

Norwegian University  
of Life Sciences

# Smart Water

Research Group



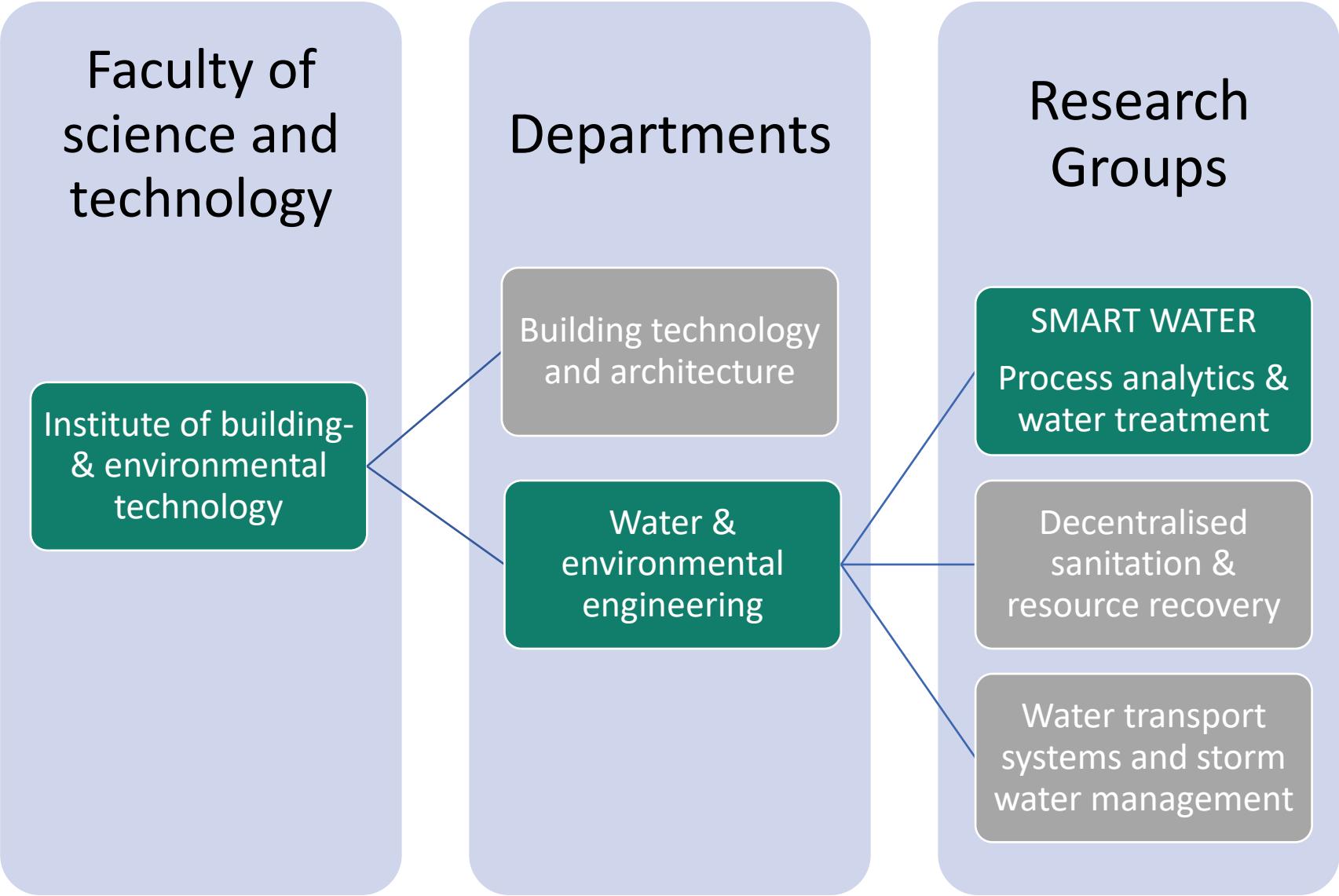
# Water Harmony

Global Network

Research & Innovation

Education

Internationalisation



# Department of Water & Environmental Engineering

## Water Transport

1. Sustainable Stormwater Management
2. Infrastructure Asset Management

## Resource Recovery

1. Decentralised & NBS
2. Energy Recovery & Green Chemicals
3. Nutrient Recovery & Biofertilisers
4. Env Impacts & Health Risks
5. Biorefineries



## Smart Water

1. Process Surveillance, Modeling and Control (process analytics)
2. Advancement & Innovation in Water Treatment

## CROSS-CUTTING

- I. Circular Economy
- II. Digital Water
- III. Sustainable Water
- IV. Global Challenges & Network
- V. Education-Research-Innovation
- VI. Health & Environment

# Smart Water

- **We are** an international group of water researchers, educators and innovators. **We address** global water challenges to secure human health and protect the environment



