

## Work Package 2

### R2.1.1: Report on partners' assets

This report was generated in the Task T2.1.1 - Analysis of partners' assets. This task consists in a review of digital water curricula elements and university-enterprise collaboration existing in the partner universities. For this purpose, a survey with single choice questions and some short open-ended questions was filled in by each of the six partner universities. These surveys are included in the report as appendices.

The cross review of existing curricula focused on the key issues that will constitute the topic of the courses from this project: IoT, Big Data and Cybersecurity. It was considered the case of general cases on the subject and also the application of these subject on the water field. Also, the curricula on the digital water subject were also reviewed. Tables 1-4 present the comparable situation on these topics for each partner in order to have an easy analyze for future development.

**Table 1:** Comparable situation regarding the existence of curricula in the partner universities on IoT

|           | In your university there are any curricula and guidelines available for application relevant regarding the subject IoT? | In your university there are any curricula and guidelines available for application relevant regarding the subject IoT in water field? |
|-----------|---|--|
| TH OWL    | YES   | YES  |
| UCY       | YES   | NO   |
| ITU       | NO  | NO   |
| KU LEUVEN | YES   | NO   |
| NMBU      | YES   | NO   |
| UGAL      | YES   | YES  |

**Table 2:** Comparable situation regarding the existence of curricula in the partner universities on Big Data

|           | In your university there are any curricula and guidelines available for application relevant regarding the subject Big Data? | In your university there are any curricula and guidelines available for application relevant regarding the subject Big Data in water field? |
|-----------|--|---|
| TH OWL    | YES  | YES   |
| UCY       | YES  | NO  |
| ITU       | YES  | NO  |
| KU LEUVEN | YES  | NO  |
| NMBU      | YES  | NO  |
| UGAL      | YES  | YES   |

**Table 3:** Comparable situation regarding the existence of curricula in the partner universities on Cybersecurity

|           | In your university there are any curricula and guidelines available for application relevant regarding the subject Cybersecurity in Critical infrastructure? | In your university there are any curricula and guidelines available for application relevant regarding the subject Cybersecurity in Critical Water infrastructure? |
|-----------|--|--|
| TH OWL    | YES  | NO   |
| UCY       | YES  | NO   |
| ITU       | YES  | NO   |
| KU LEUVEN | YES  | NO   |
| NMBU      | YES  | YES  |
| UGAL      | YES  | NO   |

**Table 4:** Comparable situation regarding the existence of curricula in the partner universities on digitalization in the water field

|           | In your university there are any curricula and guidelines available for application relevant regarding the subject digital water subject? | Briefly present the existing curricula and guidelines available for application in your university relevant to the digital water subject  |
|-----------|---|---|
| TH OWL    | YES   | <p>Application and practical use of different software tools (data analysis with MatLab, groundwater modelling, hydrological and hydraulic calculations, sewer flow models, wastewater treatment models (ASM 1 – 3), integrative modeling).</p> <p>GIS-Data for identification of catchment areas for flooding predictment</p> <p>Many master theses are using these different models and software.</p>                               |
| UCY       | NO  | -   |
| ITU       | NO  | -   |
| KU LEUVEN | YES   | <p>Students are taught on the use of digital tools in support of water engineering and water management, mainly mathematical models on water systems, in a number of courses in the following programmes: Master of Water Resources Engineering; Master of Civil Engineering – Option Hydraulic Engineering</p> <p>Some courses: Systems Approach to Water Management; River Modelling; Urban and River Hydrology and Hydraulics.</p> |
| NMBU      | YES   | There are single lectures in the water courses on Digital Water and Cybersecurity of Critical Infrastructure  |
| UGAL      | YES   | <p>There are several programmes at Bsc or Msc level on environmental sciences/engineering.</p> <p>Existing courses at Faculty of Sciences and Environment: Sensor systems used in environmental analysis and monitoring; - Instrumental methods for environmental pollution</p>   |

|  |  |   |
|--|--|---|
|  |  | <p>analysis; Biodiversity monitoring techniques and conservation measures</p> <p>Existing courses at Faculty of Food Science and Engineering: Water resources management; Ecological monitoring; Water quality management in aquaculture; Wastewater control and treatment; Integrated monitoring of ecological systems; Statistical methods for processing ecological experimental data; GIS systems (geographic information system) for environmental monitoring; Control and expertise of pollutants in aquaculture and food industry; Monitoring the environmental impact of aquaculture</p> <p>Existing courses at Faculty of Engineering: Hydrology and hydrogeology; Meteorology and climatology; Techniques for acquiring, monitoring and diagnosing the quality of the environment; Technologies and equipment for wastewater treatment; Dynamics of polluting polyphase fluids.</p> |
|--|--|---|

A similar analysis was done regarding the university-enterprise collaboration existing in the partner universities. The review was focused again on the key issues considered in this project: IoT, Big Data and Cybersecurity. It was considered the case of general cases on the subject and also the application of these subject on the water field. Also, the digital water subject were also reviewed. Tables 5-8 present the comparable situation on these topics for each partner in order to have an easy analyze of the current situation.

