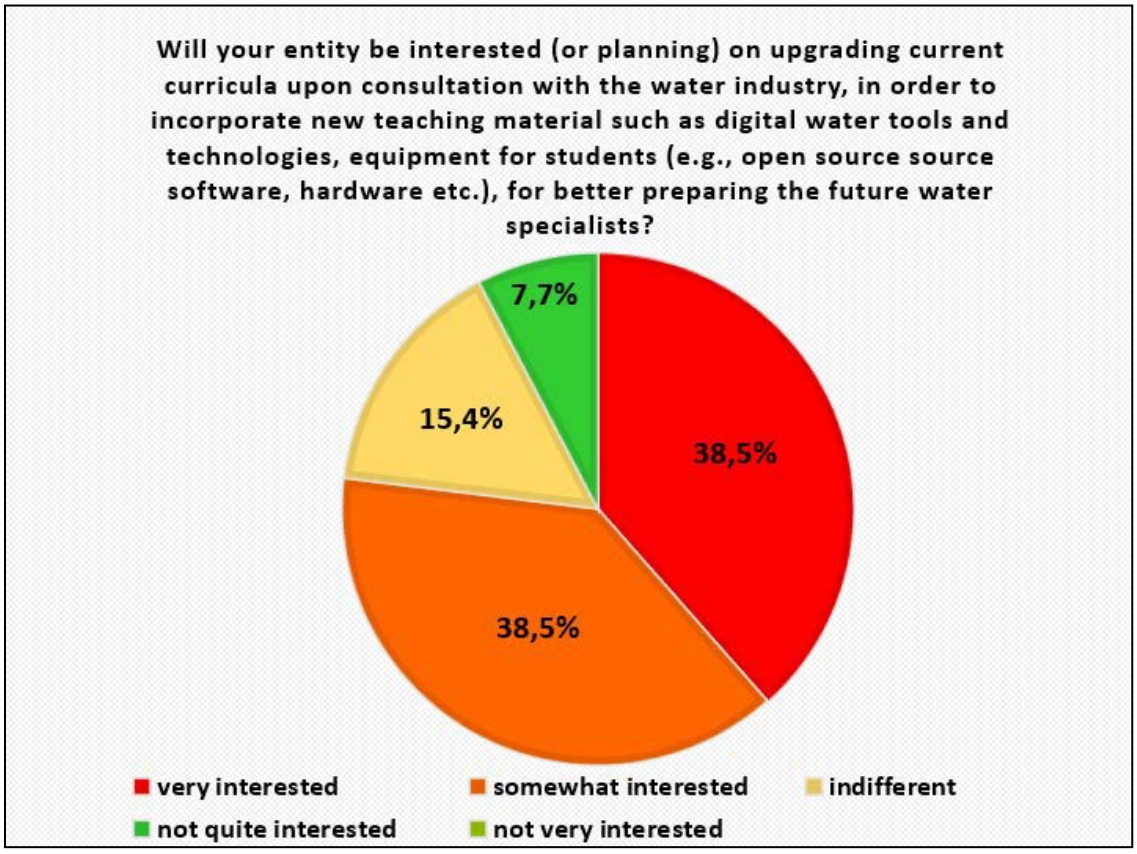


Diagram 6: Interest of the academia stakeholders on upgrading the current curricula

Cooperation and Interdependency

The majority of the participants from the Academia sector rated their cooperation with the Government and the Society as moderate, while their cooperation with Enterprises was equally rated to be mostly moderate and low.

The interdependency of the Academia sector with the other sectors seems to be mainly moderate as it is shown in the relevant pie charts below.

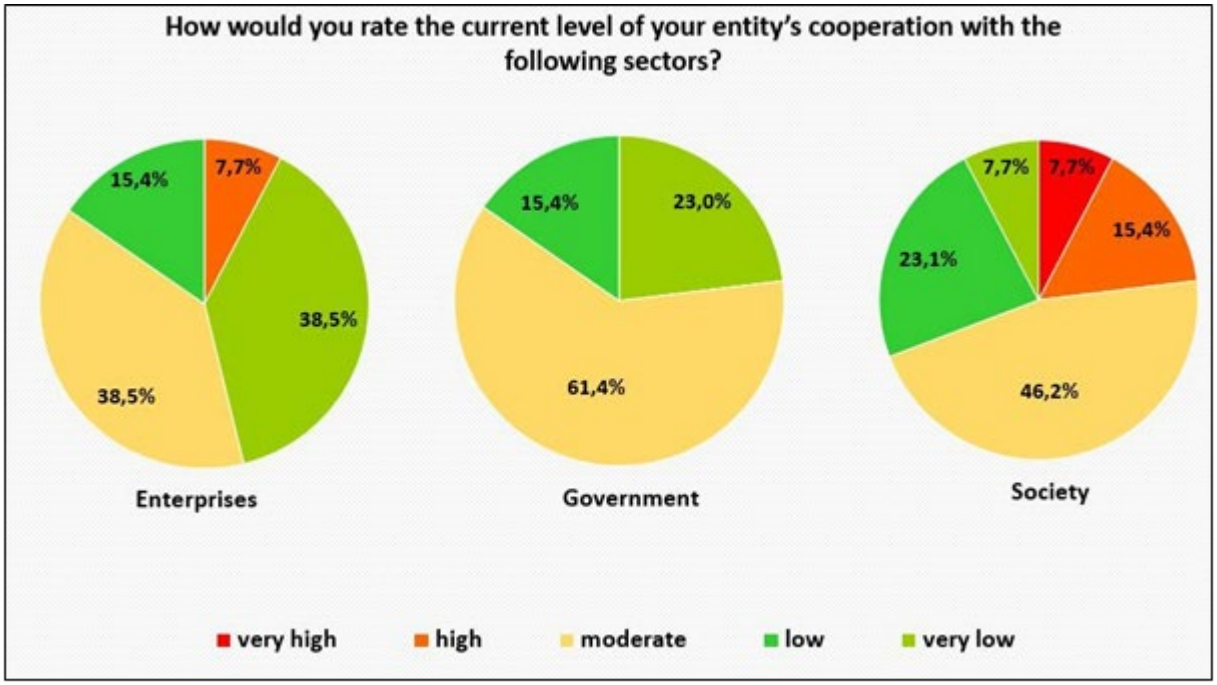


Diagram 7: Results of the cooperation of the academia with the other sectors

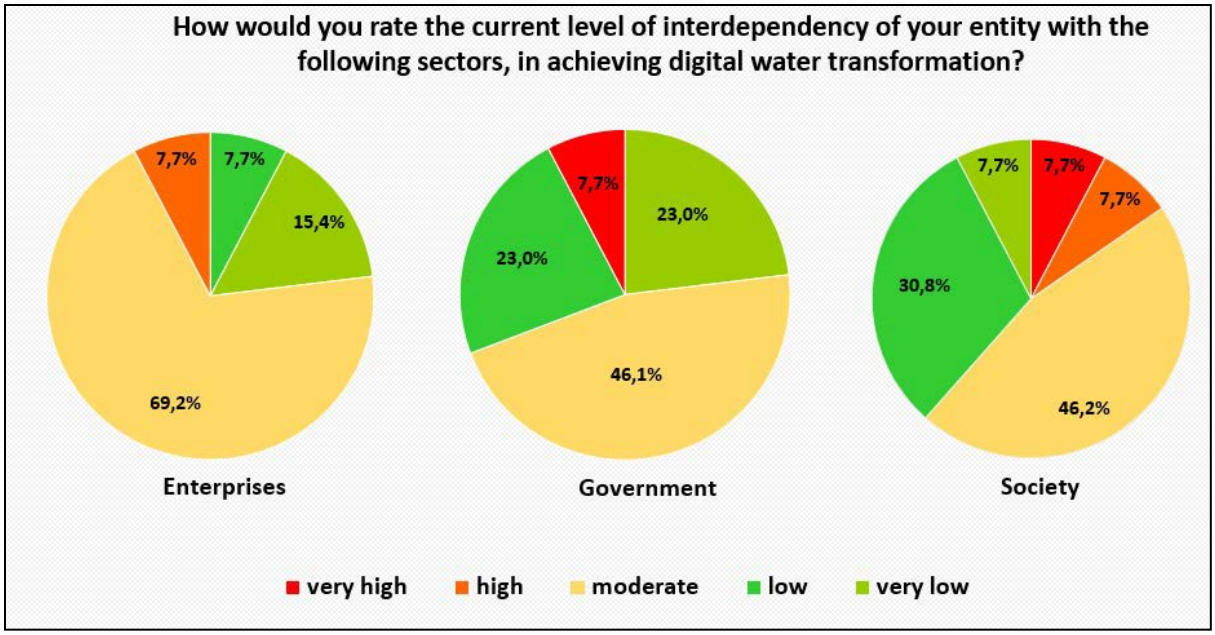


Diagram 8: Results of the interdependency level of the academia with the other sectors

The following Table 6 shows the ranking of the various options in the question about which stakeholder group is having the most crucial role in achieving the digital water transformation.

