Digitalisation of the Water Sector: Drivers, Opportunities and Challenges

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Topics covered in this presentation

- The digitalising world
- Opportunities for the water sector
- Challenges (threats) with digitalisation
- Best practices

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Digitalisation

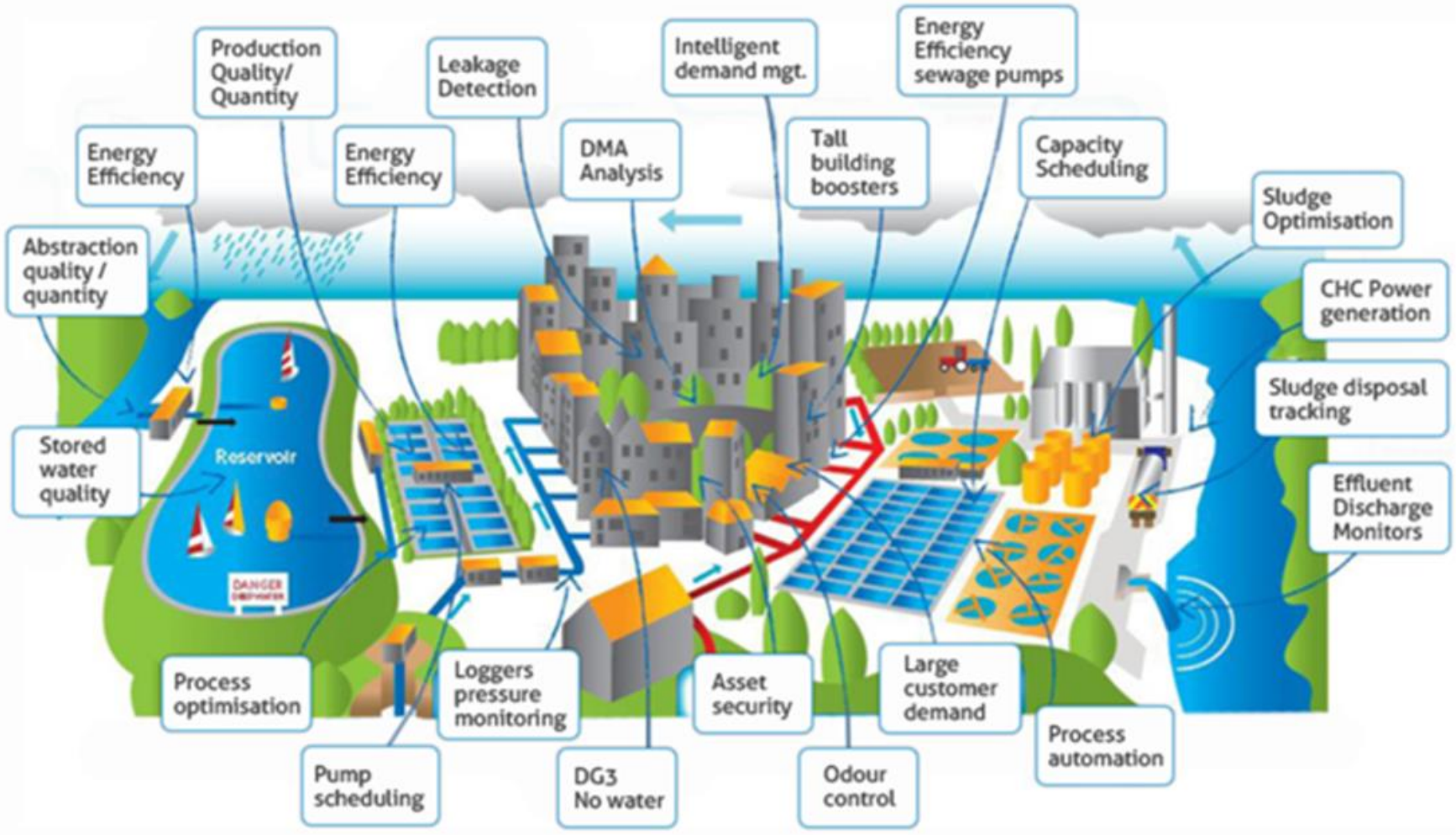
- Has already changed “our world”, and will continue to change
- Have already achieved a lot but there is a huge underutilised potential
- “Digitalisation is here to stay”

- We started digitalisation decades ago.
- COVID-19 (lack of personnel) contributed to rapid digitalisation

Increased vulnerability

- The vast advantages make it easy to forget the vulnerabilities
- “Unplanned” digitalisation in many utilities