**Table 5:** Comparable situation regarding the existence of university-enterprise collaboration in the partner universities on IoT

|           | In your university there are any practices of university - enterprise collaboration relevant regarding the subject IoT? | In your university there are any practices of university - enterprise collaboration relevant regarding the subject IoT in water field |
|-----------|---|---|
| TH OWL    | NO  | NO  |
| UCY       | YES   | NO  |
| ITU       | YES   | NO  |
| KU LEUVEN | YES   | NO  |

|      |     |     |
|------|-----|-----|
| NMBU | YES | YES |
| UGAL | YES | YES |

**Table 6:** Comparable situation regarding the existence of university-enterprise collaboration in the partner universities on Big Data

| Partner universities | In your university there are any practices of university - enterprise collaboration relevant regarding the subject Big Data | In your university there are any practices of university - enterprise collaboration relevant regarding the subject Big Data in water field |
|----------------------|---|--|
| TH OWL               | YES   | YES  |
| UCY                  | YES   | NO   |
| ITU                  | YES   | NO   |
| KU LEUVEN            | YES   | NO   |
| NMBU                 | YES   | YES  |
| UGAL                 | YES   | YES  |

**Table 7:** Comparable situation regarding the existence of university-enterprise collaboration in the partner universities on Cybersecurity

| Partner universities | In your university there are any practices of university - enterprise collaboration relevant regarding the subject Cybersecurity in Critical infrastructure | In your university there are any practices of university - enterprise collaboration relevant regarding the subject Cybersecurity in Critical Water infrastructure |
|----------------------|---|---|
| TH OWL               | YES   | NO  |
| UCY                  | YES   | NO  |
| ITU                  | YES   | NO  |
| KU LEUVEN            | YES   | NO  |
| NMBU                 | NO  | NO  |
| UGAL                 | NO  | NO  |

**Table 8:** Comparable situation regarding the existence of university-enterprise collaboration in the partner universities on digitalization in the water field

|           | In your university there are any practices of university - enterprise collaboration relevant to the digital water subject | Briefly present the existing practices of university - enterprise collaboration existing at your university relevant to the digital water subject  |
|-----------|---|--|
| TH OWL    | YES   | Close Cooperation with STEB Paderborn.<br>Currently: development of digital learning tools in cooperation with STEB Paderborn, in detail: virtual tour at wwtp with detailed explanation of processes, data acquisition, plants and design parameters. Target group of the virtual tours are students, experts and interested citizenship. Informal cooperation with other universities with the goal of exchange activities.  |
| UCY       | NO  | -  |
| ITU       | NO  | -  |
| KU LEUVEN | YES   | Research projects in which digital models of water systems are being developed and/or applied for scenario investigations. Projects funded by: <ul style="list-style-type: none"> <li>Water authorities: Flemish Environment Agency, Ministry of Public Works.</li> <li>Provinces and cities: Province of Limburg, City of Antwerp, City of Leuven.</li> </ul> Water companies: domestic wastewater treatment company Aquafin, water company Water-link, Port of Antwerp, water company Fluvius.     |
| NMBU      | YES   | There are several collaborations with SMEs working on ICT.   |
| UGAL      | YES   | One of the most important project existing is REXDAN - Integrated system for complex research and monitoring of the environment in the Danube river area. REXDAN covers a wide geographical area (2000 km on the navigable part of the Danube with extensive components of the river basin) and research areas related to water, sediments, soil, air, biodiversity, bathymetry, hydromorphology etc. corresponding to multiple specializations: chemistry, biology, physics, environmental science, |

|  |  |  |
|--|--|--|
|  |  | <p>ecology, bathymetry, topography, atmospheric chemistry, sustainable development.</p> <p>Another existing project is MultiAqualoT - Optimization of fish and plant biomass growth technologies in multi-trophic systems of intensive aquaculture through use of intelligent visual recognition and IoT techniques. This project aims to develop a recirculating sturgeon growth system by integrating innovative aquaponic methods of water quality control, based on the use of waste materials from the food industry, as well as by using intelligent visual recognition and IoT techniques to optimize technologies. to increase fish and plant biomass in order to maximize the profitability and sustainability of intensive sturgeon aquaculture.</p> |
|--|--|--|

Water companies are intensively using their resources which are usually equipment that can be expensive and difficult to maintain due to heavy duty operating conditions. There is a continuing concern about the implementation of advanced digital technology systems that allow monitoring and control of processes. Adapting these processes to digital technologies allows a significant increase in data collection speeds as well as data volume.

Data acquisition systems from sensors and transducers are mainly using the Industrial Internet of Things (IIoT) solutions, transforming the conventional infrastructure into a SMART infrastructure. The acquired data reach a central node, Cluster, Cloud, from where they are taken for control, display, and processing through SCADA systems and saved in BigData systems. Protecting data, systems, networks, programs, and devices from unauthorized attacks or access are accomplished by applying Cybersecurity technologies, methods, and processes.

Applications based on Artificial Intelligence technologies use these Big Data sets and provide results that lead to accomplishing the requirements of increasing the efficiency of production capacity in the field of water, optimizing the operation of water processes, and creating more accurate predictions and predictive models of process behavior, improving maintenance strategies and optimizing resource use.

In conclusion, there is a very high need for additional curricula items on IoT, Big Data and Cybersecurity with specific focus on the water sector as well as guidelines. This will also enhance the university-enterprise collaboration on the use of digital water system models in research projects, would meet several market needs and will also enhance the employability.

## APPENDIX 1 - TECHNISCHE HOCHSCHULE OSTWESTFALEN-LIPPE

### ERASMUS KA - DIGIWATER

#### WORK PACKAGE 2 DIGITAL WATER CURRICULUM

#### REPORT R2.1.1 - TASK T2.1.1 - ANALYSIS OF PARTNERS' ASSETS

In order to complete the task *T2.1.1 Analysis of partners' assets* please summarise the review of digital water curricula elements, university-enterprise collaboration, content relevance to the market needs / employability, (technical) guidelines (application) as well as curricula (education) existing in your universities.

