swarm

Co-funded by the Erasmus+ Programme of the European Union

Harsha Ratnaweera

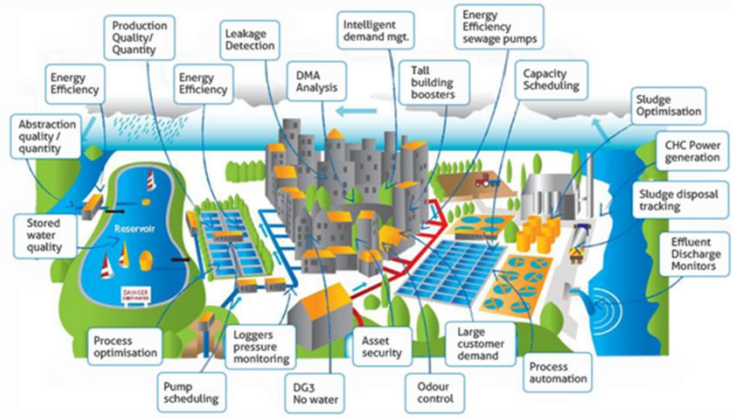
Managing risks from digitalisation in the water sector

Norwegian University of Life Sciences

International Symposium "Water Resources Management: New Perspectives and Innovative Practices„
Novi Sad, 23-24 September 2021

Global change pressures will make things more difficult in future

Digital data and concepts: to meet the challenges



Smart by design - adaptive, distributed, advanced
Smart use - doing more with less, RRR (R3)
Smart control - sensors, analytics, OT-IT integration

Defining the digital water

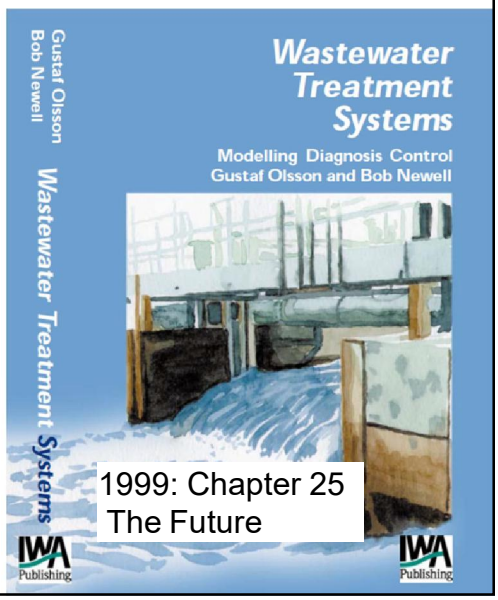
Digital water, Smart Water, Internet of Water, Water 4.0

Efficient collection and use of digital data
for smart digital solutions
to address the challenges in critical physical assets and their services…..

Water sector started digital tools since early 60s…

Probably the first digital tool for water

- "The Application of Newton's Method to Network Analysis by Digital. Computer", Martin D.W. and G. Peters.
- Journal of the Institute of Water Engineers, 17: 115-129, **1963**



1999: Chapter 25 The Future

Benefits of digitalisation

Community Benefits

INCREASED AFFORDABILITY

- Improved long-term affordability of rate structure
- Greater transparency in the use of proceeds from water tariffs
- Reduced likelihood of bill shock, non-payment and cut-offs

CUSTOMER EXPERIENCE

- Increased customer engagement and responsiveness to customer inquiries
- Reduced disruptions in water service
- Reduction in the volume of disruptive construction projects

ENVIRONMENTAL PROTECTION

- Reduced risk of sewage overflows into the environment
- Reduced GHG emissions from utility operations
- Improved conservation and management of critical water resources

Operational Benefits

PROCESS EXCELLENCE

- Data-driven operations and decision making reduces errors
- Speed in decision making due to efficient data analysis and processing

PREDICTIVE MAINTENANCE

- Reduced number of emergency call-outs
- Reduced downtime of critical assets

REGULATORY COMPLIANCE

- Reduced incidences of failure and overflows
- Reduced risk of non-compliance resulting from network water quality issues

Benefits of digitalisation

Financial Benefits

REDUCED OPERATIONAL EXPENDITURE

- Optimised operations reduce energy and maintenance costs
- Reduction in costs and risks associated with ad-hoc field maintenance

INCREASED CAPITAL EFFICIENCY

- Improved cash flow as a result of targeted rehabilitation of faulty infrastructure
- Reduced liability and costs from unexpected water main breaks and sewage overflows

INCREASED REVENUE

- Targeted interventions with faulty meters increases revenue
- Value-added digital services available to bulk water customers

Long-term Resiliency Benefits

INCREASED RESILIENCE

- Improved operational flexibility from changing climate and demographics
- Increased safety through rapid customer engagement on public safety concerns

WORKFORCE DEVELOPMENT

- Improved cross-department collaboration through systems integration
- Reduced safety risk to workforce through fewer emergency call-outs

BRAND AND INNOVATION

- Elevates utility brand and engagement in the water industry
- Enables the utility to more easily pilot and adopt latest technologies

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

Automation…

- Can you imagine a water utility without any automation and/or remote surveillance?