Status and potential of digitalisation in the water sector

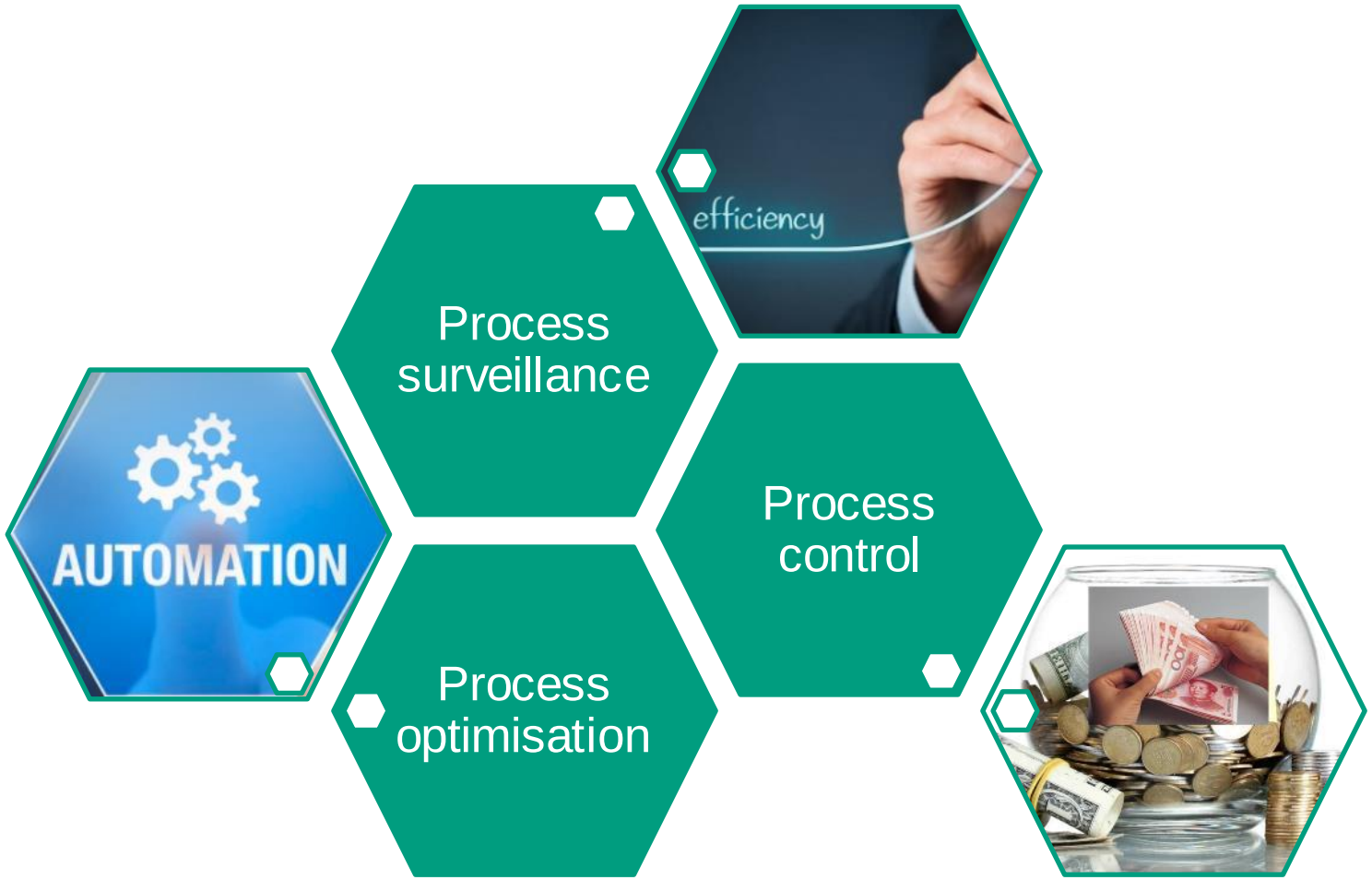


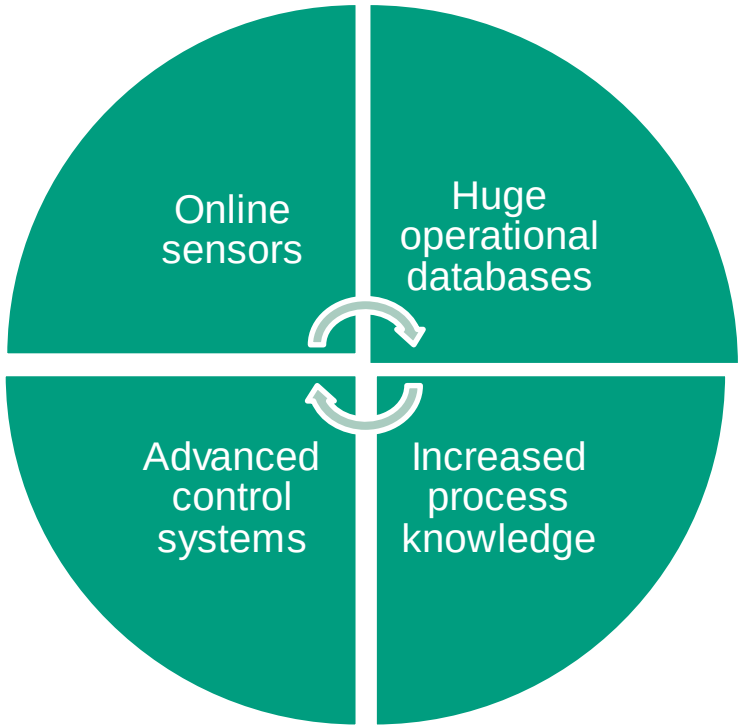
Smart by design - adaptive, distributed, advanced

Smart use - doing more with less

Smart control - sensors, analytics, OT-IT integration

Recent developments in the data sciences has changed to world - also the water sector





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Digital solutions for water & wastewater utilities

- **Remote watershed integrity** Proactive remote monitoring enables fewer callouts and surprises in headwater parameters, including monitoring of multiple parameters (Temperature, pH, Nitratets, etc)
- **Treatment process optimization** Water quality sensors combined with advanced logarithms to optimize the treatment processes, reducing operational costs (e.g. energy, treatment chemicals, etc)
- **Water network management** Sensors and algorithmic solutions provide monitoring of network pressure, failures, and overall asset condition
- **Combined sewer overflow management** Intelligent equipment and real time analytics to prepare for and prepare sewage and stormwater overflows, reducing the need for emergency call-outs