Your document will contain information on:

#### 1. CROSS-REVIEW OF EXISTING CURRICULA

A. In your university there are any **curricula** and **guidelines available for application** (e.g. single courses, seminars or modules) relevant regarding the subject IoT?

|     |   |
|-----|---|
| YES | X |
| NO  |   |

B. In your university there are any **curricula** and **guidelines available for application** (e.g. single courses, seminars or modules) relevant regarding the subject IoT in water field?

|     |   |
|-----|---|
| YES | X |
| NO  |   |

C. In your university there are any **curricula** and **guidelines available for application** (e.g. single courses, seminars or modules) relevant regarding the subject Big Data?

|     |   |
|-----|---|
| YES | X |
| NO  |   |

D. In your university there are any **curricula** and **guidelines available for application** (e.g. single courses, seminars or modules) relevant regarding the subject Big Data in water field?

|     |   |
|-----|---|
| YES | X |
| NO  |   |

E. In your university there are any **curricula** and **guidelines available for application** (e.g. single courses, seminars or modules) relevant regarding the subject Cybersecurity in Critical infrastructure?

|     |   |
|-----|---|
| YES | X |
| NO  |   |

F. In your university there are any **curricula** and **guidelines available for application** (e.g. single courses, seminars or modules) relevant regarding the subject Cybersecurity in Critical Water infrastructure?

|     |   |
|-----|---|
| YES |   |
| NO  | X |



G. In your university there are any **curricula** and **guidelines available for application** (e.g. single courses, seminars or modules) relevant to the digital water subject?

|     |   |
|-----|---|
| YES | X |
| NO  |   |

H. If the answer to the question G is Yes, please briefly present the existing **curricula** and **guidelines available for application** in your university (e.g. single courses, seminars or modules) relevant to the digital water subject. This information will be presented in comparable tables easy to analyse for future development.

Application and practical use of different software tools (data analysis with MatLab, groundwater modelling, hydrological and hydraulic calculations, sewer flow models, wastewater treatment models (ASM 1 – 3), integrative modeling)  
GIS-Data for identification of catchment areas for flooding predictment  
Many master theses are using these different models and software.

## 2. CROSS-REVIEW OF UNIVERSITY-ENTERPRISE COLLABORATION PRACTICES

A. In your university there are any practices of university - enterprise collaboration relevant regarding the subject IoT?

|     |   |
|-----|---|
| YES |   |
| NO  | X |

B. In your university there are any practices of university - enterprise collaboration relevant regarding the subject IoT in water field?

|     |   |
|-----|---|
| YES |   |
| NO  | X |

C. In your university there are any practices of university - enterprise collaboration relevant regarding the subject Big Data?

|     |   |
|-----|---|
| YES | X |
| NO  |   |

D. In your university there are any practices of university - enterprise collaboration relevant regarding the subject Big Data in water field?

|     |   |
|-----|---|
| YES | X |
| NO  |   |

E. In your university there are any practices of university - enterprise collaboration relevant regarding the subject Cybersecurity in Critical infrastructure?

|     |   |
|-----|---|
| YES | X |
| NO  |   |

F. In your university there are any practices of university - enterprise collaboration relevant regarding the subject Cybersecurity in Critical Water infrastructure?

|     |   |
|-----|---|
| YES |   |
| NO  | X |

G. In your university there are any practices of university - enterprise collaboration relevant to the digital water subject?

|     |   |
|-----|---|
| YES | X |
| NO  |   |

H. If the answer to the question G is Yes, please briefly present the information about practices of university - enterprise collaboration existing at your universities. This will include forms of collaborations, partnership modalities, ways to establish contacts with enterprises, etc.

Close Cooperation with STEB Paderborn  
Currently: development of digital learning tools in cooperation with STEB Paderborn, in detail: virtual tour at wwtp with detailed explanation of processes, data acquisition, plants and design parameters. Target group of the virtual tours are students, experts and interested citizenship. Informal cooperation with other universities with the goal of exchange activities.

### 3. CONCLUSIONS

Present the key findings regarding the review of digital water curricula elements, university-enterprise collaboration, content relevance to the market needs / employability, (technical) guidelines (application) as well as curricula (education) existing in your universities.

Data management and data analysis has to be enhanced  
Data pools have to be evaluated  
Digital learning tools will be used more in the future, but are still missing  
Application of digital learning tools is hindered by licence regulations, missing knowledge, safety concerns  
Not all data are open source, often this hinders the use in education  
Positive: software companies offer license fee reduction for universities

## APPENDIX 2 - UNIVERSITY OF CYPRUS

### ERASMUS KA - DIGIWATER

#### WORK PACKAGE 2 DIGITAL WATER CURRICULUM

#### REPORT R2.1.1 - TASK T2.1.1 - ANALYSIS OF PARTNERS' ASSETS

In order to complete the task *T2.1.1 Analysis of partners' assets* please summarise the review of digital water curricula elements, university-enterprise collaboration, content relevance to the market needs / employability, (technical) guidelines (application) as well as curricula (education) existing in your universities.

Your document will contain information on:

#### 1. CROSS-REVIEW OF EXISTING CURRICULA

A. In your university there are any **curricula** and **guidelines available for application** (e.g. single courses, seminars or modules) relevant regarding the subject IoT?

|     |   |
|-----|---|
| YES | ✓ |
| NO  |   |

B. In your university there are any **curricula** and **guidelines available for application** (e.g. single courses, seminars or modules) relevant regarding the subject IoT in water field?

|     |   |
|-----|---|
| YES |   |
| NO  | ✓ |

C. In your university there are any **curricula** and **guidelines available for application** (e.g. single courses, seminars or modules) relevant regarding the subject Big Data?

|     |   |
|-----|---|
| YES | ✓ |
| NO  |   |

D. In your university there are any **curricula** and **guidelines available for application** (e.g. single courses, seminars or modules) relevant regarding the subject Big Data in water field?

|     |   |
|-----|---|
| YES |   |
| NO  | ✓ |

E. In your university there are any **curricula** and **guidelines available for application** (e.g. single courses, seminars or modules) relevant regarding the subject Cybersecurity in Critical infrastructure?

|     |   |
|-----|---|
| YES | ✓ |
| NO  |   |

F. In your university there are any **curricula** and **guidelines available for application** (e.g. single courses, seminars or modules) relevant regarding the subject Cybersecurity in Critical Water infrastructure?