Most participants (38,5%) believe that the government is having the most crucial role in achieving the digital water transformation, followed by the technology providers (30,7%) and the end-users (30,7%). The stakeholders having the least influence, is the academia and the consultants. The utility owners, the employees and the employers are having an average role in achieving the goal of digitalisation.

Table 6: Ranking of which stakeholder group is having the most crucial role in achieving the digital water transformation according to the academia stakeholders (where 1 is most crucial and 9 is least crucial)

Group / Ranking	Academia	Employees	Employers	Technology providers	End-users	Utility Owners	Government	Consultants	Other
1	7,7%			7,7%		23%	**38,5%**		
2	15,4%	7,7%	7,7%	**30,7%**		7,7%	23%	7,7%	
3	15,4%		7,7%	30,7%	**30,7%**	7,7%			
4		7,7%	15,4%	7,7%	7,7%	23%	15,4%	15,4%	
5	15,4%	23%	30,7%			7,7%	7,7%		7,7%*
6	15,4%	30,7%	7,7%	7,7%	3	7,7%		7,7%	
7	7,7%	23%	15,4%	7,7%	7,7%	15,4%		15,4%	
8	7,7%		7,7%	7,7%	23%		7,7%	30,7%	
9	**7,7%**							**7,7%**	23%**

*Stakeholders organisations like IWA, EWA, National Water Associations

**International organisations, Water and Sewerage administrations

3.4.2 Government

Cooperation and Interdependency

A percentage of 36,4% of the participants from the Government sector believe that the level of the cooperation of the Government with Enterprises is moderate and another 36,4% low. Their level of cooperation with the Academia is mostly moderate (45,4%) and low (36,3%), while these percentages are decreasing with regards to their cooperation with the Society (36,4% moderate and 27,3% low).

Concerning the level of interdependency with the Enterprises, a percentage of 36,4% answered that this is moderate, and the same trend applies with the Government. On the other hand, this level is below moderate in regards to the Society.

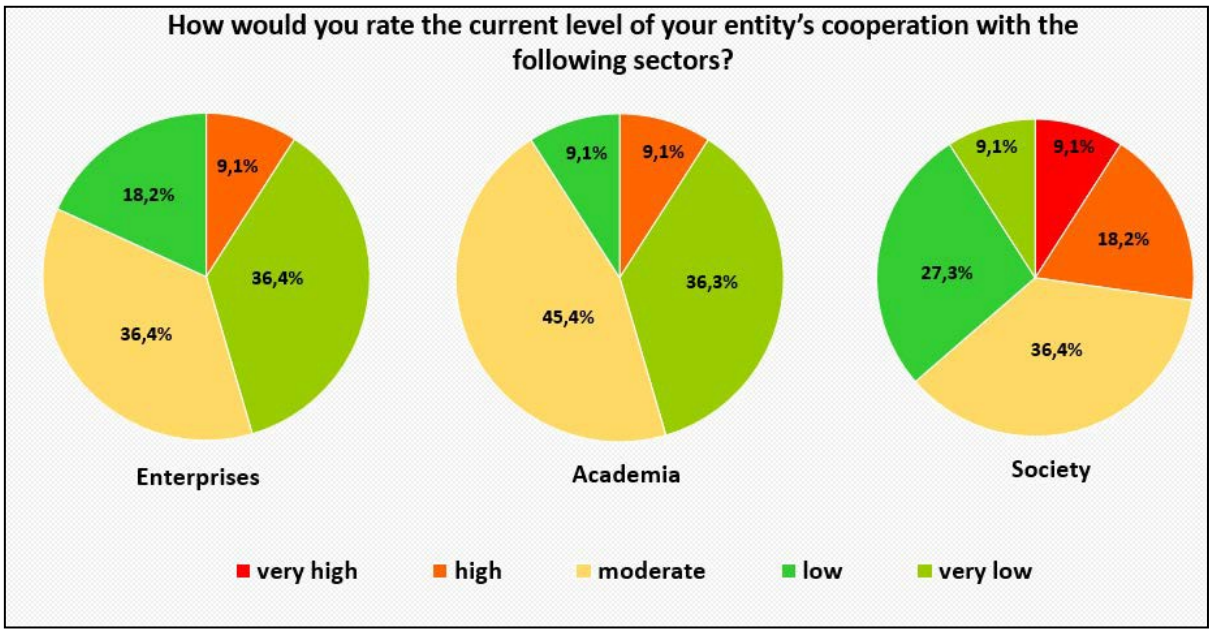


Diagram 9: Results of the cooperation level of the government with the other sectors

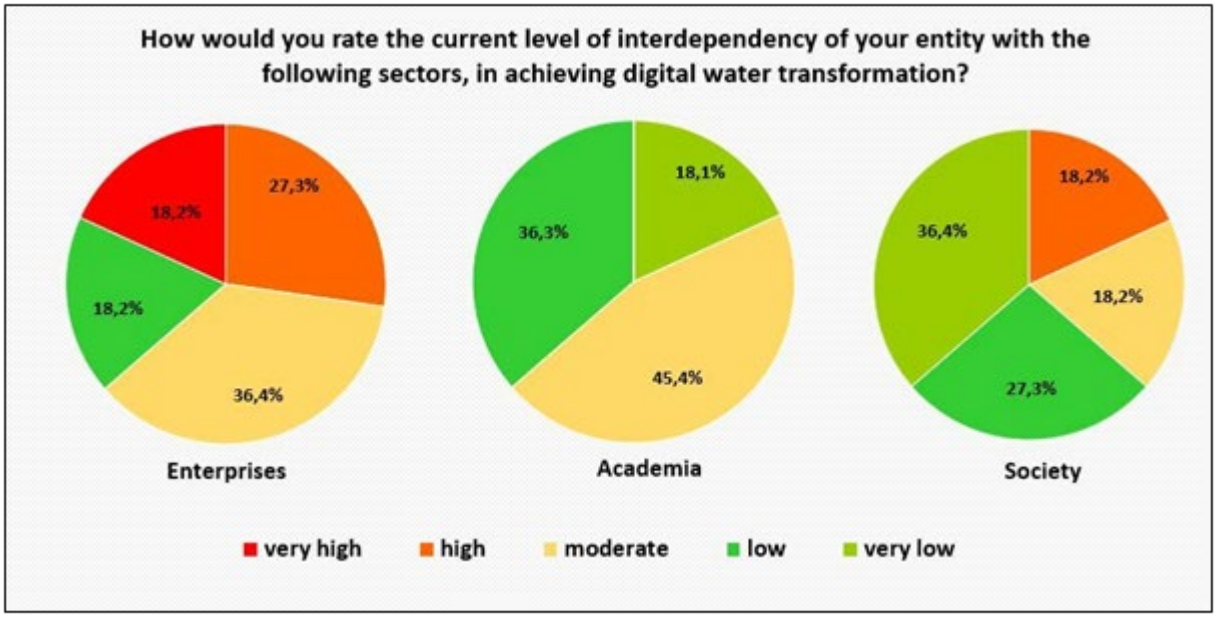


Diagram 10: Results of the interdependency level of the government with the other sectors

According to the results shown on the following Table, the Government sector seems to believe that the communities have the most crucial role in achieving the digital water transformation (referred as "Other" in the Table), together with employees, utility owners and the government. The end-users seem to be having the least crucial role.

Table 7: Ranking of which stakeholder group is having the most crucial role in achieving the digital water transformation according to the government sector (where 1 is most crucial and 9 is least crucial)

Group/ Ranking	Academia	Employees	Employers	Technology providers	End-users	Utility Owners	Government	Consultants	Other
1	9,1%	**18,2%**		9,1%		**18,2%**	**18,2%**		**18,2%***
2	18,2%	18,2%	**18,2%**	**18,2%**			9,1%	9,1%	
3	18,2%	18,2%			9,1%	18,2%	27,3%		
4	9,1%		18,2%	27,3%	9,1%			27,3%	
5	27,3%	9,1%	9,1%	9,1%	9,1%	9,1%		18,2%	
6			27,3%		9,1%	18,2%	18,2%	18,2%	
7	9,1%	9,1%	18,2%	9,1%	9,1%	9,1%	9,1%	9,1%	
8	9,1%			18,2%	**27,3%**	9,1%	9,1%	9,1%	
9		18,2%			18,2%	9,1%			18,2%**

* Worldwide communities

** R&D

3.4.3 Enterprises

Cooperation and Interdependency

The Enterprises' cooperation with the other sectors seems to be low, as it is illustrated in the following Diagram 11.