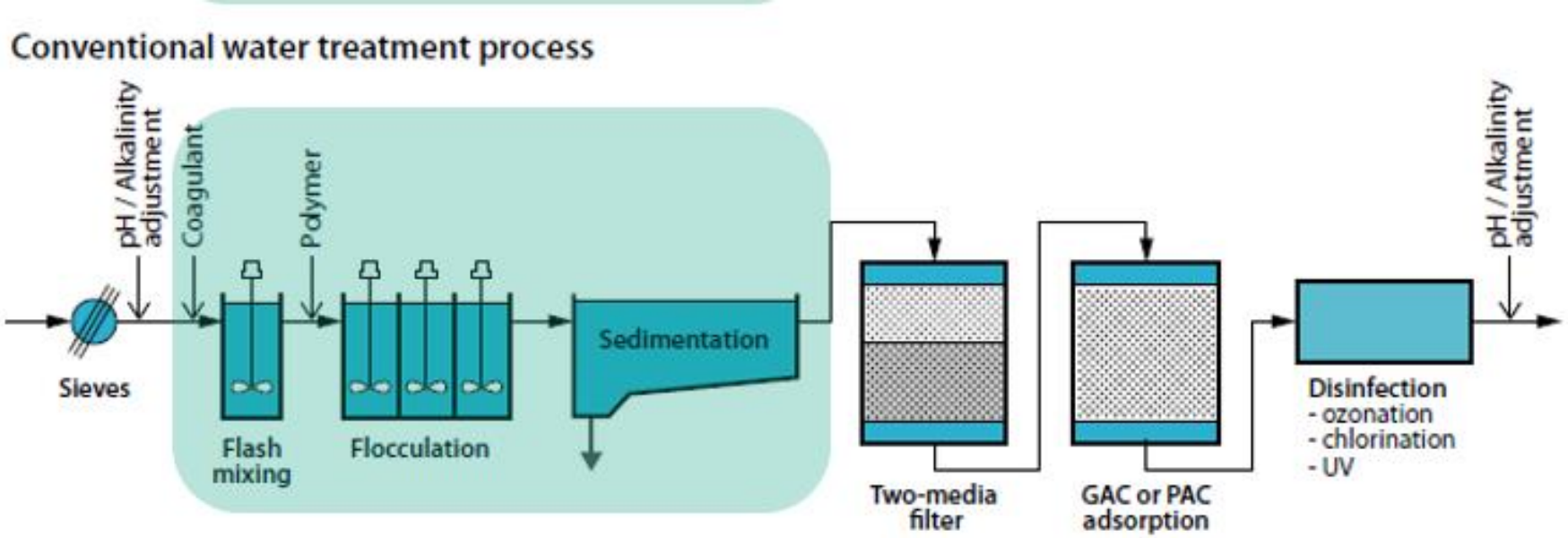
Digital solutions for water & wastewater utilities

- **Preventative & predictive maintenance** Connected equipment and maintenance solutions to reduce downtime and failures of critical equipment and pipelines, reducing the need for emergency call outs
- **Stormwater management and flood relief** Comprehensive range of on-site water capture and dewatering solutions – including emergency response capabilities – to mitigate and manage a range of stormwater and wastewater flooding events
- **Intelligent pumping & treatment equipment** Intelligent equipment – including pumps, mixers, diffusers, and other equipment- which is capable of self-optimizing for enhanced performance, lower maintenance, and lower total cost of ownership

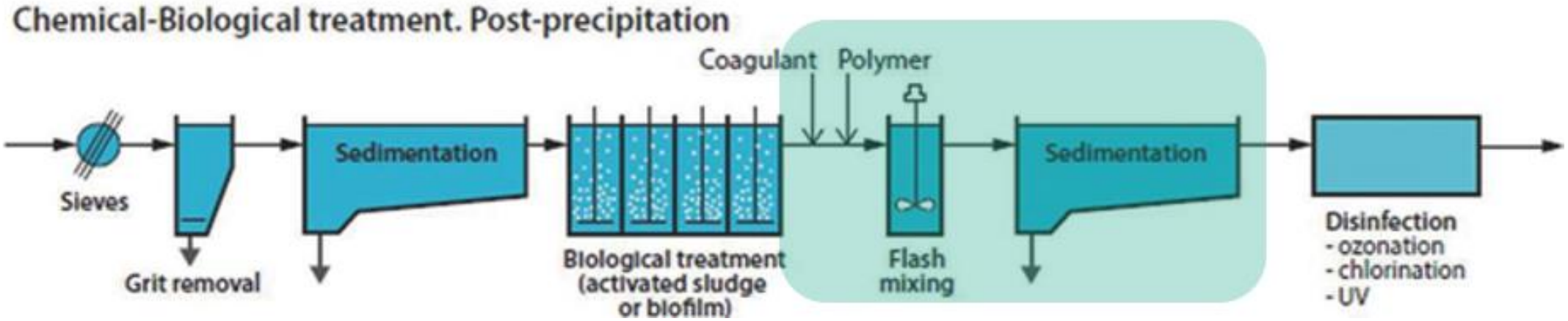
Real-time water quality measurement is useful and can also be crucial!