|     |   |
|-----|---|
| YES |   |
| NO  | ✓ |

G. In your university there are any **curricula** and **guidelines available for application** (e.g. single courses, seminars or modules) relevant to the digital water subject?

|     |   |
|-----|---|
| YES |   |
| NO  | ✓ |

H. If the answer to the question G is Yes, please briefly present the existing **curricula** and **guidelines available for application** in your university (e.g. single courses, seminars or modules) relevant to the digital water subject. This information will be presented in comparable tables easy to analyse for future development.

|  |  |
|--|--|
|  |  |
|--|--|

## 2. CROSS-REVIEW OF UNIVERSITY-ENTERPRISE COLLABORATION PRACTICES

A. In your university there are any practices of university - enterprise collaboration relevant regarding the subject IoT?

|     |   |
|-----|---|
| YES | ✓ |
| NO  |   |

B. In your university there are any practices of university - enterprise collaboration relevant regarding the subject IoT in water field?

|     |   |
|-----|---|
| YES |   |
| NO  | ✓ |

C. In your university there are any practices of university - enterprise collaboration relevant regarding the subject Big Data?

|     |   |
|-----|---|
| YES | ✓ |
| NO  |   |

D. In your university there are any practices of university - enterprise collaboration relevant regarding the subject Big Data in water field?

|     |   |
|-----|---|
| YES |   |
| NO  | ✓ |

E. In your university there are any practices of university - enterprise collaboration relevant regarding the subject Cybersecurity in Critical infrastructure?

|     |   |
|-----|---|
| YES | ✓ |
| NO  |   |

F. In your university there are any practices of university - enterprise collaboration relevant regarding the subject Cybersecurity in Critical Water infrastructure?

|     |   |
|-----|---|
| YES |   |
| NO  | ✓ |

G. In your university there are any practices of university - enterprise collaboration relevant to the digital water subject?

|     |   |
|-----|---|
| YES |   |
| NO  | ✓ |

H. If the answer to the question G is Yes, please briefly present the information about practices of university - enterprise collaboration existing at your universities. This will include forms of collaborations, partnership modalities, ways to establish contacts with enterprises, etc.

### 3. CONCLUSIONS

Present the key findings regarding the review of digital water curricula elements, university-enterprise collaboration, content relevance to the market needs / employability, (technical) guidelines (application) as well as curricula (education) existing in your universities.

## APPENDIX 3 - ISTANBUL TEKNİK UNIVERSITESİ

### ERASMUS KA - DIGIWATER

#### WORK PACKAGE 2 DIGITAL WATER CURRICULUM

#### REPORT R2.1.1 - TASK T2.1.1 - ANALYSIS OF PARTNERS' ASSETS

In order to complete the task *T2.1.1 Analysis of partners' assets* please summarise the review of digital water curricula elements, university-enterprise collaboration, content relevance to the market needs / employability, (technical) guidelines (application) as well as curricula (education) existing in your universities.

Your document will contain information on:

#### 1. CROSS-REVIEW OF EXISTING CURRICULA

A. In your university there are any **curricula** and **guidelines available for application** (e.g. single courses, seminars or modules) relevant regarding the subject IoT?

|     |   |
|-----|---|
| YES |   |
| NO  | X |

B. In your university there are any **curricula** and **guidelines available for application** (e.g. single courses, seminars or modules) relevant regarding the subject IoT in water field?

|     |   |
|-----|---|
| YES |   |
| NO  | X |

C. In your university there are any **curricula** and **guidelines available for application** (e.g. single courses, seminars or modules) relevant regarding the subject Big Data?

|     |   |
|-----|---|
| YES | X |
| NO  |   |

D. In your university there are any **curricula** and **guidelines available for application** (e.g. single courses, seminars or modules) relevant regarding the subject Big Data in water field?

|     |   |
|-----|---|
| YES |   |
| NO  | X |

E. In your university there are any **curricula** and **guidelines available for application** (e.g. single courses, seminars or modules) relevant regarding the subject Cybersecurity in Critical infrastructure?

|     |   |
|-----|---|
| YES | X |
| NO  |   |

F. In your university there are any **curricula** and **guidelines available for application** (e.g. single courses, seminars or modules) relevant regarding the subject Cybersecurity in Critical Water infrastructure?

|     |   |
|-----|---|
| YES |   |
| NO  | X |

G. In your university there are any **curricula** and **guidelines available for application** (e.g. single courses, seminars or modules) relevant to the digital water subject?

|     |   |
|-----|---|
| YES |   |
| NO  | X |

H. If the answer to the question G is Yes, please briefly present the existing **curricula** and **guidelines available for application** in your university (e.g. single courses, seminars or modules) relevant to the digital water subject. This information will be presented in comparable tables easy to analyse for future development.

|  |
|--|
|  |
|--|

## 2. CROSS-REVIEW OF UNIVERSITY-ENTERPRISE COLLABORATION PRACTICES

A. In your university there are any practices of university - enterprise collaboration relevant regarding the subject IoT?

|     |   |
|-----|---|
| YES | X |
| NO  |   |

B. In your university there are any practices of university - enterprise collaboration relevant regarding the subject IoT in water field?

|     |   |
|-----|---|
| YES |   |
| NO  | X |

C. In your university there are any practices of university - enterprise collaboration relevant regarding the subject Big Data?

|     |   |
|-----|---|
| YES | X |
| NO  |   |

D. In your university there are any practices of university - enterprise collaboration relevant regarding the subject Big Data in water field?

|     |   |
|-----|---|
| YES |   |
| NO  | X |

E. In your university there are any practices of university - enterprise collaboration relevant regarding the subject Cybersecurity in Critical infrastructure?

|     |   |
|-----|---|
| YES | X |
| NO  |   |

F. In your university there are any practices of university - enterprise collaboration relevant regarding the subject Cybersecurity in Critical Water infrastructure?

|     |   |
|-----|---|
| YES |   |
| NO  | X |

G. In your university there are any practices of university - enterprise collaboration relevant to the digital water subject?

|     |   |
|-----|---|
| YES |   |
| NO  | X |

H. If the answer to the question G is Yes, please briefly present the information about practices of university - enterprise collaboration existing at your universities. This will include forms of collaborations, partnership modalities, ways to establish contacts with enterprises, etc.