In addition, their interdependency with the Government is moderate to very low, with the Academia is mainly moderate and low, and with the Society is mostly low (see Diagram 12).

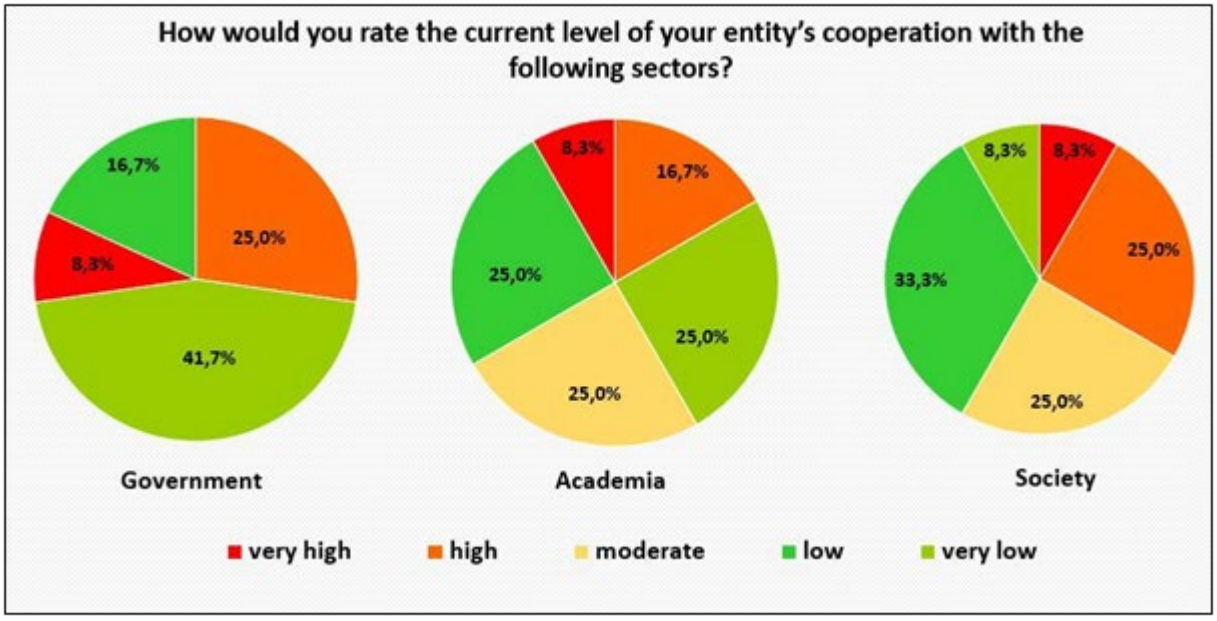


Diagram 11: Results of the cooperation level of the enterprises with the other sectors

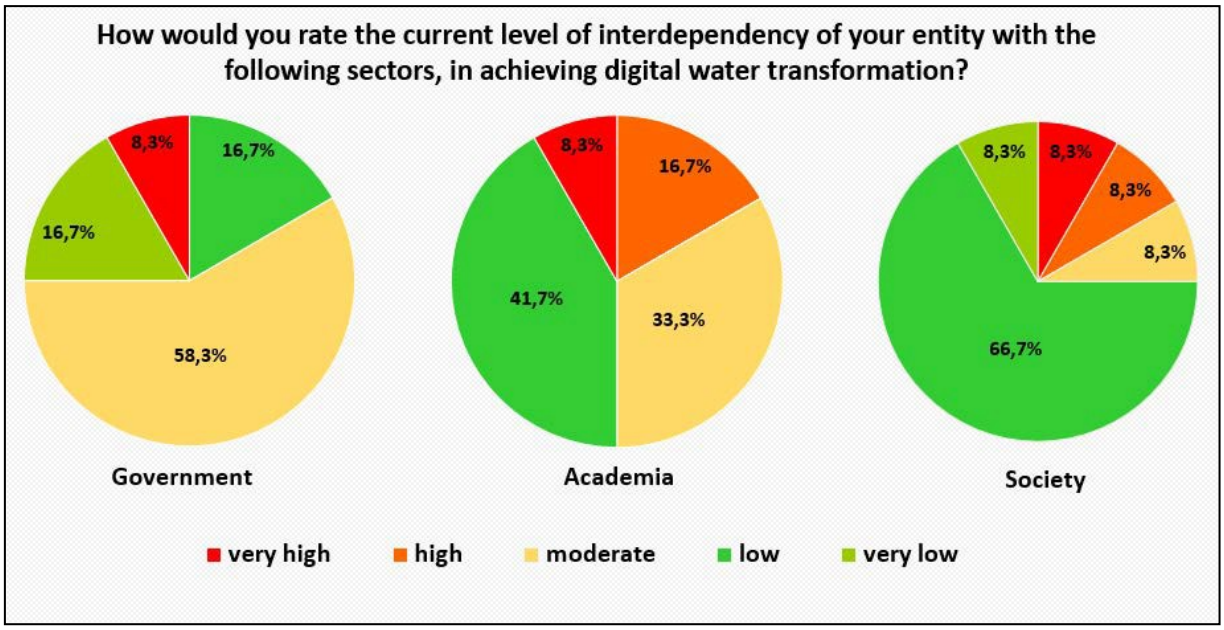


Diagram 12: Results of the interdependency level of the enterprises with the other sectors

Most participants from the Enterprise sector, consider that the government plays the most crucial role in achieving the digital water transformation, followed by the technology providers and the academia. The consultants are believed of having the least crucial role.

Table 8: Ranking of which stakeholder group is having the most crucial role in achieving the digital water transformation according to the enterprise stakeholders (where 1 is most crucial and 9 is least crucial)

Group/ Ranking	Academia	Employees	Employers	Technology providers	End-users	Utility Owners	Government	Consultants	Other
1	16,7%	8,3%				8,3%	**25%**	8,3%	8,3%
2	**16,7%**	8,3%	8,3%	**41,7%**	8,3%	8,3%			
3		16,7%	8,3%	16,7%	16,7%	16,7%	8,3%	8,3%	
4	16,7%				8,3%	33,3%	8,3%	25%	
5	25%	8,3%	8,3%	8,3%	8,3%	8,3%	8,3%	25%	
6		8,3%	41,7%	16,7%	8,3%		8,3%	8,3%	
7	8,3%	41,7%	25%			16,7%		8,3%	
8	16,7%				41,7%		25%	**66,7%**	
9		8,3%	8,3%	8,3%			16,7%		33,3%

3.5 Needs in Digital Water

Identifying the needs in digital water of the stakeholders involved, was one of the most important aspects of this online survey. The specification and the prioritization of the needs will be the guide for the subsequent Work Package 2 (WP2) of the project, the "Digital Water Curriculum". The questions that were formed as well as the answers received in order to lead to the stakeholders' needs, are analysed below.

3.5.1 Academia

The participants were asked to rank the significance of specific barriers in achieving digitalisation, and the results are shown in the Table below. The academia stakeholders consider as the most significant barrier in the 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 with other sectors, are considered to be the least barriers.

Table 9: Ranking of the barriers in achieving the digital water transformation according to the academia stakeholders (where 1 is most significant and 8 is least significant)

Barrier/ Ranking	Lack of funding	Hardware, software and network deficiencies	Lack of specialized human resources	Data limitations	Lack of protection against cyberterrorism	Dependency with other sectors	Current management policies	Other
1	**23,1%**	7,7%	**23,1%**	7,7%		7,7%	7,7%	
2	**38,5%**		**30,7%**		7,7%		15,4%	7,7%[1]
3	7,7%	30,7%	15,4%		15,4%	7,7%	7,7%	
4		15,4%	15,4%	38,5%			23,1%	
5	7,7%	30,7%		15,4%	15,4%	15,4%	7,7%	
6		7,7%	15,4%	7,7%	7,7%	23,1%	15,4%	7,7%[2]
7				15,4%	**23,1%**	**30,7%**	7,7%	7,7%[3]
8	15,4%				15,4%		7,7%	15,4%[4]

[1]Lack of awareness of consequences of cyber attacks
[2]Communication coverage area
[3]Climate change

[4] Old school techniques, sensibilisation

The level of preparation of the new water specialists in digital water aspects for entering the water industry, was questioned to the professionals of the Academia sector (see Diagram 13). The participants at a percentage of 38,5% believe that the new water specialists are moderately prepared, while a percentage of 30,8% believes that are well prepared. It is noticeable though, that a percentage of 23,1% believes that the new water specialists are not well prepared.