- Many accurate and affordable sensors
- Require maintenance, sensor failures
- No sensors for all parameters
- Many systems are not affordable
- Difficulty in predicting treatment results

Not only the outlet quality, but also in between the processes



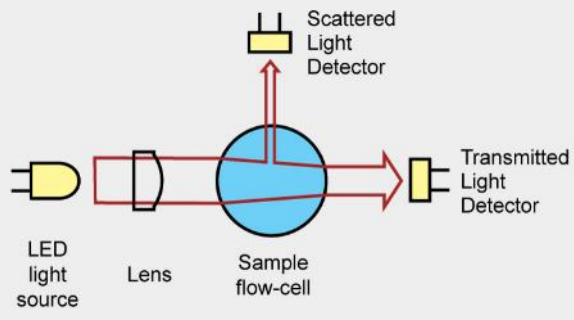
Turbidity
Colour/DOC
pH
Pathogens
Heavy metals
CEC

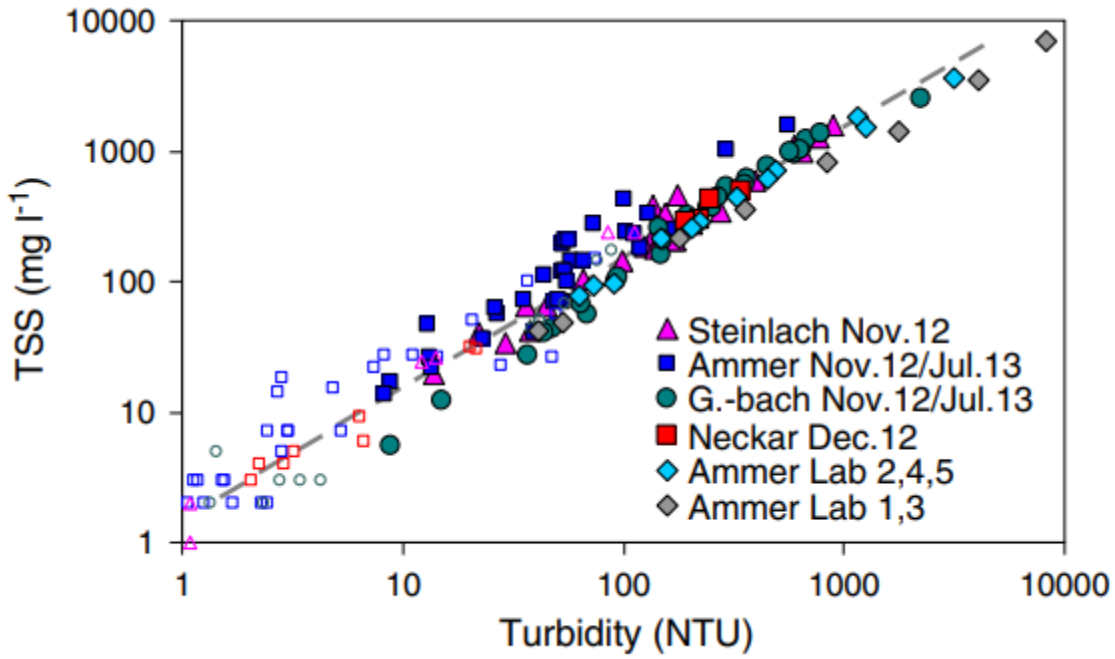


Turbidity/SS
pH
COD/BOD
N and P
CEC

Virtual sensors (software/surrogate sensors)

Typical example: measurement of SS via turbidity

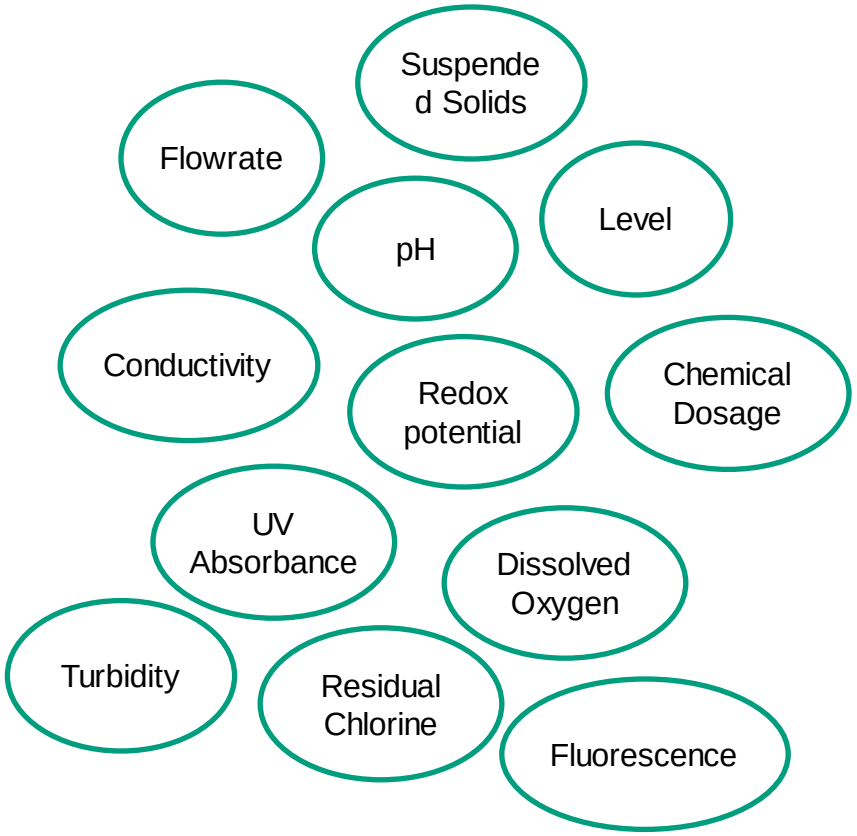




Hybrid sensors

Secondary variables (physical probes)