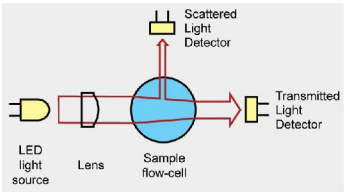
The SCADA market for water and wastewater management is predicted to reach US$ 2.2 billion by 2025, an increase from US$ 1.3 billion in 2015.

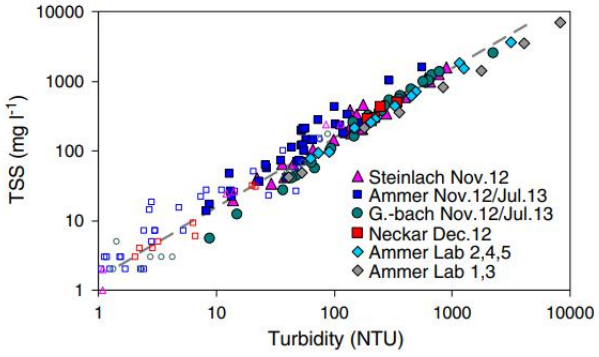
Transparency Market Research (TMR)

SCADA: Supervisory Control And Data Acquisition

Virtual sensors (software sensors)

Typical example: measurement of SS via turbidity





«Anything is possible»

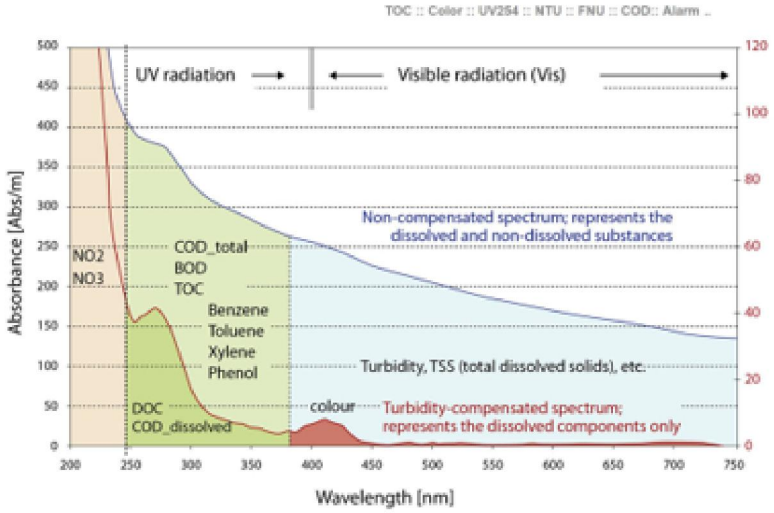
	Drinking Water		Environmental		Municipal Waste Water			Industrial			
	Drinking Water	Ground Water	River/Surface Water	Sea Water	Effluent Municipal	Aeration	Influent Municipal	Dairy	Paper Influent	Paper Effluent	Brewery
	D	G	R	O	E	A	I	M	P	Q	B
TSS	■		■		■		■	■	■	■	■
TS						■					
Turbidity	■	■	■	■	■						
Color app / true	■	■	■	■	■		■				
TOC	■	■	■	■	■		■				
DOC	■	■	■	■	■		■				
BOD			■		■		■				
COD / CODf			■		■	■	■	■	■	■	■
NO3-N / NO3	■	■	■	■	■	■	■	■	■	■	■
Chloramine	■										
HS-		■	■				■				
O3	■				■						
CLD	■										
Chl-a			■								
BTX		■	■								
UV254 t / UV254 f	■	■	■	■	■	■	■	■	■	■	■
UV436 t / UV436 f	■	■	■	■	■	■	■	■	■	■	■
Single wavelength	■	■	■	■	■	■	■	■	■	■	■
Temperature	■	■	■	■	■	■	■	■	■	■	■
Fingerprint	■	■	■	■	■	■	■	■	■	■	■
Fingerprint comp	■	■	■	■	■	■	■	■	■	■	■

s::can

GO SYSTEMELEKTRONIK

WE MAKE LIQUIDS TRANSPARENT.