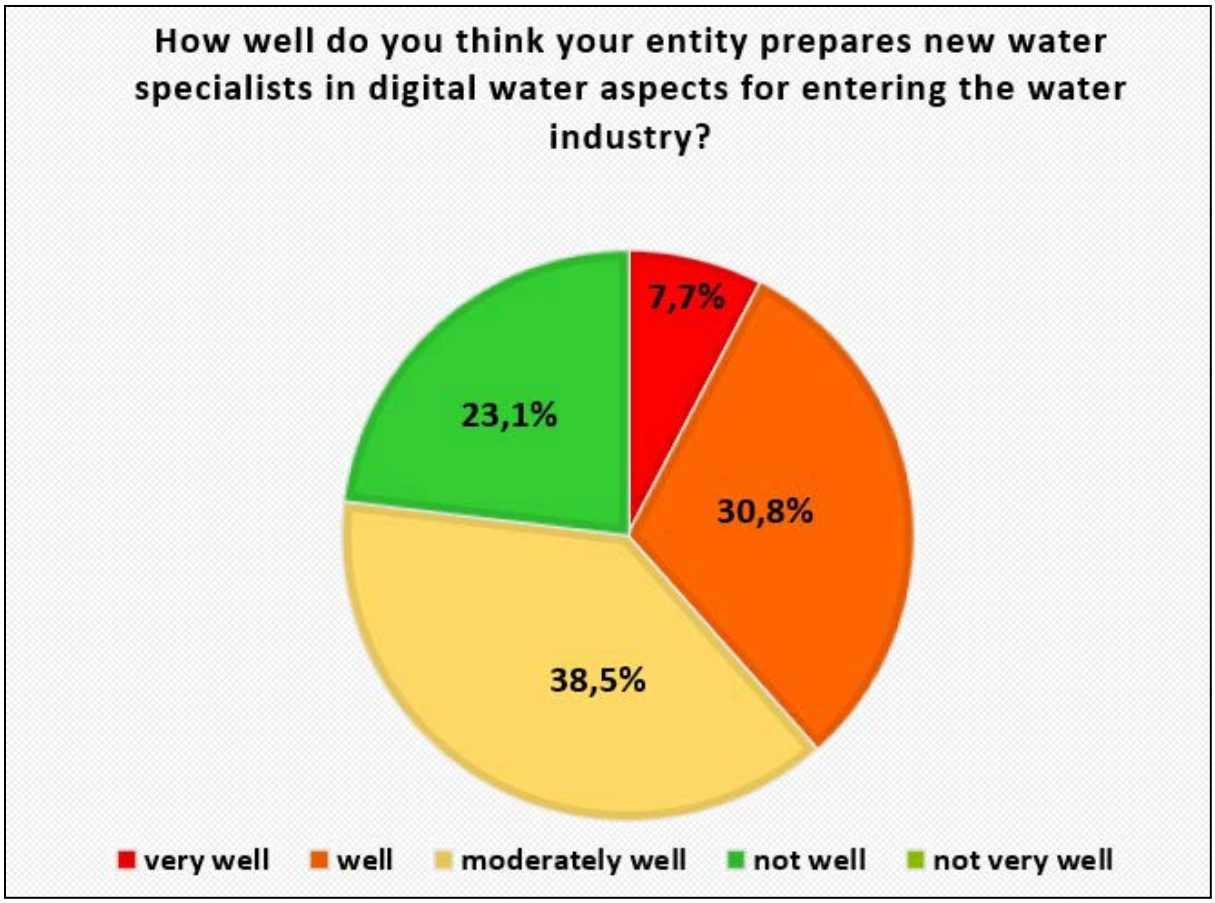


Diagram 13: Responses regarding the level of preparation of the new water specialists according to the academia stakeholders

The most important outcomes of the digitalisation of the water industry, is the advanced monitoring technologies and the intelligent equipment (see Table 10). 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.

Table 10: Prioritization of the outcomes according to the academia stakeholders (where 1 is most important and 7 is least important)

Outcome/ Ranking	Intelligent equipment	Accessible and user-friendly database	Advanced e-learning tools	Integrated water management tools	Advanced monitoring technologies	Industry engagement	Other
1		23,1%	23,1%		**30,7%**		
2	**30,7%**	7,7%	7,7%		15,4%	30,7%	
3	30,7%			38,5%	23,1%		
4	7,7%	30,7%	7,7%	23,1%	15,4%	7,7%	
5	15,4%		23,1%	23,1%	7,7%	23,1%	
6	7,7%	15,4%	**30,7%**	7,7%		**30,7%**	
7	7,7%	15,4%					7,7%*

*Education for water quality preservation

3.5.2 Government

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

Table 11: Ranking of the barriers in achieving the digital water transformation according to the government stakeholders (where 1 is most significant and 8 is least significant)

Barrier/ Ranking	Lack of funding	Hardware, software and network deficiencies	Lack of specialized human resources	Data limitations	Lack of protection against cyberterrorism	Dependency with other sectors	Current management policies	Other
1	**27,3%**	9,1%	18,1%	9,1%			**27,3%**	
2		18,1%	**27,3%**	18,1%	9,1%	9,1%		9,1%*
3	18,1%	18,1%				36,4%	18,1%	
4	18,1%		18,1%	18,1%	9,1%		18,1%	
5	27,3%	9,1%	9,1%	9,1%	27,3%	9,1%		
6		**27,3%**		18,1%	18,1%	18,1%	9,1%	
7			9,1%	18,1%	18,1%	18,1%	18,1%	
8		18,1%	9,1%		9,1%			

*A digital system that can operate with near-zero human staff

The professionals from the Government sector, were asked to rate the level of preparedness of the newly recruited water specialists for the changing needs of the water industry (see Diagram 14). The majority of the participants (72,7%) considered that the newly recruited water specialists are moderately prepared, in contrast to a percentage of 18,2% who believe that are well prepared.

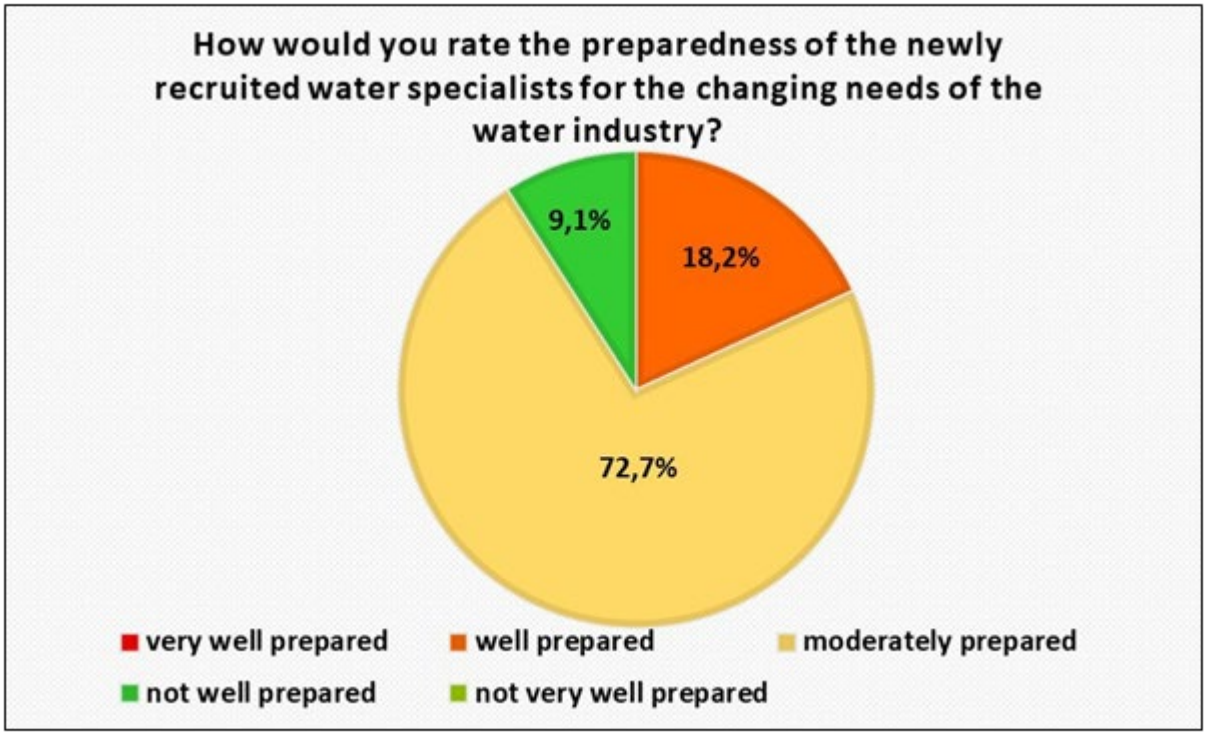


Diagram 14: Rate of the level of preparation of the new water specialists according to the government stakeholders

The Government sector has a key role in digital water transformation, as it holds and manages numerous water-related databases, e.g., for monitoring results, other measurements etc. The government stakeholders were asked to express their opinion whether it is feasible to transform those data into an easily accessible and user-friendly digital format. Most of the participants answered that this is feasible (45,5%), followed by a percentage of 27% who believe that this is moderately feasible. It is notable that 18% of the participants answered that this is not very feasible (see Diagram 15) and no one considered that this is very feasible.