- Easy-to-measure
- Reliable
- Low capital costs
- Low maintenance



HYBRID SENSOR

Primary variables (Hybrid sensors)

- Hard-to-measure
- Expensive
- High maintenance costs
- Time delayed-response

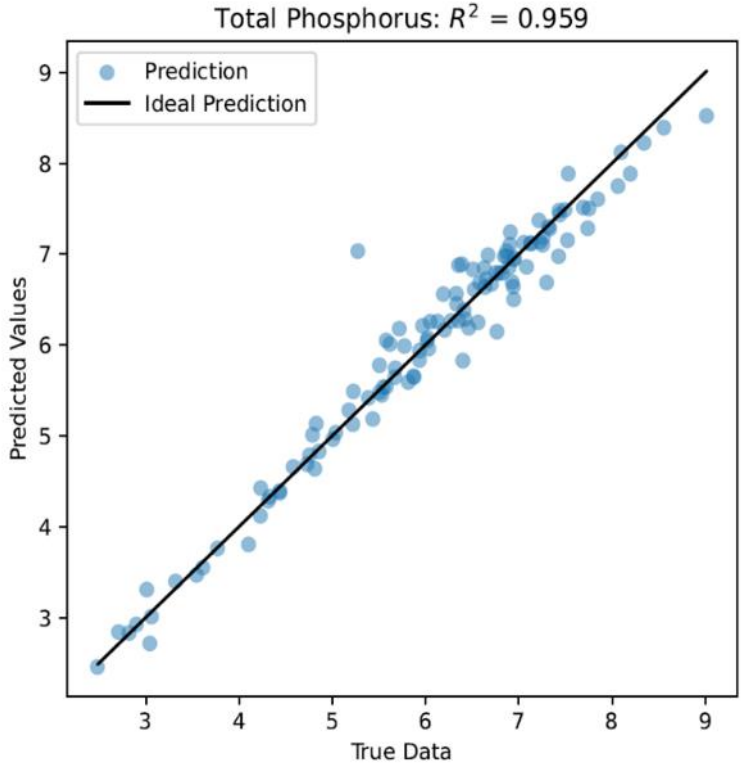
Carbon
(COD, BOD, TOD)

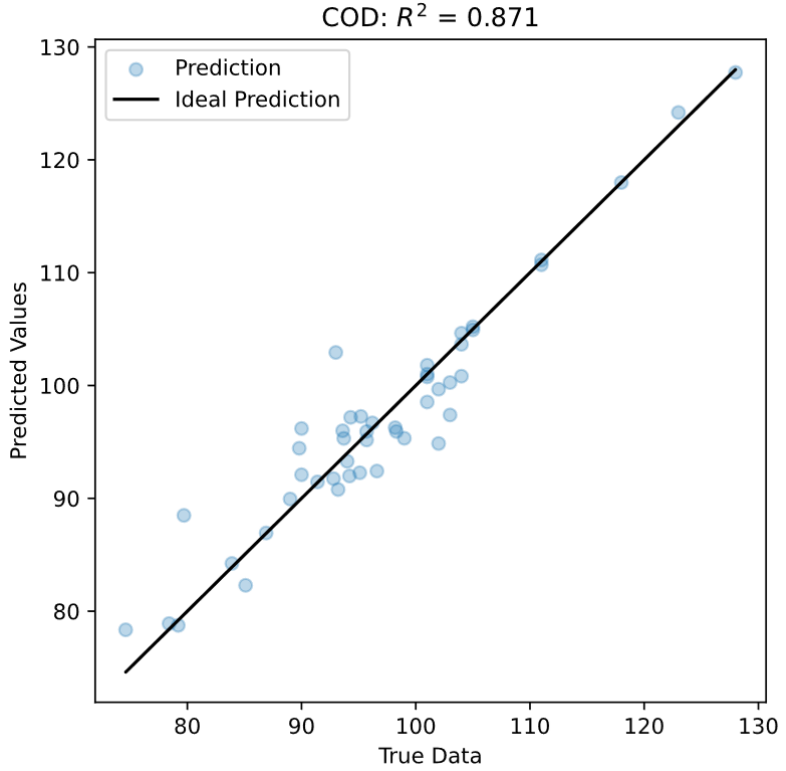
Phosphorus
(PO_4-P, TP)

Nitrogen
(NH_4-N, NO_3-N, TN)

and more….

Virtual /Hybrid sensors





EDITOR'S CHOICE | AUGUST 12 2019

Implementing an Extended Kalman Filter for estimating nutrient composition in a sequential batch MBBR pilot plant

Abhilash M. Nair; Abaynesh Fanta; Finn Aakre Haugen; Harsha Ratnaweera

Check for updates

Water Sci Technol (2019) 80 (2): 317–328.
https://doi.org/10.2166/wst.2019.272 **Article history**

Open Access | Feature Paper | Article

Estimating Phosphorus and COD Concentrations Using a Hybrid Soft Sensor: A Case Study in a Norwegian Municipal Wastewater Treatment Plant

by **Abhilash Nair** [1,*], **Aleksander Hykkerud** [1] and **Harsha Ratnaweera** [1,2]