- **We evolved** from an international capacity building network Water Harmony
- **Today** our research covers:
  - I. Process Surveillance, Modelling and Control – Process Analytics
  - II. Advancement & Innovation in Water Treatment

# Research & Innovation Areas

## Environmental & Industrial Process Analytics

### Smart Water Quality Monitoring

- Soft sensors for nutrients and contaminants of emerging concern
- Sensor fusion

### Process Surveillance and Control

- Data Mining and Big Data Analytics
- Machine learning and ANN
- Digital water security
- Real-time Predictive Analytics
- Image analysis in process surveillance
- Image analysis for plant growth tests

## Advancement in Water Treatment

### Coagulation & Flocculation

- State-of-the-art coagulation control
- Fusion of coagulants
- Nature-derived reagents
- Increasing fertiliser value of coagulated sludge

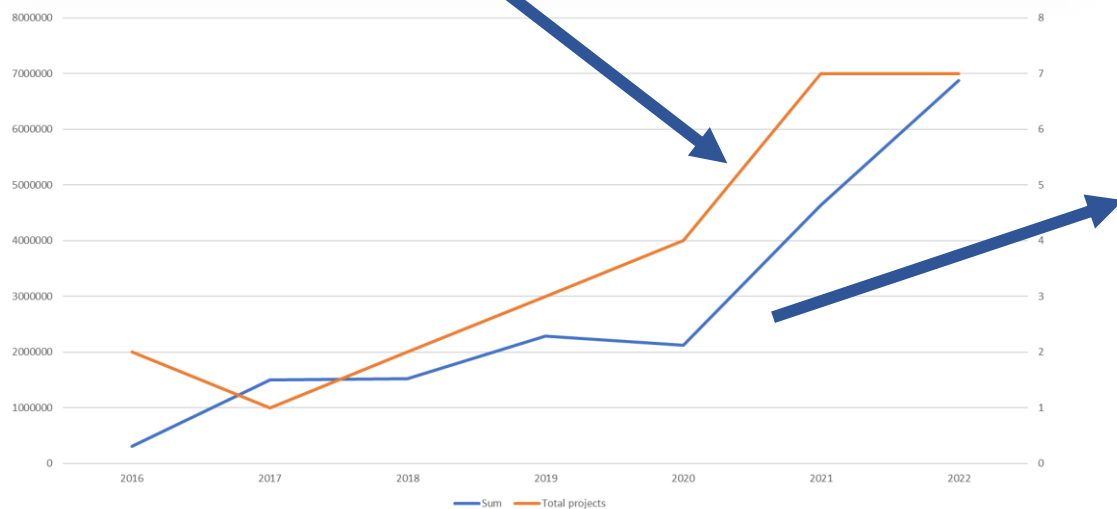
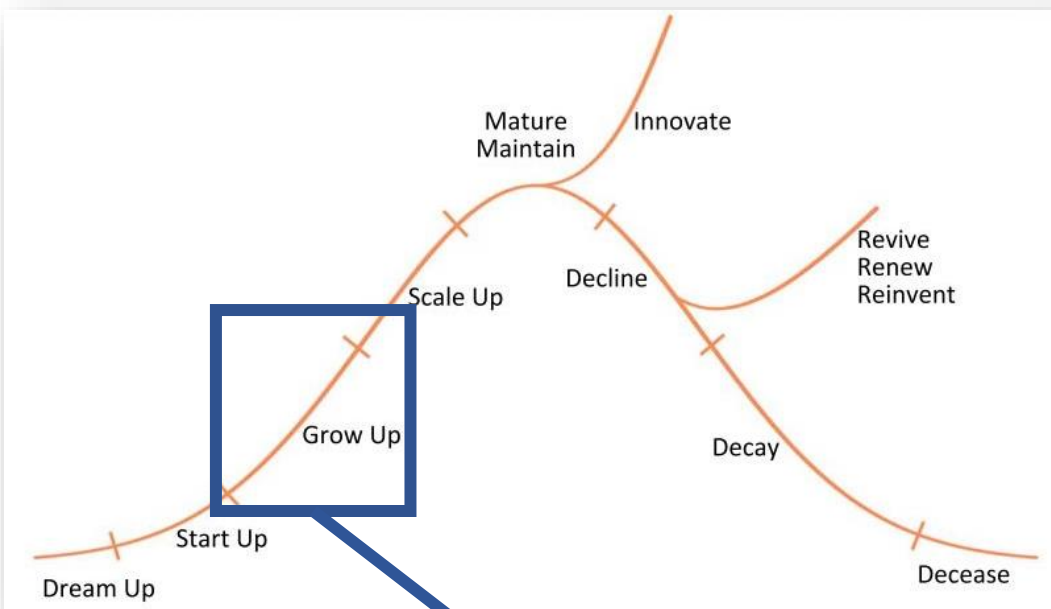
### Membrane Separation