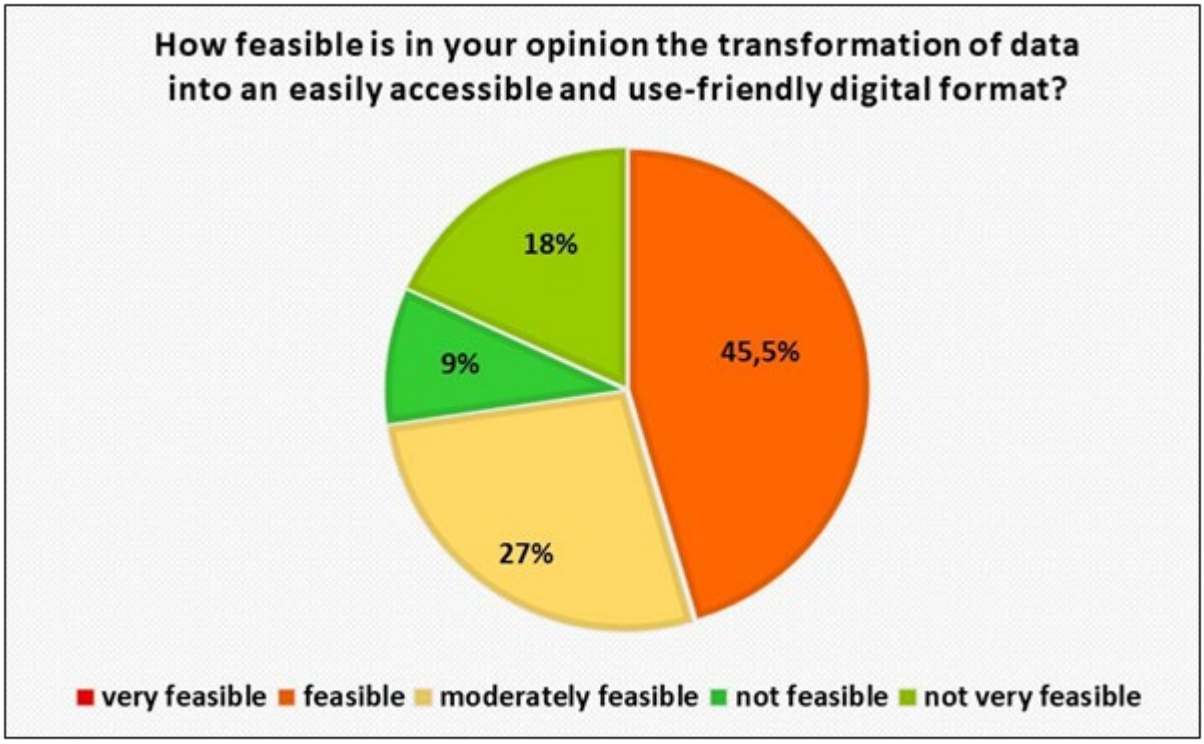


Diagram 15: Rate of the level of feasibility in transforming the data into a digital format according to the government stakeholders

The most important outcome of the digitalisation of the water industry, is considered by the respondents to be an Accessible and user-friendly database, in contrast with the End-users' engagement which seems to be of less importance. The ranking of each outcome, is shown in the following Table.

Table 12: Prioritization of the outcomes according to the government stakeholders (where 1 is most important and 8 is least important)

Outcome/ Ranking	Intelligent equipment	Accessible and user-friendly database	Integrated water management tools	Advanced monitoring technologies	Advanced infrastructure inspection and maintenance	Real-time system monitoring and control	End-users' engagement	Other
1		**27,3%**	9,1%	9,1%		18,2%		9,1%*
2	18,2%	18,2%		18,2%	18,2%	9,1%	18,2%	
3	18,2%	9,1%	9,1%	45,5%		9,1%		
4	27,3%	9,1%	18,2%	18,2%	18,2%			
5	9,1%	9,1%	27,3%		18,2%	27,3%		
6	18,2%	9,1%	9,1%		18,2%	9,1%	9,1%	
7			9,1%	9,1%	18,2%	9,1%	**45,5%**	
8		9,1%	9,1%				18,2%	9,1%**

**GIS

* 24/7 monitoring and advance warning to certain quality and quantity parameters

3.5.3 Enterprises

Table 13 shows the results of the barriers ranking in achieving digital water transformation by the participants from the Enterprise sector. The most significant barriers are considered to be the lack of funding, the data limitations and the hardware/software and network deficiencies. The majority of the enterprise professionals (25%), believes that the lack of specialized human resources is not an important barrier.

Table 13: Ranking of the barriers in achieving the digital water transformation according to the enterprise stakeholders (where 1 is most significant and 8 is least significant)

Barrier/ Ranking	Lack of funding	Hardware, software and network deficiencies	Lack of specialized human resources	Data limitations	Lack of protection against cyberterrorism	Dependency with other sectors	Current management policies	Other
1	**25%**	8,3%	8,3%		8,3%	16,7%	16,7%	
2	8,3%	**25%**	16,7%	**25%**	8,3%	8,3%	8,3%	
3	8,3%	33,3%	8,3%	25%	8,3%	8,3%	8,3%	
4	8,3%	16,7%	25%	16,7%	8,3%	8,3%	8,3%	
5	8,3%	8,3%	8,3%		16,7%	25%	16,7%	
6	8,3%		8,3%	16,7%	41,7%	8,3%	16,7%	
7	25%	8,3%		8,3%		25%	25%	
8			**25%**	8,3%				8,3%*

*Non concurrent digitization of all needed information

The following Diagram shows the results of the enterprise stakeholders in regards to the preparedness of the newly recruited water specialists. Most of the participants (58,3%) believe that the newly recruited water specialists are only moderately prepared,a percentage of 16,7% believe that they are well prepared and another 16,7% that are not well prepared. It is worth mentioning that no one of the participants believes that the newly recruited water specialists are very well prepared.

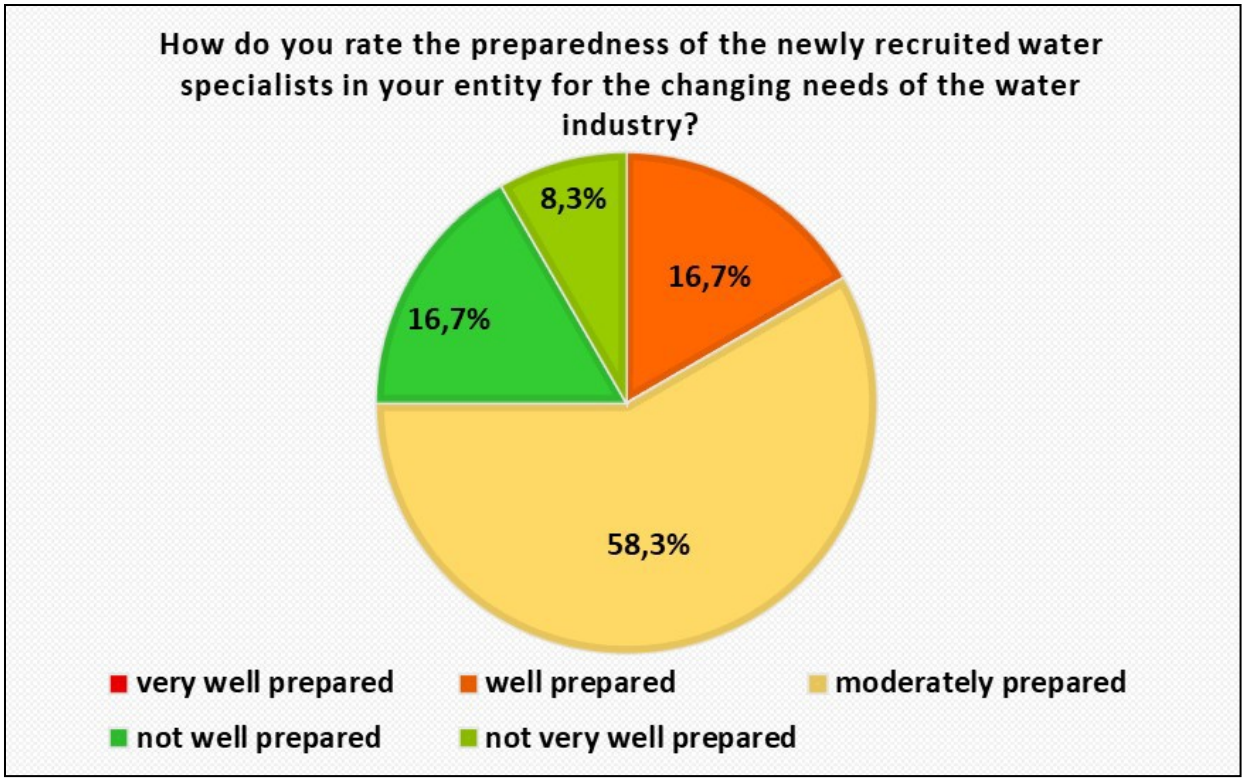


Diagram 16: Rate of the level of preparation of the new water specialists according to the enterprise stakeholders

The most important outcome of the digitalisation of the water industry for the enterprises, is an Accessible and user-friendly database and the Integrated water management tools, as it is shown in the following Table. Advanced monitoring technologies and the End-users' engagement seem to be the least important outcomes.