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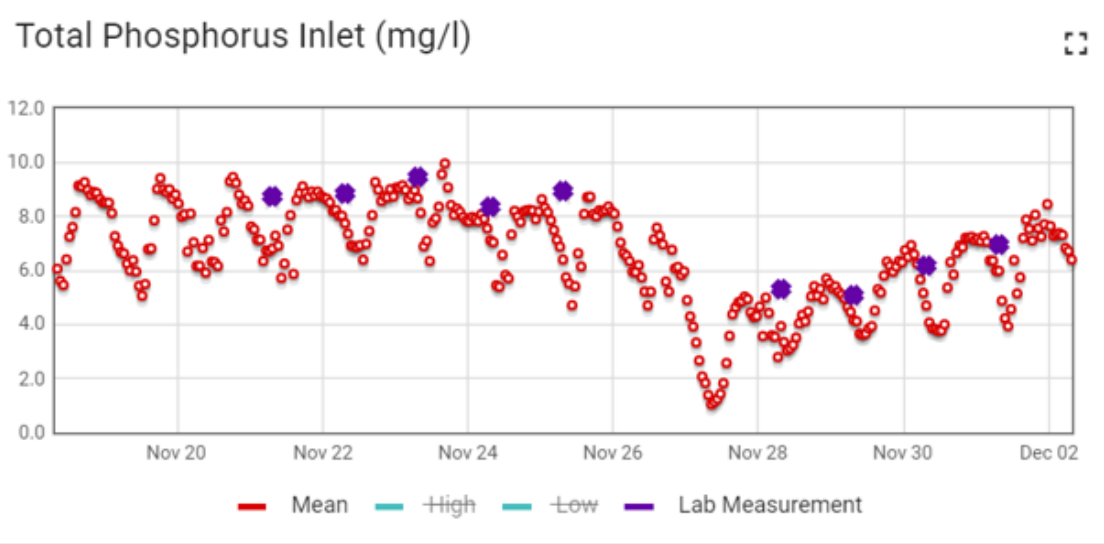
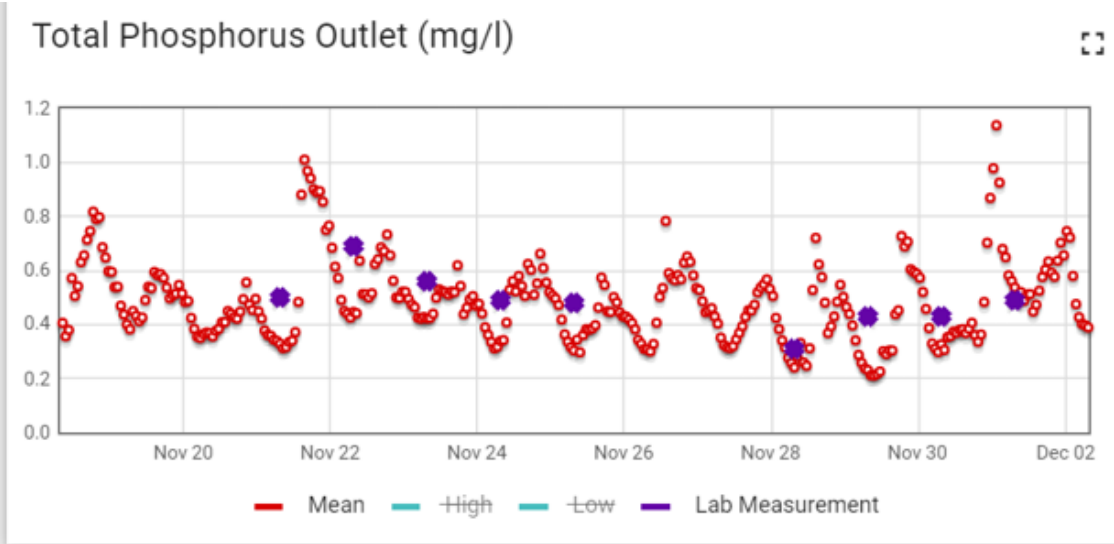
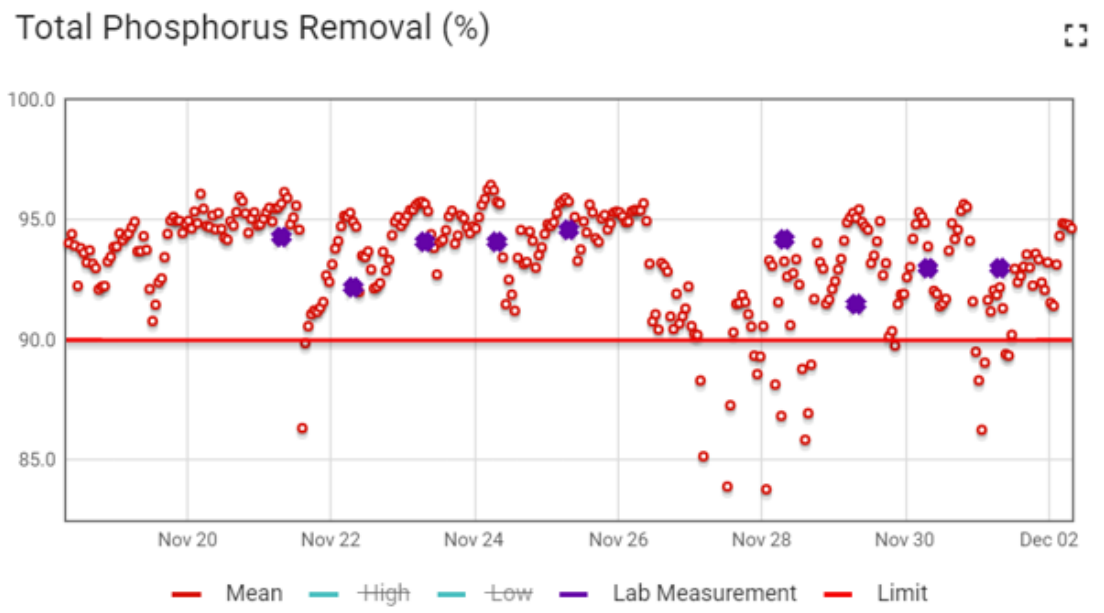
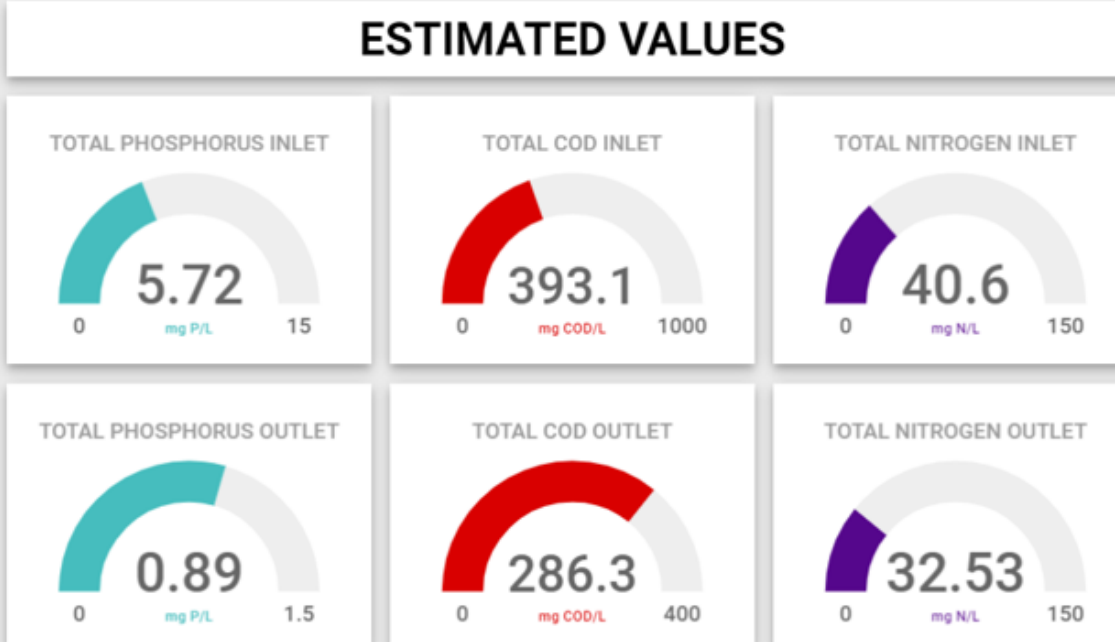
DASHBOARDS...with virtual/hybrid sensors









