Digital transformation of the water sector

Highlight publication

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DIGITAL TRANSFORMATION OF THE WATER SECTOR
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Introduction

The water industry is facing a growing number of challenges affecting all parts of its operations and business. Climate change and limited water resources combined with the demands to keep doing more with less means that water professionals across the globe are under pressure to find new and more efficient ways of working.

Taking a data-driven approach to running a water utility opens up opportunities for optimisation of everything from operations to asset management, customer relations and revenue protection. And as several Danish water utilities have proven over the last decade, digitalisation truly holds the key to radically transforming the industry.

However, while the steps involved in a utility's digitalisation journey are the same, their individual starting points and ambitions may not be. By understanding the process, defining a strategic purpose, and being inspired by the many concrete cases from more experienced water companies, utilities can increase their chances of a successful digital transformation.

CHAPTER 1

Transforming water utilities for tomorrow

Taking a systematic approach to the digitalisation journey is key to a successful transformation for water utilities.

European water utilities are under pressure to become more digitalised and efficient to overcome the challenges they face today as well as meet the demands of the future. But a digital transformation starts with understanding the journey and starting point.

Climate change, rising energy costs, faulty and aging infrastructures, changes in consumption patterns, and EU demands in connection with recovery funds are among the numerous challenges faced by water utilities in Europe.

Most of them express finding themselves operating in a world of change. Combined with an aging workforce and a pressing need for talent acquisition, this makes digitalisation the lever for improving processes and acquiring new competences to embrace and refine new ways of working.

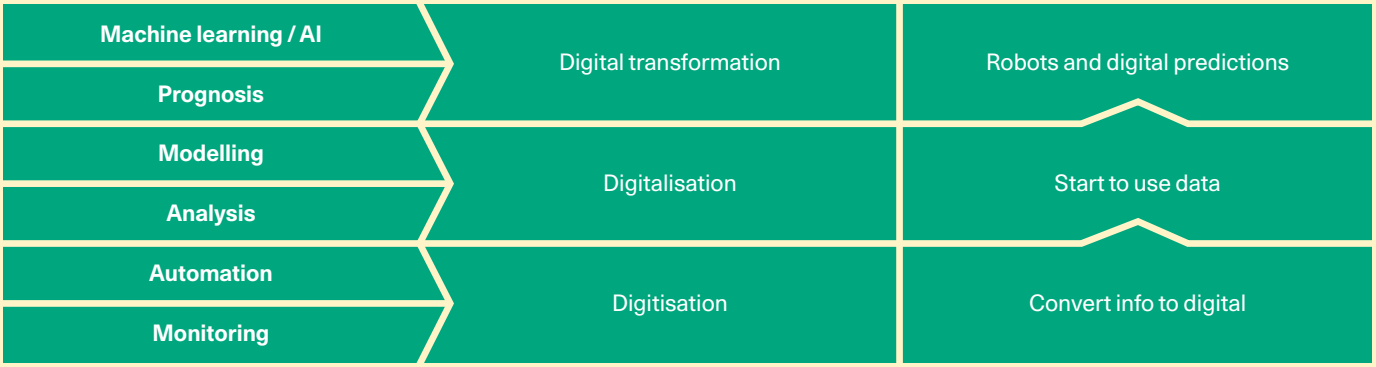
Today, most utilities see digitalisation as one of the most important tools for overcoming their challenges – even though some are unable to explain in detail what digitalisation is and how it will affect their business. It's important to remember that digitalisation means different things not just from country to country, but also from utility to utility. Plus, each utility's starting point will be different depending on the decisions made in the past.

Regardless of the starting point, a digital transformation affects the entire water company, which means that the sponsors for such a project go beyond the usual departments. A truly digital solution and setup will benefit all departments, and their wins should therefore be included in a business case calculation.

Digitisation, digitalisation and digital transformation – what are the differences

The three concepts digitisation, digitalisation and digital transformation are widely used interchangeably – sometimes without a clear distinction between them. In reality, they are three different concepts and are used to describe the digital maturity level of an organisation.

There are no exact definitions, but the figure below is a good and comprehensible way of framing the three concepts and their distinctions:



This model shows a development from digitisation over digitalisation until you reach the digital transformation.

- **Digitisation** refers to the process of converting information into a digital (i.e. computer-readable) format.
- **Digitalisation** is the process in which aspects of social (and work) life are restructured around digital communication.
- **Digital transformation** is the adoption of digital technology by a water company or utility. Common goals for its implementation are to improve efficiency, value or innovation.