- Ceramic Membrane Biological Reactor
- Nanofiltration for surface water treatment
- Reverse Osmosis for groundwater treatment

### Electrochemical Methods

- Electrocoagulation
- Electrooxidation of Contaminants of Emerging Concern

# Current phase – growth



	period	Budget, mill NOK			
PATCHER	2021/09-2026/08	12.5	RCN	Harsha	
AECo	2020/05-2026/04	12.5	RCN	Zakhar	
MEMPREX-II	2017/07-2023/06	6.3	RCN	Harsha	
SekRens	2021/04-2023/03	3.3	RFF	Harsha	Zakhar
WATERLINE	2022/07-2025/06	20	EU HE	Zakhar	
ECO-SOS	2021/07-2023/06	2.2	EU H2020	Harsha	Agnieszka
NanoWater	2020/09-2022/12	0.3	DiKU	Harsha	
SMARETN E+	2021/03-2023/02	2.5	E+	Zakhar	
Water Arctic	2021-2022/06	0.03	Diku	Harsha	
CCWater E+	2021/01-2023/12	10	EU E+	Harsha	Zakhar
DIGIWAT E+	2021/01-2023/12	10	EU E+	Harsha	
IntelMEM	2021/01-2022/12	0.1	DAAD	Zakhar	
Water ESSENCE	2021/09-2026/08	20	NORAD	Harsha	
SWARM E+	2018/11-2022/06	9.4	EU E+	Harsha	
WH Eurasia	2021/06-2022/07	6	DikU	Harsha	
WH WaterJPI	2018-2023/06	19	EU H2020	Harsha	
DigiwatRO	2021/09-2023/08	0.9	EEA	Harsha	Goitom
QUT-NMBU	2021/09-2029/07	4	QUT	Harsha	
Global mob E+	2021-2023	0.15	E+	Harsha	
NOMentum	2022/10-2025/09	12	RCN	Harsha	
ENTIRE	2022/1-2026/10	12.9	RCN	Zakhar	
EEA-Greece					
CONCES	2022/10-2027/09	12	RCN	Harsha	
Smart4ENV					

## Research & Innovation




**PATCHER** – Protecting aquatic ecosystem and human health from micropollutants. 2021-2026 (BR)

**IntelMEM** – Intelligent nanofiltration membrane systems for natural organic matter removal in water treatment. 2021-2022 (DE)

**SEKRENS** – Secondary chemical treatment of wastewater: optimisation with process control, oxidative and biofilm processes. 2021-2023 (NO)

**AECo** – Advancing EleCtrochemical processes for water safety and circularity. 2020-2023 (CA, US)

**MEMPREX** – International partnership on membrane processes in water treatment for research and educational excellence. 2017-2023 (US, CA, JP, CN)

**Arctic Water** 2019-2021 (IS) The logo for rannís, featuring a stylized red and white circular icon to the left of the text "rannís" in a bold, lowercase font.

## Current projects (Norwegian funding)

## Education



**Water ESSENCE Africa** - creating synergy to meet the global challenges. 2021-2026



**NANOWATER** – Managing nanoparticles and use of nanotechnology in water. 2020-2021

**Water Harmony Eurasia II.** 2016-2022



**ECO-SOS** – Development of Emerging Contaminants Soft Sensor. 2021-2023



HORIZON-WIDERA



Closing the Water Cycle Gap with Harmonised Actions for Sustainable Management of Water Resources. 2019-2021 (SE, NL, TR, US, SG, CN, JP, IL, RO, PL)



**CCWater** – Graduates for Climate Change adapted water management. Capacity Building in Higher Education. 2021-2023 (DE, PL, CN, MN, LK)

**DIGIWATER** – Digitalisation of water industry by innovative graduate water education. Knowledge Alliance. 2021-2023 (BE, DE, CY, TR, DE)

**SMARTEN** – Serious games for digital readiness of water education. Strategic partnership. 2021-2022 (RS, GR, NL)



## Education

### Academic courses

- Water and wastewater treatment technology (15 ECTS)
- Water and wastewater treatment engineering (15 ECTS)
- Water resources management and treatment technologies (10 ECTS)
- Water management in cold climate (5 ECTS)

### International Water Summer Schools

- Organised annually in June-July in Norway
- International participants are funded through collaborative projects

### Student and staff exchange

- Erasmus+, MITCAS, NORHED, Valle/UoW
- Research stays (Sabbatical)