### 3. CONCLUSIONS

Present the key findings regarding the review of digital water curricula elements, university-enterprise collaboration, content relevance to the market needs / employability, (technical) guidelines (application) as well as curricula (education) existing in your universities.

In Istanbul Technical University, there are some university-enterprise collaboration and Cybersecurity in Critical infrastructure companies in technology development region. But these companies do not work in the field of water industry.



## APPENDIX 4 - STADTENTWÄSSERUNGSBETRIEB PADERBORN

### ERASMUS KA - DIGIWATER

#### WORK PACKAGE 2 DIGITAL WATER CURRICULUM

#### REPORT R2.1.1 - TASK T2.1.1 - ANALYSIS OF PARTNERS' ASSETS

In order to complete the task *T2.1.1 Analysis of partners' assets* please summarise the review of digital water curricula elements, university-enterprise collaboration, content relevance to the market needs / employability, (technical) guidelines (application) as well as curricula (education) existing in your universities.

Your document will contain information on:

#### 1. CROSS-REVIEW OF EXISTING CURRICULA

A. In your university there are any **curricula** and **guidelines available for application** (e.g. single courses, seminars or modules) relevant regarding the subject IoT?

|     |   |
|-----|---|
| YES |   |
| NO  | X |

B. In your university there are any **curricula** and **guidelines available for application** (e.g. single courses, seminars or modules) relevant regarding the subject IoT in water field?

|     |   |
|-----|---|
| YES |   |
| NO  | X |

C. In your university there are any **curricula** and **guidelines available for application** (e.g. single courses, seminars or modules) relevant regarding the subject Big Data?

|     |   |
|-----|---|
| YES |   |
| NO  | X |

D. In your university there are any **curricula** and **guidelines available for application** (e.g. single courses, seminars or modules) relevant regarding the subject Big Data in water field?

|     |   |
|-----|---|
| YES |   |
| NO  | X |

E. In your university there are any **curricula** and **guidelines available for application** (e.g. single courses, seminars or modules) relevant regarding the subject Cybersecurity in Critical infrastructure?

|     |   |
|-----|---|
| YES |   |
| NO  | X |

F. In your university there are any **curricula** and **guidelines available for application** (e.g. single courses, seminars or modules) relevant regarding the subject Cybersecurity in Critical Water infrastructure?

|     |   |
|-----|---|
| YES |   |
| NO  | X |

G. In your university there are any **curricula** and **guidelines available for application** (e.g. single courses, seminars or modules) relevant to the digital water subject?

|     |   |
|-----|---|
| YES |   |
| NO  | X |

H. If the answer to the question G is Yes, please briefly present the existing **curricula** and **guidelines available for application** in your university (e.g. single courses, seminars or modules) relevant to the digital water subject. This information will be presented in comparable tables easy to analyse for future development.

## 2. CROSS-REVIEW OF UNIVERSITY-ENTERPRISE COLLABORATION PRACTICES

A. In your university there are any practices of university - enterprise collaboration relevant regarding the subject IoT?

|     |   |
|-----|---|
| YES |   |
| NO  | X |

B. In your university there are any practices of university - enterprise collaboration relevant regarding the subject IoT in water field?

|     |   |
|-----|---|
| YES |   |
| NO  | X |

C. In your university there are any practices of university - enterprise collaboration relevant regarding the subject Big Data?

|     |   |
|-----|---|
| YES |   |
| NO  | X |

D. In your university there are any practices of university - enterprise collaboration relevant regarding the subject Big Data in water field?

|     |   |
|-----|---|
| YES |   |
| NO  | X |

E. In your university there are any practices of university - enterprise collaboration relevant regarding the subject Cybersecurity in Critical infrastructure?

|     |   |
|-----|---|
| YES |   |
| NO  | X |

F. In your university there are any practices of university - enterprise collaboration relevant regarding the subject Cybersecurity in Critical Water infrastructure?

|     |   |
|-----|---|
| YES |   |
| NO  | X |

G. In your university there are any practices of university - enterprise collaboration relevant to the digital water subject?

|     |   |
|-----|---|
| YES |   |
| NO  | X |

H. If the answer to the question G is Yes, please briefly present the information about practices of university - enterprise collaboration existing at your universities. This will include forms of collaborations, partnership modalities, ways to establish contacts with enterprises, etc.

### 3. CONCLUSIONS

Present the key findings regarding the review of digital water curricula elements, university-enterprise collaboration, content relevance to the market needs / employability, (technical) guidelines (application) as well as curricula (education) existing in your universities.

We refer this questionnaire to our vocational school (<https://www.hsbk-ge.de/>) for training for the three-year vocational school apprenticeship as a wastewater technology specialist.

Unfortunately, there is little to no work on the internet or other media such as IoT or Big Data at vocational schools. Therefore, there is a lot of catching up to do at these vocational schools.

## APPENDIX 5 - KATHOLIEKE UNIVERSITEIT LEUVEN

### ERASMUS KA - DIGIWATER

#### WORK PACKAGE 2 DIGITAL WATER CURRICULUM

#### REPORT R2.1.1 - TASK T2.1.1 - ANALYSIS OF PARTNERS' ASSETS

In order to complete the task *T2.1.1 Analysis of partners' assets* please summarise the review of digital water curricula elements, university-enterprise collaboration, content relevance to the market needs / employability, (technical) guidelines (application) as well as curricula (education) existing in your universities.