Seen together with the model above, this means that:

Machine learning / AI	**Digital transformation** is the transformation of business activities, processes, products, and models to fully leverage the opportunities of digital technologies. The main goal is to improve efficiency, manage risk or discover new opportunities. Digital transformation is doing things in a new (digital) way.
Prognosis	• Analysis without human interaction • Online robot surveillance of overflows, operation of plants or piping systems
Modelling	**Digitalisation** is the process of leveraging digitalisation to improve business processes. Digitalisation means making digitalised information work for the water company. This term refers to the use of digital technologies and data to create revenue, improve business, and create a digital culture where digital information is at the core. It converts processes to be more efficient, productive and profitable.
Analysis	• Information is often shared in the cloud with all relevant colleagues and partners • Human interaction is needed to keep information updated and relevant
Automation	**Digitisation** is the process of converting information from a physical format to digital one. It means converting something non-digital into a digital representation to be used by computer systems and automate processes or workflows. Digitalisation enables utilities to create business value, which requires data. It helps to lay the foundation for business use cases that leverage data.
Monitoring	• Converting piping information to databases • Securing data from employees and saving them locally

In other words, utilities will normally go from digitisation over digitalisation to digital transformation. But it all starts with knowing the different steps on that journey – starting at the bottom and moving upwards. Also, by taking a systematic approach to digitalisation and knowing their individual starting point, utilities get an accurate understanding of the fact that being truly digitalised involves every single corner of their business. And this enables them to talk more efficiently about reaching a full digital transformation.

CHAPTER 2

Achieving water sustainability through strategic digital transformation

With a well-defined strategic direction for digitalisation, water utilities are better able to involve all employees and reach their goals.

Digitalisation has the potential to revolutionise the way water companies and utilities work – and huge strides have already been taken. Having a clear sense of purpose and direction for the digitalisation journey helps ensure commitment and success.

For several years, the Danish water sector has been challenged by climate change, fluctuating energy costs, an aging and faulty infrastructure, changes in consumption patterns, water loss, and efficiency demands. In addition, an aging workforce and talent acquisition challenges are only adding to the problem.

That said, the way of working has changed significantly as data-driven approaches have been adopted when it comes to the development, but also operation and maintenance of water companies or utilities

Denmark is one of the most digital countries in the world, and as the surrounding society has become more and more digital, the water sector has also implemented more and more digital solutions and ways of working. While it has sometimes seemed as if the digital transformation is a goal in itself, it is in fact a means for improving both operations and investments, attracting and maintaining workforce, monitoring and documenting performance towards stakeholders such as customers, authorities, owners and employees, and last but not least for improving customer satisfaction.

In many ways, this has resulted in a digital transformation. And today, water companies see digital transformation as a prerequisite for being able to meet the challenges they face and optimise the way they run their utilities.

On a strategic level, executive management has been setting the targets for a truly transformational digital journey. Ultimately this ensures that the direction is clear for the rest of the company making it easier and more motivating for employees to take part in reaching the finish line.