Table 14: Prioritization of the outcomes according to the enterprise stakeholders (where 1 is most important and 8 is least important)

Outcome/ Ranking	Intelligent equipment	Accessible and user-friendly database	Integrated water management tools	Advanced monitoring technologies	Advanced infrastructure inspection and maintenance	Real-time system monitoring and control	End-users' engagement	Other
1		**33,3%**	8,3%	8,3%	8,3%		8,3%	
2	16,7%	25%	**25%**	8,3%		8,3%	8,3%	
3	16,7%	8,3%	16,7%	8,3%	8,3%	25%	8,3%	
4	8,3%	8,3%	8,3%	16,7%	8,3%	16,7%	33,3%	
5	33,3%			8,3%	41,7%	16,7%		
6	16,7%		16,7%	**41,7%**	8,3%	16,7%		
7		16,7%	16,7%	8,3%	16,7%	8,3%	**33,3%**	
8		8,3%	8,3%		8,3%	8,3%	8,3%	8,3%*

* User friendly software and exposure to available digital water applications

3.6 Anticipated Benefits from Digital Water

In this paragraph, the questions that were aiming at collecting information about the anticipated benefits from digital water, are analyzed. The participants were asked to rank the benefits and the results per sector are described below.

3.6.1 Academia

According to the answers shown in the Table below, a percentage of about 38,5% of the participants believes that "Effective monitoring and the data collection" is the most important benefit of the water industry's digital transformation. In contrast, "Increased entity reputation" is believed to be the least important benefit.

Table 15: Results of ranking the significance of the benefits of the water industry's digital transformation according to the academia stakeholders (where 1 is most significant and 8 is least significant)

Benefit/ Ranking	Quality of higher education	Improved graduate labour market opportunities	Easier data exchange	Improved productivity, creativity and motivation	Effective monitoring and data collection	Effective maintenance of equipment	Increased entity reputation	Other
1	15,4%	7,7%	7,7%		**38,5%**			
2		15,4%	15,4%	7,7%	15,4%	23,1%	15,4%	
3	15,4%	15,4%	7,7%	30,7%		7,7%	7,7%	
4	23,1%	7,7%	23,1%	23,1%			7,7%	
5		30,7%	15,4%	15,4%	7,7%	15,4%		
6	15,4%	7,7%	15,4%	15,4%	7,7%	23,1%		
7	7,7%				7,7%	15,4%	**53,8%**	
8	7,7%				7,7%			7,7%*

*Population health

3.6.2 Government

A percentage of about 45,5% and 36,4% of the participants from the Government sector, consider that the most important benefits of the water industry's digital transformation is "Securing the water quality" and the "Effective monitoring and data collection", respectively.

On the other hand, a percentage of about 36,4% of the participants believes that "More efficient planning in construction" is the least important benefit.

Table 16: Results of ranking the significance of the benefits of the water industry's digital transformation according to the government sector (where 1 is most significant and 8 is least significant)

Benefit/ Ranking	Securing water quality	Water saving	Effective monitoring and data collection	Effective infrastructure maintenance leading to an extended life expectancy	Easier data exchange	Reduction of non-revenue water	Better quality of services through improved productivity and efficiency	More efficient planning in construction	Other
1	**45,5%**		27,3%	9,1%					
2		18,2%	**36,4%**	9,1%			9,1%	18,2%	
3	9,1%	27,3%	9,1%	18,2%			18,2%	9,1%	
4		18,2%		36,4%	18,2%		9,1%		
5	9,1%				45,5%	27,3%	9,1%		
6	27,3%			18,2%	18,2%	18,2%		9,1%	
7		18,2%				27,3%	27,3%	9,1%	
8		9,1%	9,1%		9,1%	9,1%	18,2%	**36,4%**	
9	9,1%		9,1%			9,1%		9,1%	9,1%**

*Increased efficiency of work and services

3.6.3 Enterprises

The majority of the participants from the Enterprise sector, believes that "Better quality of services" is the most important benefit, followed by "Improved productivity and efficiency" and "Easier data exchange". The least important benefit according to their answers is the "Greater profitability" with a percentage of about 33,3%.

Table 17: Results of ranking the significance of the benefits of the water industry's digital transformation according to the enterprise sector (where 1 is most significant and 7 is least significant)

Benefit/ Ranking	Effective monitoring and data collection	Easier data exchange	Better quality of services	Improved productivity and efficiency	Greater profitability	Ensuring enterprise's viability	Other
1	16,7%	8,3%	**33,3%**	8,3%	8,3%		
2	25%	8,3%	8,3%	**41,7%**	8,3%		
3	16,7%	**50%**	16,7%		8,3%	8,3%	
4		16,7%	16,7%	8,3%	25%	33,3%	
5	16,7%	8,3%	25%	16,7%	16,7%	16,7%	
6	25%	8,3%		8,3%	**33,3%**	25%	
7				16,7%		16,7%	

Even though further analysis could be performed (e.g., per country), this was not encouraged due to the small and potentially non-representative sample size. The results as analyzed and presented above, provide a general trend on the important digital water pillars – digital water transformation,

interests, needs, anticipated benefits - as experienced by water front-line stakeholders. These can provide the basis for shaping up and design the subsequent Digiwater deliverables.

4. CONCLUSIONS

The objective of the present document was to report upon the implementation of Task 1.1 "Stakeholders' online survey", which is part of the Work Package 1 "Digital Water Needs Analysis".

For implementing Task 1.1, an online survey was developed using Google Forms. The questionnaire was elaborated using mainly multiple choice, linear scale and checkbox grid questions and aimed at collecting information from four stakeholder target groups; Academia, Government, Enterprises and Society.

The majority of the participants represented the Academia sector, while the participation from the Society sector was very limited, and thus this sector it was excluded from the analysis.

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

The level of interdependency and the cooperation between the various sectors is considered by the participants as moderate to low, and it is believed that the **Government and the Technology Providers** are having the most crucial role in achieving the digital water transformation.

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 the Government stakeholders answered that transformation of data into a digital format is feasible.

Each sector will be benefited 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.

The above, can form the basis for the development of targeted material in subsequent Digiwater WPs. The online survey as distributed is presented in Annex I and can be accessed at the link below as well here: https://forms.gle/Bit4U7mfpMaoX9Cs7.

5. ANNEX

5.1 Annex I: Online Survey

5.1.1 Introduction

Water is an irreplaceable resource and has a global value because of the role it plays in improving the economy, society and the environment. The European Commission works towards linking the physical and digital world for water solutions tackling the societal challenges of water availability, quality and climate-change-related impacts, while the water industry goes through a digital revolution.

“Digital Water” is an important concept underpinning the Water Europe vision, based on the predicted development of a world where all people, “things” and processes are connected through the “Internet of Everything”, leading to capillary networks and sensors, meters and monitoring of the water system all the way along to the individual user.

The DIGIWATER project aims to:

α) develop new, innovative and multidisciplinary approaches to teaching and learning by using multidisciplinary curricula integrated with digital learning tools and virtual facilities,

β) stimulate entrepreneurship and entrepreneurial skills of higher education teaching staff and company staff, and,

γ) facilitate the exchange, flow and co-creation of knowledge.

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 of six universities and six SMEs from Belgium, Cyprus, Germany, Norway, Romania and Turkey.

The results of the following survey, will be used in drafting a "Digital Water Roadmap for education, research and innovation", by examining how digitalisation is transforming the water sector by providing an overview of its current state as well as an assessment of its further needs.

5.1.2 Consent Form

You are being invited to participate in the “DIGIWATER” project through an online survey.