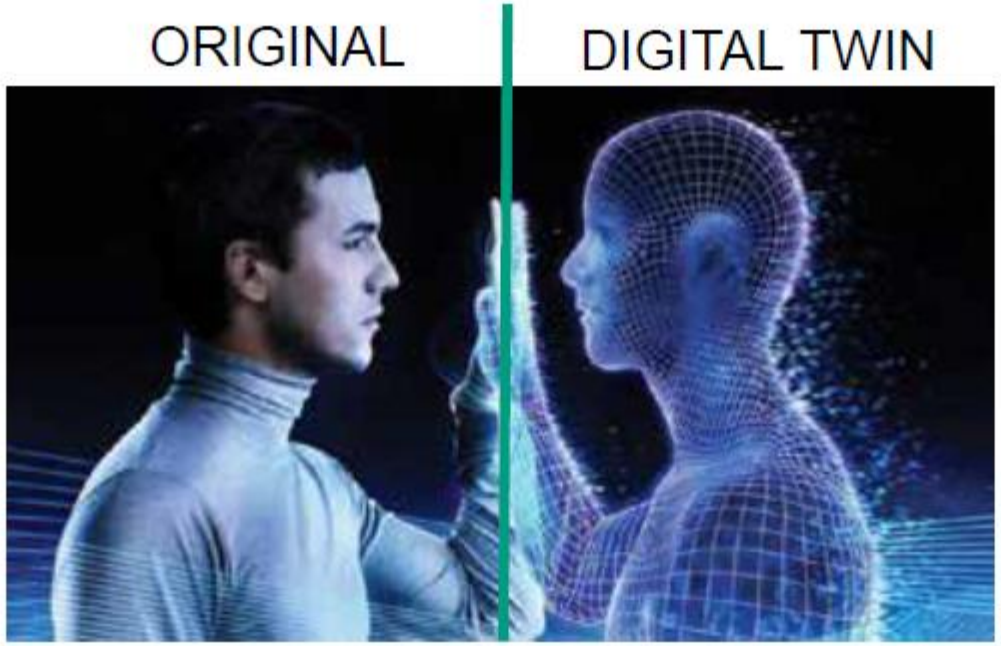
DOSCON AS, OSLO, NORWAY
WWW.DOSCON.NO

Digital twins

Physical Entity

Systems

Process



Model

Algorithms

Analytics

GUI

Photo: CSI Communications

Components of a Digital Twin

1

Data Integration

Processing the incoming data, removing outliers and maintaining a database

2

Models

Mathematical expression that can describe the responses and behavior of the process.

3

Analytics and Model Update

Algorithms to adapt the model to the latest conditions.

4

Visualization

Representing the system or the physical asset in an understandable form.