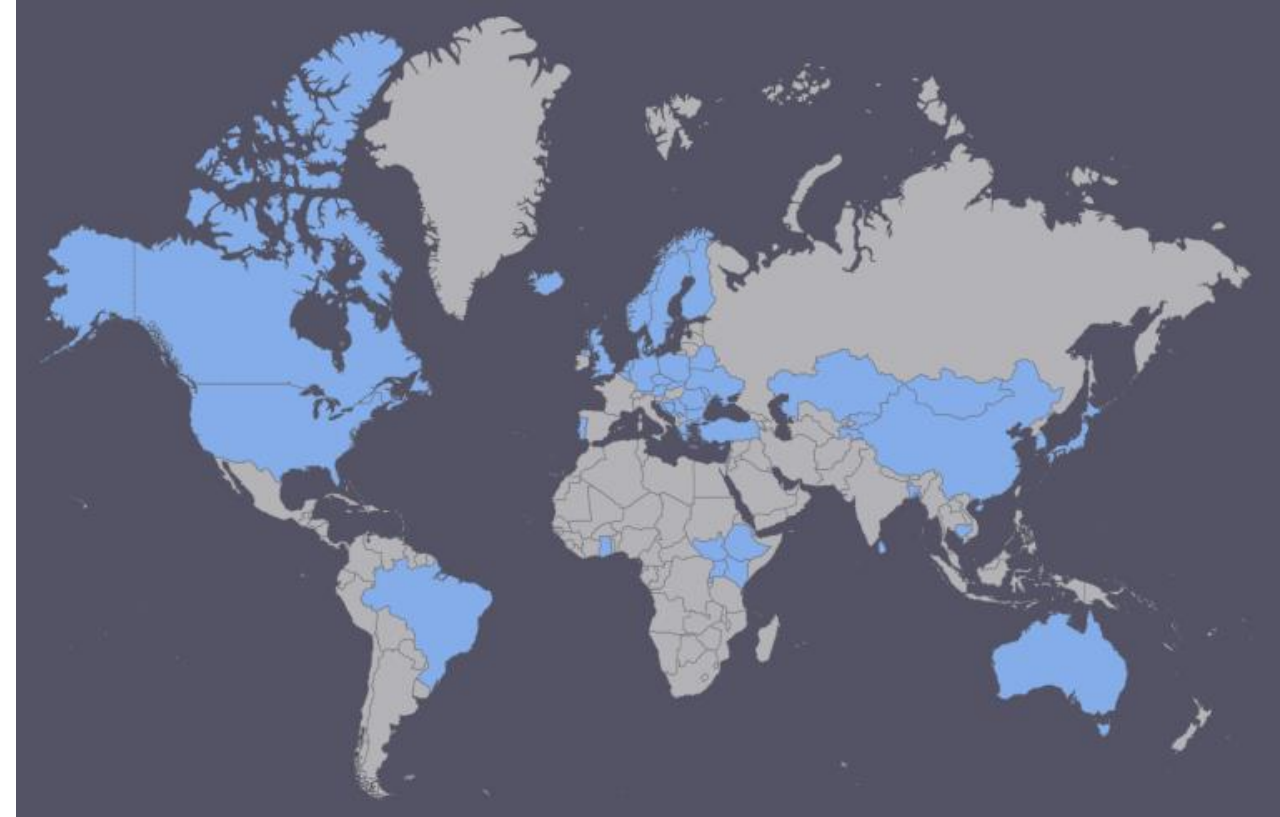
### International Water Schools co-organised with other universities

- International Arctic School, Summer and Winter, Harbin, China with UArctic
- Arctic Water Sanitation and Health, Danish Technical University



# Water Harmony

global network  
of 81 universities  
and research organisations  
across 51 nations  
since 2012



co-funded through projects granted by:



## Events organised by Water Harmony

- |      |                     |  |
|------|---------------------|--|
| 2020 | Harbin, China       | 2 <sup>nd</sup> EWA/IWA conference on Water Management in Cold Climates                                    |
| 2019 | Oslo, Norway        | EWA Green Capital Conference: Sustainable urban drainage solutions   |
| 2018 | Norway-Germany      | NATO Advanced Research Workshop on Physical and Cyber Safety in Critical Water Infrastructure (CYBERWATER) |
| 2016 | Spitsbergen, Norway | 1 <sup>st</sup> EWA Conference on Water Management in Cold Climates  |
| 2016 | Oslo, Norway        | IWA Particle separation conference   |





## Norwegian University of Life Sciences (NMBU)

### Researchers

Harsha Ratnaweera, Professor, *Principal Investigator* <https://www.nmbu.no/emp/harsha.ratnaweera>

Zakhar Maletskyi, Associate Professor, *Co-Principal Investigator* <https://www.nmbu.no/emp/zakhar.maletskyi>

Agnieszka Cuprys, Postdoctoral MSCA Fellow, *Co-Investigator* <https://www.nmbu.no/ans/agnieszka.cuprys>

Goitom Weldehawaryat, Postdoctoral Fellow, *Co-Investigator*

### Administration & Coordination

Susann Andersen

[www.waterharmony.net](http://www.waterharmony.net)