Your participation in this survey is voluntary. If you choose to participate, you may withdraw at any point during the survey. The survey should take about 15 minutes to be completed, and only by clicking the “Submit” button at the end your results will be submitted.

Please note that all data collected through this survey will be kept completely anonymous and confidential and the results will be analyzed in an aggregated form. The results of this survey will be used for the “DIGIWATER” project purposes only.

By clicking “I agree” below you are indicating that you are at least 18 years old, have read and understood this consent form and agree to participate in this survey.

If you do not wish to participate, please click “I decline” below.

5.1.3 QUESTIONS

A. For all Sectors

1. Which is your entity's country of establishment?

1. Belgium
2. Cyprus
3. Germany
4. Norway
5. Romania
6. Turkey
7. Other (please specify):

2. Which of the following sectors represents better your entity?

(Depending on the answer, the participant will be accordingly led to the relevant questions).

1. Academia
2. Enterprises
3. Government
4. Society

B. Academia

3. What is your function in your entity?

1. Academic Staff
2. Undergraduate Student
3. Postgraduate Student
4. Researcher
5. Other (please specify):

4. What are your main activities/responsibilities within your entity?

5. How would you rate the current digital transformation status of your entity's water related curriculum/curricula?

1 very low, 2 low, 3 moderate, 4 high, 5 very high

6. The water industry generally expects that graduates are better equipped for the changing needs of the industry. How would you rate the digital skills mismatch between your entity's water curricula and the industry needs?

1 very significant, 2 significant, 3 moderately significant, 4 insignificant, 5 very insignificant

7. How would you rate the current digital water transformation status of your entity in the field of research?

1 very low, 2 low, 3 moderate, 4 high, 5 very high

8. How would you rate the current digital water transformation status of your entity regarding the level of training of the personnel (teaching staff, researchers, etc.) in supporting the digital water transformation in general?

1 very low, 2 low, 3 moderate, 4 high, 5 very high

9. How would you rate the current digital water transformation status of your entity regarding the level of training of the personnel (teaching staff, researchers, etc.) in supporting the digital water transformation with regards to cybersecurity?

1 very low, 2 low, 3 moderate, 4 high, 5 very high

10. Which of the following tools/technologies does your entity use for achieving digital water transformation? Select all that apply.

1. Geographic Information Systems (GIS)
2. Remote sensing

3. Satellite images
4. Drones
5. Sensors
6. Simulation tools
7. Interaction between different tools
8. Building Information Management Systems
9. Augmented and virtual reality technologies
10. Artificial intelligence
11. Cloud data warehousing
12. Other (please define):

11. How would you rate the current level of your entity's cooperation with the following sectors?

Government: 1 very low, 2 low, 3 moderate, 4 high, 5 very high

Enterprises: 1 very low, 2 low, 3 moderate, 4 high, 5 very high

Society: 1 very low, 2 low, 3 moderate, 4 high, 5 very high

12. How would you rate the current level of interdependency of your entity with the following sectors, in achieving digital water transformation?

Government: 1 very low, 2 low, 3 moderate, 4 high, 5 very high

Enterprises: 1 very low, 2 low, 3 moderate, 4 high, 5 very high

Society: 1 very low, 2 low, 3 moderate, 4 high, 5 very high

13. Which stakeholder groups do you consider of having the most crucial role in achieving the digital water transformation?

Assign a ranking next to the following options where 1 is most important and 9 is least important.

1. Academia
2. Employees
3. Employers
4. Technology providers

5. End-users
6. Utility owners
7. Government
8. Consultants
9. Other

Please specify the “Other” option as mentioned above:

14. While the digital water transformation is not an easy task, how significant are the following barriers for the digitalisation of the water industry?

Assign a ranking next to the following options where 1 is most important and 8 is least important.

1. Lack of funding
2. Hardware, software and network deficiencies
3. Lack of specialized human resources
4. Data limitations (e.g., accessibility, unsuitable form, etc.)
5. Lack of protection against cyberterrorism/ inefficient cybersecurity
6. Dependency with other sectors
7. Current management policies (e.g., resistance to change, etc.)
8. Other

Please specify the “Other” option as mentioned above:

15. How well do you think your entity prepares new water specialists in digital water aspects for entering the water industry?

1 Not very well, 2 not well, 3 moderately well, 4 well, 5 very well

16. Will your entity be interested (or planning) on upgrading current curricula upon consultation with the water industry, in order to incorporate new teaching material such as digital water tools and technologies, equipment of the students (e.g., open-source software, hardware etc.), for better preparing the future water specialists?

1 not very interested, 2 not quite interested, 3 indifferent, 4 somewhat interested, 5 very interested

17. How significant do you consider the following benefits of the water industry's digital transformation to your entity?

Assign a ranking to the following options where 1 is most important and 8 is least important.

1. Quality of higher education
2. Improved graduate labour market opportunities
3. Easier data exchange
4. Improved productivity, creativity and motivation
5. Effective monitoring and data collection
6. Effective maintenance of equipment
7. Increased entity reputation
8. Other

Please specify the "Other" option as mentioned above:

18. Which of the following digital water applications/outcomes do you consider as a priority for your entity?

Assign a ranking to the following options where 1 is most important and 7 is least important.

1. Intelligent equipment
2. Accessible and user-friendly database
3. Advanced e-learning tools
4. Integrated water management tools
5. Advanced monitoring technologies
6. Industry engagement
7. Other

Please specify the "Other" option as mentioned above:

19. Do you have any other comments/suggestions?

C. Government

3. What is your position/function in your entity?

4. What are your main activities/responsibilities within your entity?

5. How would you rate the current digital water transformation status of your entity?

1 very low, 2 low, 3 moderate, 4 high, 5 very high

6. How do you rate the current digital water transformation status of your entity regarding the level of training of the personnel in supporting the digital water transformation in general?

1 very low, 2 low, 3 moderate, 4 high, 5 very high

7. How do you rate the current digital water transformation status of your entity regarding the level of training of the personnel in supporting the digital water transformation with regards to cybersecurity?

1 very low, 2 low, 3 moderate, 4 high, 5 very high

8. Which of the following tools/technologies does your entity use for achieving digital water transformation? Select all that apply.

1. Geographic Information Systems (GIS)
2. Remote sensing
3. Satellite images
4. Drones
5. Sensors
6. Simulation tools
7. Interaction between different tools
8. Building Information Management Systems
9. Augmented and virtual reality technologies
10. Artificial intelligence
11. Cloud data warehousing
12. Digital tendering

13. Other (please define):

9. How do you rate the current level of cooperation of your entity with the following sectors?

Academia: 1 very low, 2 low, 3 moderate, 4 high, 5 very high

Enterprises: 1 very low, 2 low, 3 moderate, 4 high, 5 very high

Society: 1 very low, 2 low, 3 moderate, 4 high, 5 very high

10. How do you rate the current level of interdependency of your entity with the following in achieving digital water transformation?

Academia: 1 very low, 2 low, 3 moderate, 4 high, 5 very high

Enterprises: 1 very low, 2 low, 3 moderate, 4 high, 5 very high

Society: 1 very low, 2 low, 3 moderate, 4 high, 5 very high

11. Which stakeholder groups do you consider of having the most crucial role in achieving the digital water transformation?

Assign a ranking to the following options where 1 is most important and 9 is least important.

1. Academia
2. Employees
3. Employers
4. Technology providers
5. End-users
6. Utility owners
7. Government
8. Consultants
9. Others

Please specify the “Other” option as mentioned above:

12. How would you rate the preparedness of the newly recruited water specialists for the changing needs of the water industry?

1 not very well prepared, 2 not well prepared, 3 moderately prepared, 4 well prepared, 5 very well prepared

13. The government sector has a key role in digital water transformation, as it holds and manages numerous water-related databases, e.g. for monitoring results, other measurements, etc. How feasible is in your opinion the transformation of data into an easily accessible and use friendly digital format?

1 not very feasible, 2 not feasible, 3 moderately feasible, 5 feasible, 5 very feasible

14. While the digital water transformation is not an easy task, how significant are the following barriers for the digitalisation of the water industry?

Assign a ranking to the following options where 1 is most important and 8 is least important.

1. Lack of funding
2. Hardware, software and network deficiencies
3. Lack of specialized human resources
4. Data limitations (e.g., accessibility, unsuitable form, etc.)
5. Lack of protection against cyberterrorism/ inefficient cybersecurity
6. Dependency with other sectors
7. Current management policies (e.g., resistance to change, etc.)
8. Other

   Please specify the “Other” option as mentioned above:

15. How significant do you consider the following benefits of the water industry’s digital transformation to your entity?

Assign a ranking to the following options where 1 is most important and 9 is least important.