Example of a Digital Twin in the water sector

1 Data Integration

2 Process Models

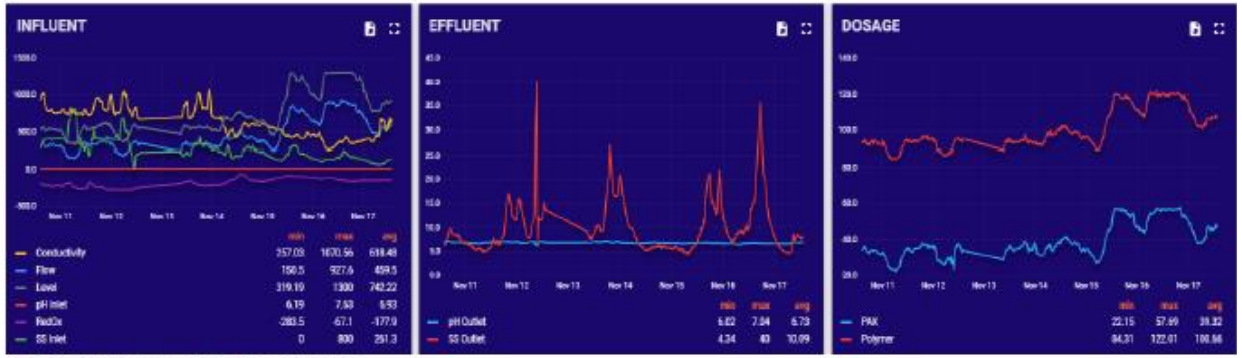
3 Analytics and Model Update

4 Visualization

Dashboard Widgets

www.thingsboard.doscon.no

Trend Curves



www.thingsboard.doscon.no

Virtual Reality

www.stambol.com

www.esri.com

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Water and wastewater services – A critical infrastructure

New European directive designed to improve security

News item | 22-07-2022 | 08:38

The Member States of the European Union (EU), the European Commission and the European Parliament have reached an agreement o a European directive on Critical Entities Resilience (CER). This directive will protect providers of critical processes by increasing their resistance and resilience, thereby guaranteeing the continuity of these processes more effectively. The directive focuses on the physical security and

EU

Government of the Republic of Trinidad and Tobago
Ministry of Public Utilities

T&T

1st REPORT OF THE JOINT SELECT COMMITTEE ON LAND AND PHYSICAL INFRASTRUCTURE, 1ST SESSION OF THE 12TH PARLIAMENT

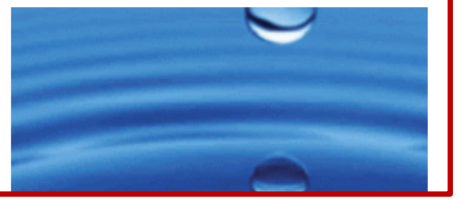
On a Continuation Inquiry into the Measures for Ensuring Water Security in Trinidad and Tobago with reference to the 11th Report of the Committee in the 5th Session of the 11th Parliament

National Critical Functions > NCF Water

NATIONAL CRITICAL FUNCTIONS - SUPPLY WATER AND MANAGE WASTEWATER

US

Ensuring the supply of safe drinking water and treatment of wastewater is essential to modern life and the Nation's economy. Every day, more than 150,000 public water systems provide drinking water to millions of Americans and U.S. wastewater



Australian Government
Department of Home Affairs

he recent Optus data breach ↗ or the Medibank Private cyber incident.

About us → Our functions → National security → Security coordination

AU

Security coordination

Critical infrastructure resilience

Critical infrastructure provides services that are essential for everyday life such as energy, food, water, transport, communications, health and banking and finance.

edition.cnn.com/2021/02/10/us/florida-water-poison-cyber/index.html

CNN US Crime + Justice Energy + Environment Extreme Weather Space + Science Edition

Florida water treatment facility hack used a dormant remote access software, sheriff says

By Alex Marquardt, Eric Levenson and Amir Tal, CNN

Updated 2203 GMT (0603 HKT) February 10, 2021

20 years of attacks….

U.S. Water Supply System Being Targeted By Cybercriminals

Iranian Hackers Access Unprotected ICS at Israeli Water Facility

What can cyber attacks do?

- Interfere with operations – over/under dosage
- Unauthorised changes to programmed instructions; reduced pressure, overflow of sewage, malfunction of unit processes
- Modify control systems to produce unpredictable results
- Block data or send false information to operators
- Change alarm thresholds or disable them
- Prevent access to account information
- Access to personal information (GPDR directive)
- Ransomware

Managing cyber threats

Strategic principles for secure water sector against cyber threats

1. **Understand threats:** Build on our joint work to develop our shared understanding of the cyber threats facing the water sector as they evolve.
2. **Manage risks**: Develop and implement approaches to manage risks and address cyber security vulnerabilities in the water sector, now and in the future.
3. **Manage incidents**: Respond effectively, with industry, to any serious cyber incidents, including those that compromise critical water infrastructure.
4. **Develop capabilities**: The government and sector enhance the cyber skills and capabilities of the water sector to meet future needs.
5. **Strengthen collaboration**: Strengthen collaboration between government and the water sector and within the water sector.

Concluding remarks

- Digitalisation- is here to stay, so better to utilize the potential
- We will continue to see many changes for the better
- Digitalisation also makes our utilities more vulnerable
- Be aware of your risks!
- Preventive measures and preparedness will reduce impacts


Digitalisation is the key to our sector’s success
Thank you