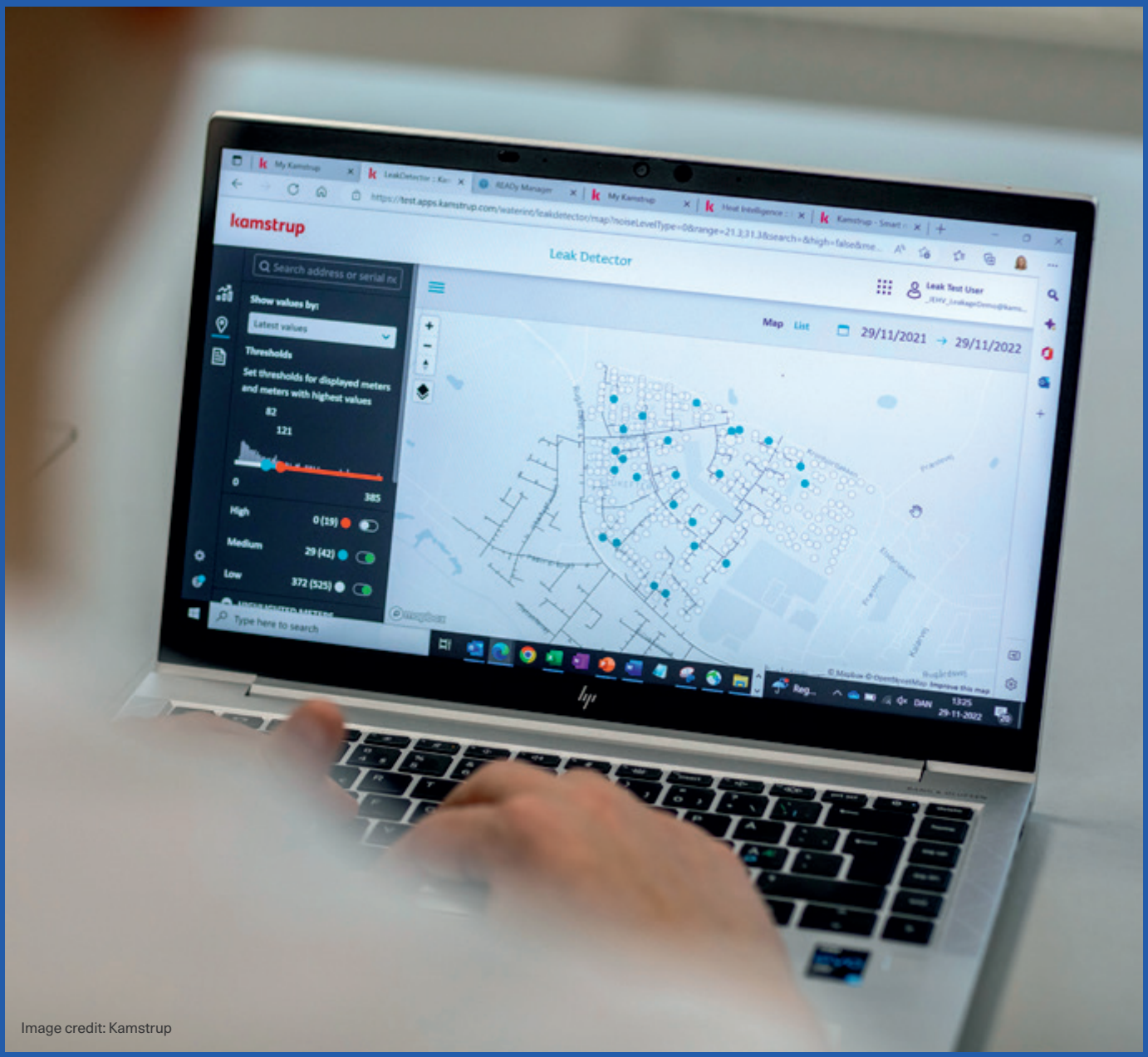


Image credit: Kamstrup

Revolutionising leak detection in service connections

Novafos – one of the largest water utilities in Denmark – was struggling with inefficient and time-consuming leak detection based primarily on night-time flow data on a district-level only. With Kamstrup's innovative Leak Detector software the utility was able to leverage acoustic noise data from their 80,000+ flowIQ® 2200 smart water meters to efficiently locate leaks in service connections. The information provided by Leak Detector delivers highly specific algorithm-based insights related to high-risk installations, which enables the Novafos team to prioritize their daily efforts and focus on the installations that have the biggest impact. And as Leak Detector provides specific street addresses to investigate, Novafos' employees now spend their time fixing leaks instead of searching for them, meaning they can optimise their resource allocation and save a significant amount of time. Since implementing the software, Leak Detector has successfully helped guide Novafos to genuine leaks across its network – boasting a 50% hit rate with 88 detected leaks and counting.

CONTRIBUTORS

Novafos
Kamstrup

LOCATION

Copenhagen, Denmark

CHAPTER 3

From data to decisions

Innovative collaborations between utilities and technology providers light the way towards a more digitalised utility.

Basing decisions and efforts on data from smart meters opens up new opportunities for today's water utilities – from increased efficiency and reduced water loss to talent attraction. Going forward, the digital journey continues in close collaboration amongst ambitious key players.

Maintenance and renovation efforts were previously performed either based on a fixed schedule, a reactive approach or with a high margin of safety. Common to all of them was that they were highly inefficient. Choosing a data-driven approach allows water utilities to take a more proactive approach focusing on the performance of each asset.

Building on data

One example of making innovative use of smart metering is utilising the individual meters as noise loggers to detect leaks on a daily basis by. By doing so, utilities can monitor leaks and prioritise addressing areas where their effort will have the greatest impact in minimising water loss.

Of course, the leaks still have to be fixed, but the success rate of finding the most important leaks becomes significantly higher.

Another example of building on data is using radar weather data combined with sewege network modelling to efficiently handle rainwater from extreme cloudbursts by utilising the existing capacity within the network instead of embarking on large construction projects.

Furthermore, the utilities are improving their appeal as a workplace by incorporating ambitious digital solutions — thereby minimising the struggle of attracting the right candidates.

With the right sensors and software to analyse information, many Danish utilities are also starting to optimise their pressure management. By understanding peak demands and distribution patterns, the pressure can be adjusted

Image credit: Grundfos

accordingly to save energy, reduce water loss and improve operational efficiency.

The openness regarding the use of data has changed with many utilities now sharing information with their customers. One of them is the local water utility company in the city of Billund, Denmak that has made information about the annual combined sewage overflows and daily overflow details from specific locations readily available online.

As these many examples show, the data-driven approach sheds light on both drinking water and sewage networks, increasing both visibility and understanding of the networks' performances. With this gained knowledge, utility professionals are able to proactively run operations and investments.