1. Securing water quality
2. Water saving

3. Effective monitoring and data collection
4. Effective infrastructure maintenance leading to an extended life expectancy
5. Easier data exchange
6. Reduction of non-revenue water
7. Better quality of services through improved productivity and efficiency
8. More efficient planning in construction
9. Other

Please specify the "Other" option as mentioned above:

16. Which of the following digital water applications/outcomes do you consider as a priority for your entity?

Assign a ranking to the following options where 1 is most important and 8 is least important.

1. Intelligent equipment
2. Accessible and user-friendly database
3. Integrated water management tools
4. Advanced monitoring technologies
5. Advanced infrastructure inspection and maintenance
6. Real-time system monitoring and control
7. End-users' engagement (e.g., real-time consumption)
8. Other

Please specify the "Other" option as mentioned above:

17. Do you have any other comments/suggestions?

D. Enterprises

3. What is your position/function in your entity?

4. What are your main activities/responsibilities within your entity?

5. How would you rate the current digital water transformation status of your entity?

1 very low, 2 low, 3 moderate, 4 high, 5 very high

6. How do you rate the current digital water transformation status of your entity regarding the level of training of the personnel in supporting the digital water transformation in general?

1 very low, 2 low, 3 moderate, 4 high, 5 very high

7. How do you rate the current digital water transformation status of your entity regarding the level of training of the personnel in supporting the digital water transformation with regards to cybersecurity?

1 very low, 2 low, 3 moderate, 4 high, 5 very high

8. Which of the following tools/technologies does your entity use for achieving digital water transformation? *Select all that apply.*

1. Geographic Information Systems (GIS)
2. Remote sensing
3. Satellite images
4. Drones
5. Sensors
6. Simulation tools
7. Interaction between different tools
8. Building Information Management Systems
9. Augmented and virtual reality technologies
10. Artificial intelligence
11. Cloud data warehousing
12. Digital tendering
13. Other (please define):

9. How do you rate the current level of cooperation with the following sectors?

Academia: 1 very low, 2 low, 3 moderate, 4 high, 5 very high

Government: 1 very low, 2 low, 3 moderate, 4 high, 5 very high

Society: 1 very low, 2 low, 3 moderate, 4 high, 5 very high

10. How do you rate the current level of interdependency of your entity with the following sectors in achieving digital water transformation?

Academia: 1 very low, 2 low, 3 moderate, 4 high, 5 very high

Government: 1 very low, 2 low, 3 moderate, 4 high, 5 very high

Society: 1 very low, 2 low, 3 moderate, 4 high, 5 very high

11. Which stakeholder groups do you consider of having the most crucial role in achieving the digital water transformation?

Assign a ranking to the following options where 1 is most important and 9 is least important.

1. Academia
2. Employees
3. Employers
4. Technology providers
5. End-users
6. Utility owners
7. Government
8. Consultants
9. Other

Please specify the "Other" option as mentioned above:

12. While the digital water transformation is not an easy task, how significant are the following barriers for the digitalisation of the water industry?

Assign a ranking to the following options where 1 is most important and 8 is least important.

1. Lack of funding
2. Hardware, software and network deficiencies
3. Lack of specialized human resources
4. Data limitations (e.g., accessibility, unsuitable form, etc.)
5. Lack of protection against cyberterrorism/ inefficient cybersecurity
6. Dependency with other sectors
7. Current management policies (e.g., resistance to change, etc.)
8. Other

Please specify the "Other" option as mentioned above:

13. How significant do you consider the following benefits of the water industry's digital transformation to your entity?

Assign a ranking to the following options where 1 is most important and 7 is least important.

1. Effective monitoring and data collection
2. Easier date exchange
3. Better quality of services
4. Improved productivity and efficiency
5. Greater profitability
6. Ensuring enterprise's viability
7. Other

Please specify the "Other" option as mentioned above:

14. How do you rate the preparedness of the newly recruited water specialists in your entity for the changing needs of the water industry?

1 not very well prepared, 2 not well prepared, 3 moderately prepared, 4 well prepared, 5 very well prepared

15. Which of the following digital water applications/outcomes do you consider as a priority for your entity?

Assign a ranking to the following options where 1 is most important and 8 is least important.

1. Intelligent equipment
2. Accessible and user-friendly database
3. Integrated water management tools
4. Advanced monitoring technologies
5. Advanced infrastructure inspection and maintenance
6. Real-time system monitoring and control
7. End-users' engagement (e.g., real-time consumption)
8. Other

Please specify the "Other" option as mentioned above:

16. Do you have any other comments/suggestions?

E. Society

3. What is your position/function in your entity?

4. What are your main activities/responsibilities within your entity?

5. How would you rate the current digital water transformation status of your entity?

1 very low, 2 low, 3 moderate, 4 high, 5 very high

5. How would you rate the current digital water transformation status of your entity regarding the level of training of the personnel in supporting the digital water transformation in general?

1 very low, 2 low, 3 moderate, 4 high, 5 very high

6. How would you rate the current digital water transformation status of your entity regarding the level of training of the personnel in supporting the digital water transformation with regards to cybersecurity?

1 very low, 2 low, 3 moderate, 4 high, 5 very high

7. Which of the following tools/technologies does your entity use for achieving digital water transformation? *Select all that apply.*

1. Geographic Information Systems (GIS)
2. Remote sensing
3. Satellite images
4. Drones
5. Sensors
6. Simulation tools
7. Interaction between different tools
8. Building Information Management Systems
9. Augmented and virtual reality technologies
10. Artificial intelligence
11. Cloud data warehousing
12. Other (please define):

8. How do you rate the current level of cooperation with the following sectors?

Academia: 1 very low, 2 low, 3 moderate, 4 high, 5 very high

Government: 1 very low, 2 low, 3 moderate, 4 high, 5 very high

Enterprises: 1 very low, 2 low, 3 moderate, 4 high, 5 very high

9. How do you rate the current level of interdependency of your entity with the following in achieving digital transformation?

Academia: 1 very low, 2 low, 3 moderate, 4 high, 5 very high

Government: 1 very low, 2 low, 3 moderate, 4 high, 5 very high

Enterprises: 1 very low, 2 low, 3 moderate, 4 high, 5 very high

10. Which stakeholder groups do you consider of having the most crucial role in achieving the digital water transformation?

Assign a ranking to the following options where 1 is most important and 9 is least important.

1. Academia
2. Employees
3. Employers
4. Technology providers
5. End-users
6. Utility owners
7. Government
8. Consultants
9. Other

Please specify the "Other" option as mentioned above:

11. While the digital transformation is not an easy task, how significant are the following barriers for the digitalisation of the water industry?

Assign a ranking to the following options where 1 is most important and 11 is least important.

1. Lack of funding
2. Hardware, software and network deficiencies
3. Lack of specialized human resources
4. Data limitations (e.g., accessibility, unsuitable form, etc.)
5. Lack of protection against cyberterrorism/ inefficient cybersecurity
6. Dependency with other sectors
7. Current management policies (e.g., resistance to change, etc.)
8. Other

Please specify the "Other" option as mentioned above:

12. How significant do you consider the following benefits of digital transformation of the water industry to your entity?

Assign a ranking to the following options where 1 is most important and 9 is least important.

1. Securing water quality
2. Water saving
3. Effective monitoring and data collection
4. Easier data exchange
5. Extension of the infrastructure life expectancy
6. Reduction of non-revenue water
7. Better quality of services
8. Improved productivity, creativity and motivation
9. Other

Please specify the “Other” option as mentioned above:

13. How significant do you consider the following benefits of the water industry’s digital transformation to the society in general?

Assign a ranking to the following options where 1 is most important and 6 is least important.

1. Securing of water quality
2. Water saving
3. Better quality of services
4. Job growth opportunities
5. Continued education and training
6. Other

Please specify the “Other” option as mentioned above:

14. How feasible in your opinion is for the society to adapt to digital water transformation?

1 not very feasible, 2 not feasible, 3 moderately feasible, 5 feasible, 5 very feasible

15. Which of the following do you consider as the most efficient ways to encourage the digital culture among the society your entity represents?

1. Access to information

2. Seminars/Webinars/Workshops
3. Stakeholder engagement (e.g., active participation in pilot programs)
4. Collaboration
5. Digital training
6. Other (please define):

17. Which of the following digital water applications/outcomes do you consider as a priority for your entity?

Assign a ranking to the following options where 1 is most important and 8 is least important.

1. Intelligent equipment
2. Accessible and user-friendly database
3. Integrated water management tools
4. Advanced monitoring technologies
5. Advanced infrastructure inspection and maintenance
6. Real-time system monitoring and control
7. End-users' engagement (e.g., real-time consumption)
8. Other

Please specify the "Other" option as mentioned above:

16. Do you have any other comments/suggestions?

Thank you for your time!