Your document will contain information on:

#### 1. CROSS-REVIEW OF EXISTING CURRICULA

A. In your university there are any **curricula** and **guidelines available for application** (e.g. single courses, seminars or modules) relevant regarding the subject IoT?

|     |   |
|-----|---|
| YES | X |
| NO  |   |

B. In your university there are any **curricula** and **guidelines available for application** (e.g. single courses, seminars or modules) relevant regarding the subject IoT in water field?

|     |   |
|-----|---|
| YES |   |
| NO  | X |

C. In your university there are any **curricula** and **guidelines available for application** (e.g. single courses, seminars or modules) relevant regarding the subject Big Data?

|     |   |
|-----|---|
| YES | X |
| NO  |   |

D. In your university there are any **curricula** and **guidelines available for application** (e.g. single courses, seminars or modules) relevant regarding the subject Big Data in water field?

|     |   |
|-----|---|
| YES |   |
| NO  | X |

E. In your university there are any **curricula** and **guidelines available for application** (e.g. single courses, seminars or modules) relevant regarding the subject Cybersecurity in Critical infrastructure?

|     |   |
|-----|---|
| YES | X |
| NO  |   |

F. In your university there are any **curricula** and **guidelines available for application** (e.g. single courses, seminars or modules) relevant regarding the subject Cybersecurity in Critical Water infrastructure?

|     |   |
|-----|---|
| YES |   |
| NO  | X |

G. In your university there are any **curricula** and **guidelines available for application** (e.g. single courses, seminars or modules) relevant to the digital water subject?

|     |   |
|-----|---|
| YES | X |
| NO  |   |

H. If the answer to the question G is Yes, please briefly present the existing **curricula** and **guidelines available for application** in your university (e.g. single courses, seminars or modules) relevant to the digital water subject. This information will be presented in comparable tables easy to analyse for future development.

Students are taught on the use of digital tools in support of water engineering and water management, mainly mathematical models on water systems, in a number of courses in the following programmes:

Master of Water Resources Engineering  
Master of Civil Engineering – Option Hydraulic Engineering

Some courses:

Systems Approach to Water Management  
River Modelling  
Urban and River Hydrology and Hydraulics

## 2. CROSS-REVIEW OF UNIVERSITY-ENTERPRISE COLLABORATION PRACTICES

A. In your university there are any practices of university - enterprise collaboration relevant regarding the subject IoT?

|     |   |
|-----|---|
| YES | X |
| NO  |   |

B. In your university there are any practices of university - enterprise collaboration relevant regarding the subject IoT in water field?

|     |   |
|-----|---|
| YES |   |
| NO  | X |

C. In your university there are any practices of university - enterprise collaboration relevant regarding the subject Big Data?

|     |   |
|-----|---|
| YES | X |
| NO  |   |

D. In your university there are any practices of university - enterprise collaboration relevant regarding the subject Big Data in water field?

|     |   |
|-----|---|
| YES |   |
| NO  | X |

E. In your university there are any practices of university - enterprise collaboration relevant regarding the subject Cybersecurity in Critical infrastructure?

|     |   |
|-----|---|
| YES | X |
| NO  |   |

F. In your university there are any practices of university - enterprise collaboration relevant regarding the subject Cybersecurity in Critical Water infrastructure?

|     |   |
|-----|---|
| YES |   |
| NO  | X |

G. In your university there are any practices of university - enterprise collaboration relevant to the digital water subject?

|     |   |
|-----|---|
| YES | X |
| NO  |   |

H. If the answer to the question G is Yes, please briefly present the information about practices of university - enterprise collaboration existing at your universities. This will include forms of collaborations, partnership modalities, ways to establish contacts with enterprises, etc.

Research projects in which digital models of water systems are being developed and/or applied for scenario investigations. Projects funded by:

- Water authorities: Flemish Environment Agency, Ministry of Public Works, ...
- Provinces and cities: Province of Limburg, City of Antwerp, City of Leuven, ...
- Water companies: domestic wastewater treatment company Aquafin, water company Water-link, Port of Antwerp, water company Fluviu, ...

### 3. CONCLUSIONS

Present the key findings regarding the review of digital water curricula elements, university-enterprise collaboration, content relevance to the market needs / employability, (technical) guidelines (application) as well as curricula (education) existing in your universities.

There is a very high need for additional curricula items on IoT and big data with specific focus on the water sector as well as guidelines. There is already a good university-enterprise collaboration on the use of digital water system models in research projects, typically in support of scenario investigations and decision support, but there is a strong potential to have more cooperation on IoT and big data applications; this would meet several market needs and will also enhance the employability.

## APPENDIX 6 - NORWEGIAN UNIVERSITY OF LIFE SCIENCES

### ERASMUS KA - DIGIWATER

#### WORK PACKAGE 2 DIGITAL WATER CURRICULUM

#### REPORT R2.1.1 - TASK T2.1.1 - ANALYSIS OF PARTNERS' ASSETS

In order to complete the task *T2.1.1 Analysis of partners' assets* please summarise the review of digital water curricula elements, university-enterprise collaboration, content relevance to the market needs / employability, (technical) guidelines (application) as well as curricula (education) existing in your universities.