Are we there yet?

The digital journey in Denmark has been well under way for the past 20 years. Experience has shown that we are aiming at a moving target as new regulations, expectations and technological improvements constantly bring new solutions to the market. Fortunately, the foundation has been laid for Danish utilities in collaboration with technology providers to ensure new challenges and opportunities are continuously addressed and implemented.

Water professionals are the experts in running a water utility, and it is when this knowledge is integrated with digital solutions, utilities start to improve the way of working. So, with every step taken towards a more digitalised utility, more knowledge and experience is acquired enabling proactive and data-driven decision-making.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Hydraulic Model
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Strategic water partnership to stop water losses through system integration and holistic monitoring

Nine Danish partners formed a consortium with the objective of demonstrating the use and effect of integrated high-end solutions within water loss control based on Danish technologies and know-how. The nine partners included leading technology providers, consultants, water utilities and the Technical University of Denmark. Known as the LEAKman Project, its aim was to deliver a sole, holistic non-revenue water management system.

Demonstration of a combined leakage management approach
Initiated in 2016, the 5-year project that was financed under the auspices of the Environmental Technology Development and Demonstration Programme that is supported by the Ministry of Environment, had an overall budget of EUR 5.7 million. The project included several central aspects such as economic analysis of the return on investment, Economic Level of Leakage (ELL), selecting appropriate KPIs for monitoring the status and effect of different leakage management solutions as well as the implementation of interfaces between systems. The approach integrated the four key elements of leakage management: pressure management, active leakage control, pipeline management and rehabilitation, as well as speed and quality of repairs.

Two large-scale demonstration facilities were established at the Danish water utilities Novafos and HOFOR. The implementation included installation and use of intelligent valves, pumps, deployed noise loggers, smart meters, smart inspections, SCADA, online hydraulic modelling (Aquis), GIS and a holistic management information system (HOMIS) configured for automated calculation, display and reporting of selected key performance indicators.

Integration and connectivity is key
Many of these components are generally already in use at water utilities, however, they are often installed as part of separate projects, with only little or inefficient interface between the different components. Consequently, full potential of the entire system is never reached. The LEAKman project combined several smart systems and seamlessly integrated and monitored them holistically, thereby connecting the entire water distribution network. The result of the LEAKman Project was the development of an integrated solution that facilitates water loss reduction to less than 20 per cent for any system within just a few years – with possible reductions to below 10 per cent.

In 2020, upon completion of the demonstration facilities, the pressure was reduced by 16 per cent in the first demonstration area, and an additional reduction of 15 per cent is planned. Consequently, a corresponding decrease in leakage level and burst frequency is expected.

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LOCATION

Denmark

Dynamic overview helps mitigate H2S challenges in sewer network

Danish water utility Aarhus Vand worried that high levels of hydrogen sulfide (H2S) in the wastewater collection system in the village of Solbjerg were causing its sewer network to deteriorate at a faster rate than expected. But without a clear overview, the utility was unable to uncover the cause, magnitude or development of the issue. In a joint effort, the company SulfiLogger installed 15 liquid-phase SulfiLoggerTM H2S sensors in strategic locations throughout the village. Connected to a cloud solution, all 15 sensors provide online H2S data in real time giving the utility a dynamic overview of the situation in the entire village. Data showed that while the daily variations in H2S remained similar, the magnitude of the daily H2S peaks in the discharge well varied significantly between 2 and 4 mg/L. With solid data confirming Aarhus Vand's own suspicions of high H2S levels being transported to the nearby village of Tranbjerg, the utility decided to construct a stripping tower with a filter system at the discharge well effectively eliminating the problem.

CONTRIBUTORS

SulfiLogger

LOCATION

Solbjerg, Denmark

Efficient wastewater treatment plant operation with digital twin technology

Challenged by its lack of a comprehensive plant overview to support efficient operation, Danish water utility Aarhus Vand joined forces with DHI to set up a digital twin solution for Egå WWTP. TwinPlant combines real-time sensor data with simulation models to display a detailed virtual copy of the physical plant – a digital twin – that provides forecasts of plant conditions up to three days into the future. The solution allows for testing of different scenarios involving new controllers, controller settings, maintenance procedures, and inflow profiles based on KPIs including energy consumption, operational costs, chemical dosing, effluent quality and greenhouse gas emissions. Plus, the quality of online data is continuously verified, and Aarhus Vand is informed of potential anomalies. As a result, TwinPlant works as a decision support tool enabling Aarhus Vand to virtually evaluate and optimise its wastewater plant based on a holistic view of KPIs, ensuring efficient operation and minimising its contribution to the climate footprint.

CONTRIBUTORS

DHI

LOCATION

Aarhus, Denmark

Learn more about Danish water solutions, find more cases from around the world and connect with Danish experts at:

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