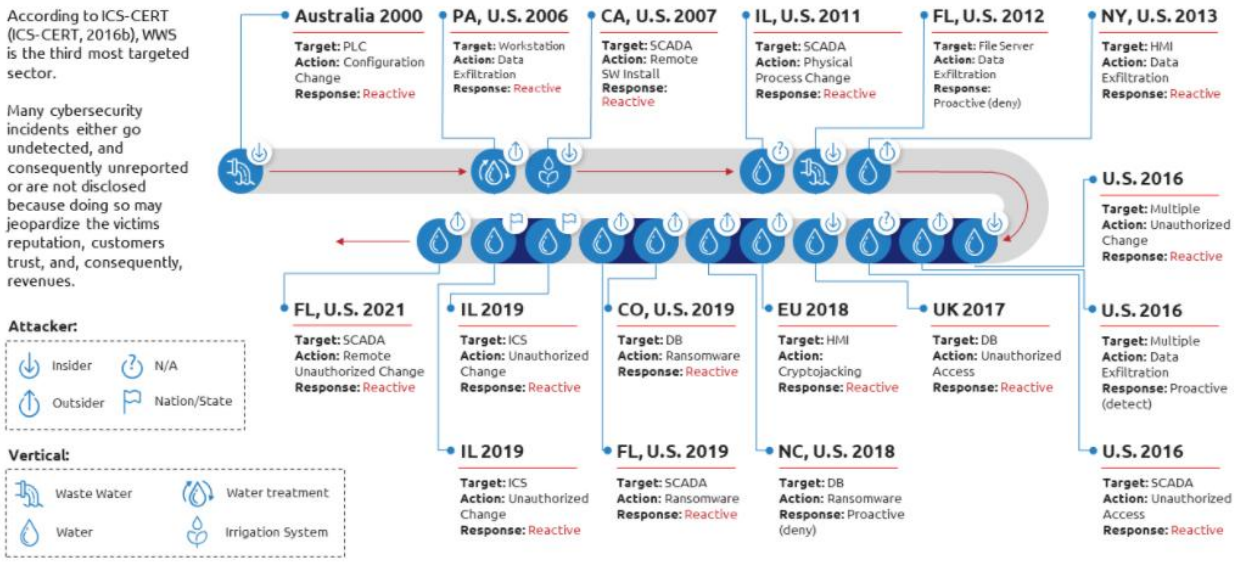
Scanning spectrometry



Risks arising from digitalisation

- **Increased dependency on automation**
  - Risk of technical failures (no sensor works 24/7 & 365 days/year…)
  - Easier escalation from a single unit failure to system collapse
  - Do they make our operators less knowledgeable on processes?
  - Increased vulnerability of process stability
  - Increased risk of cascading effects between critical infrastructure (e.g. water and energy)
- **Causes**
  - System failures
  - Natural phenomena
  - Human errors
  - Malicious actions – cyber attacks
  - Third-party failures

Cyber attacks in the water industry



What can cyber attacks do?

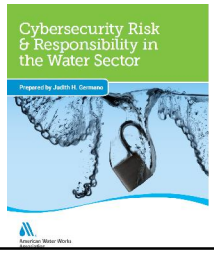
- Interfere with operations – over/under dosage
- Unauthorised changes to programmed instructions; reduced pressure, overflow of sewage, malfunction of unit processes
- Modify control systems to produce unpredictable results
- Block data or send false information to operators
- Change alarm thresholds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

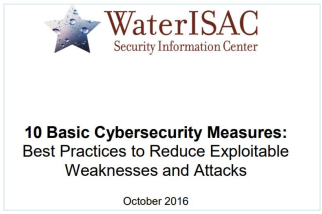
The biggest threats….

Unpreparedness

Vulnerability is possible to reduce!

1. Maintain an accurate inventory of control system devices; eliminate their exposure to external networks.
2. Implement network segmentation and apply firewalls.
3. Use secure remote access methods.
4. Establish role-based access controls and implement system logging.
5. Use only strong passwords, change default passwords, and consider other access controls.
6. Maintain awareness of vulnerabilities and implement necessary patches and updates.
7. Develop and enforce policies on mobile devices.
8. Implement an employee cybersecurity training program.
9. Involve executives in cybersecurity.
10. Implement measures for detecting compromises and develop a cybersecurity incident response plan.





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.

The key to reduce risks

- Know your risks!
- Preventive measures work!
- So does preparedness when dealing with post-attacks!

Thank you!
Хвала вам!

swarm