Your document will contain information on:

#### 1. CROSS-REVIEW OF EXISTING CURRICULA

A. In your university there are any **curricula** and **guidelines available for application** (e.g. single courses, seminars or modules) relevant regarding the subject IoT?

|     |   |
|-----|---|
| YES | + |
| NO  |   |

B. In your university there are any **curricula** and **guidelines available for application** (e.g. single courses, seminars or modules) relevant regarding the subject IoT in water field?

|     |   |
|-----|---|
| YES |   |
| NO  | + |

C. In your university there are any **curricula** and **guidelines available for application** (e.g. single courses, seminars or modules) relevant regarding the subject Big Data?

|     |   |
|-----|---|
| YES | + |
| NO  |   |

D. In your university there are any **curricula** and **guidelines available for application** (e.g. single courses, seminars or modules) relevant regarding the subject Big Data in water field?

|     |   |
|-----|---|
| YES |   |
| NO  | + |

E. In your university there are any **curricula** and **guidelines available for application** (e.g. single courses, seminars or modules) relevant regarding the subject Cybersecurity in Critical infrastructure?

|     |         |
|-----|---------|
| YES | Lecture |
| NO  |         |

F. In your university there are any **curricula** and **guidelines available for application** (e.g. single courses, seminars or modules) relevant regarding the subject Cybersecurity in Critical Water infrastructure?

|     |         |
|-----|---------|
| YES | Lecture |
| NO  |         |

G. In your university there are any **curricula** and **guidelines available for application** (e.g. single courses, seminars or modules) relevant to the digital water subject?

|     |         |
|-----|---------|
| YES | Lecture |
| NO  |         |

H. If the answer to the question G is Yes, please briefly present the existing **curricula** and **guidelines available for application** in your university (e.g. single courses, seminars or modules) relevant to the digital water subject. This information will be presented in comparable tables easy to analyse for future development.

There are single lectures in the water courses on Digital Water and Cybersecurity of Critical Infrastructure

## 2. CROSS-REVIEW OF UNIVERSITY-ENTERPRISE COLLABORATION PRACTICES

A. In your university there are any practices of university - enterprise collaboration relevant regarding the subject IoT?

|     |   |
|-----|---|
| YES | + |
| NO  |   |

B. In your university there are any practices of university - enterprise collaboration relevant regarding the subject IoT in water field?

|     |   |
|-----|---|
| YES | + |
| NO  |   |

C. In your university there are any practices of university - enterprise collaboration relevant regarding the subject Big Data?

|     |   |
|-----|---|
| YES | + |
| NO  |   |

D. In your university there are any practices of university - enterprise collaboration relevant regarding the subject Big Data in water field?

|     |   |
|-----|---|
| YES | + |
| NO  |   |

E. In your university there are any practices of university - enterprise collaboration relevant regarding the subject Cybersecurity in Critical infrastructure?

|     |   |
|-----|---|
| YES |   |
| NO  | + |



F. In your university there are any practices of university - enterprise collaboration relevant regarding the subject Cybersecurity in Critical Water infrastructure?

|     |   |
|-----|---|
| YES |   |
| NO  | + |

G. In your university there are any practices of university - enterprise collaboration relevant to the digital water subject?

|     |   |
|-----|---|
| YES | + |
| NO  |   |

H. If the answer to the question G is Yes, please briefly present the information about practices of university - enterprise collaboration existing at your universities. This will include forms of collaborations, partnership modalities, ways to establish contacts with enterprises, etc.

There are several collaborations with SMEs working on ICT

### 3. CONCLUSIONS

Present the key findings regarding the review of digital water curricula elements, university-enterprise collaboration, content relevance to the market needs / employability, (technical) guidelines (application) as well as curricula (education) existing in your universities.

NMBU has some curriculum elements (at the level of lecture/lesson) relevant to the subject. There are university-enterprise collaborations with ICT SMEs.

## APPENDIX 6 – „DUNĂREA DE JOS” UNIVERSITY OF GALAȚI

### ERASMUS KA - DIGIWATER

#### WORK PACKAGE 2 DIGITAL WATER CURRICULUM

##### REPORT R2.1.1 - TASK T2.1.1 - ANALYSIS OF PARTNERS' ASSETS

In order to complete the task *T2.1.1 Analysis of partners' assets* please summarise the review of digital water curricula elements, university-enterprise collaboration, content relevance to the market needs / employability, (technical) guidelines (application) as well as curricula (education) existing in your universities.

Your document will contain information on:

#### 1. CROSS-REVIEW OF EXISTING CURRICULA

A. In your university there are any **curricula** and **guidelines available for application** (e.g. single courses, seminars or modules) relevant regarding the subject IoT?

|     |   |
|-----|---|
| YES | X |
| NO  |   |

B. In your university there are any **curricula** and **guidelines available for application** (e.g. single courses, seminars or modules) relevant regarding the subject IoT in water field?

|     |   |
|-----|---|
| YES | X |
| NO  |   |

C. In your university there are any **curricula** and **guidelines available for application** (e.g. single courses, seminars or modules) relevant regarding the subject Big Data?

|     |   |
|-----|---|
| YES | X |
| NO  |   |

D. In your university there are any **curricula** and **guidelines available for application** (e.g. single courses, seminars or modules) relevant regarding the subject Big Data in water field?

|     |   |
|-----|---|
| YES | X |
| NO  |   |

E. In your university there are any **curricula** and **guidelines available for application** (e.g. single courses, seminars or modules) relevant regarding the subject Cybersecurity in Critical infrastructure?

|     |   |
|-----|---|
| YES | X |
| NO  |   |

F. In your university there are any **curricula** and **guidelines available for application** (e.g. single courses, seminars or modules) relevant regarding the subject Cybersecurity in Critical Water infrastructure?

|     |   |
|-----|---|
| YES |   |
| NO  | X |

G. In your university there are any **curricula** and **guidelines available for application** (e.g. single courses, seminars or modules) relevant to the digital water subject?

|     |   |
|-----|---|
| YES | X |
| NO  |   |

H. If the answer to the question G is Yes, please briefly present the existing **curricula** and **guidelines available for application** in your university (e.g. single courses, seminars or modules) relevant to the digital water subject. This information will be presented in comparable tables easy to analyse for future development.

Existing courses at Faculty of Sciences and Environment:

- Sensor systems used in environmental analysis and monitoring
- Instrumental methods for environmental pollution analysis
- Biodiversity monitoring techniques and conservation measures

Existing courses at Faculty of Food Science and Engineering:

- Water resources management
- Ecological monitoring
- Processing of aquaculture products
- Recirculating aquaculture systems
- Water quality management in aquaculture
- Wastewater control and treatment
- Integrated monitoring of ecological systems
- Statistical methods for processing ecological experimental data
- GIS systems (geographic information system) for environmental monitoring
- Control and expertise of pollutants in aquaculture and food industry
- Engineering of recirculating systems in aquaculture
- Population dynamics and assessment of aquatic bioresources stocks
- Monitoring the environmental impact of aquaculture

Existing courses at Faculty of Engineering:

- Hydrology and hydrogeology
- Meteorology and climatology
- Techniques for acquiring, monitoring and diagnosing the quality of the environment
- Technologies and equipment for wastewater treatment
- Dynamics of polluting polyphase fluids

Existing courses at Faculty of Engineering and Agronomy from Brăila:

- Technologies for wastewater treatment
- River regularizations and dams

## 2. CROSS-REVIEW OF UNIVERSITY-ENTERPRISE COLLABORATION PRACTICES

A. In your university there are any practices of university - enterprise collaboration relevant regarding the subject IoT?

|     |   |
|-----|---|
| YES | X |
| NO  |   |

B. In your university there are any practices of university - enterprise collaboration relevant regarding the subject IoT in water field?

|     |   |
|-----|---|
| YES | X |
| NO  |   |

C. In your university there are any practices of university - enterprise collaboration relevant regarding the subject Big Data?

|     |   |
|-----|---|
| YES | X |
| NO  |   |

D. In your university there are any practices of university - enterprise collaboration relevant regarding the subject Big Data in water field?

|     |   |
|-----|---|
| YES | X |
| NO  |   |

E. In your university there are any practices of university - enterprise collaboration relevant regarding the subject Cybersecurity in Critical infrastructure?

|     |   |
|-----|---|
| YES |   |
| NO  | X |

F. In your university there are any practices of university - enterprise collaboration relevant regarding the subject Cybersecurity in Critical Water infrastructure?

|     |   |
|-----|---|
| YES |   |
| NO  | X |

G. In your university there are any practices of university - enterprise collaboration relevant to the digital water subject?

|     |   |
|-----|---|
| YES | X |
| NO  |   |

H. If the answer to the question G is Yes, please briefly present the information about practices of university - enterprise collaboration existing at your universities. This will include forms of collaborations, partnership modalities, ways to establish contacts with enterprises, etc.

One of the most important project/collaboration existing is **REXDAN** - Integrated system for complex research and monitoring of the environment in the Danube river area. REXDAN covers a wide geographical area (2000 km on the navigable part of the Danube with extensive components of the river basin) and research areas related to water, sediments, soil, air, biodiversity, bathymetry, hydromorphology, etc. corresponding to multiple specializations: chemistry, biology, physics, environmental science, ecology, bathymetry, topography, atmospheric chemistry, sustainable development.

Another existing project/collaboration is **MultiAqualoT** - Optimization of fish and plant biomass growth technologies in multi-trophic systems of intensive aquaculture through use of intelligent visual recognition and IoT techniques. This project aims to develop a recirculating sturgeon growth system by integrating innovative aquaponic methods of water quality control, based on the use of waste materials from the food industry, as well as by using intelligent visual recognition and IoT techniques to optimize technologies. to increase fish and plant biomass in order to maximize the profitability and sustainability of intensive sturgeon aquaculture.

The objectives of this project are both the technical improvement of sturgeon recirculating systems by integrating new multi-trophic techniques, and the inclusion in the resulting multi-trophic system of an imaging module for real-time estimation of the growth performance of the two masses (fish and vegetable) involved in the technological production process, implicitly of a data acquisition module, for the control of feed management. Following the application of the mentioned technical solutions, will result a series of technologies optimized for the production of fish and plant biomass, which ensures an increase of production, respectively an improvement of the economic efficiency and sustainability of the industrial activity of sturgeon aquaculture, contributing to the development of intelligent specialization biotechnology.

Maximizing the profitability and improving the sustainability of sturgeon aquaculture by using the intelligent techniques mentioned above justifies the contribution of this project proposal to the connection of technological progress in Romania to the requirements of the national and international socio-economic environment. By centralizing the technological data obtained in a software application developed in this project proposal, it facilitates the dissemination for a fee of new technologies planned to be developed, to the domestic and international market, encouraging the beneficiary's desire to innovate.

### 3. CONCLUSIONS

Present the key findings regarding the review of digital water curricula elements, university-enterprise collaboration, content relevance to the market needs / employability, (technical) guidelines (application) as well as curricula (education) existing in your universities.

Water companies are intensively using their resources which are usually equipment that can be expensive and difficult to maintain due to heavy duty operating conditions. There is a continuing concern about the implementation of advanced digital technology systems that allow monitoring and control of processes. Adapting these processes to digital technologies allows a significant increase in data collection speeds as well as data volume.

Data acquisition systems from sensors and transducers are mainly using the Industrial Internet of Things (IIoT) solutions, transforming the conventional infrastructure into a SMART infrastructure. The acquired data reach a central node, Cluster, Cloud, from where they are taken for control, display, and processing through SCADA systems and saved in BigData systems. Protecting data, systems, networks, programs, and devices from unauthorized attacks or access are accomplished by applying Cybersecurity technologies, methods, and processes.

Applications based on Artificial Intelligence technologies use these Big Data sets and provide results that lead to accomplishing the requirements of increasing the efficiency of production capacity in the field of water, optimizing the operation of water processes, and creating more accurate predictions and predictive models of process behavior, improving maintenance strategies and optimizing resource use.