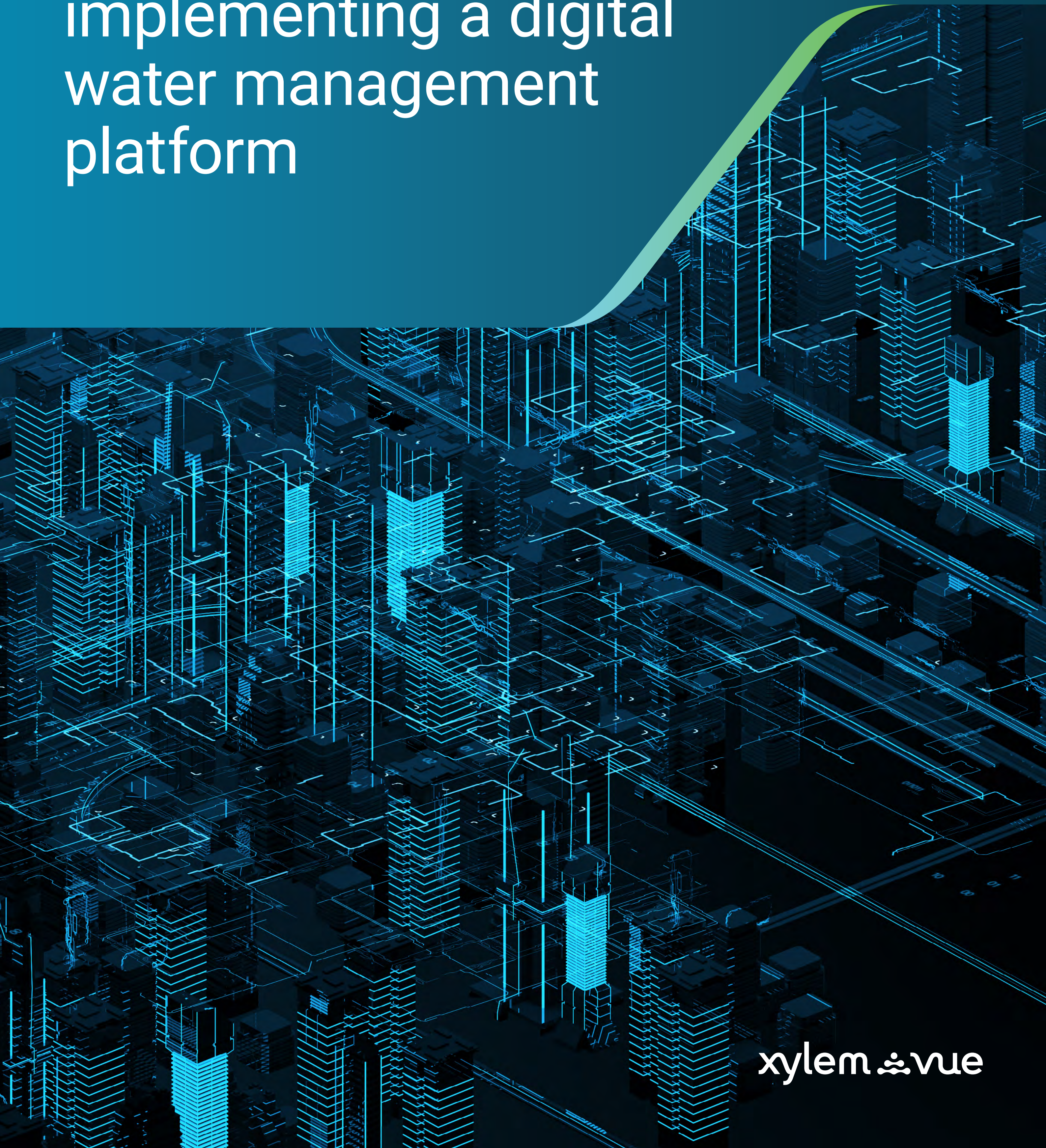
Whitepaper

Keys to successfully implementing a digital water management platform



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Background

Water cycle management is one of the greatest environmental and social challenges of the 21st century, especially amid ever-growing pressure on water resources due to climate change, population growth, and accelerated urbanization. According to the United Nations (UN) approximately five billion people could live in areas with water scarcity by 2050 if proper measures are not taken for conservation and efficient management (UN, 2018). In this context, the implementation of digital platforms that leverage and integrate advanced technologies, such as the Internet of Things (IoT), big data and artificial intelligence, plays a crucial role in improving water management in all its phases: from catchment and treatment to distribution, use and reuse.

Today, advances in digital technologies can create interconnected systems capable of monitoring key water cycle variables in real time, optimizing decision-making processes and boosting operational efficiency. Experts suggest that adopting digital technologies in water management could reduce non-revenue water losses by up to 20%, positively impacting the environment, while also helping utilities bolster profitability. These digital platforms enable greater transparency and proactive responses to adverse events, such as leaks and sudden changes in water quality, ensuring a safe, sustainable supply for citizens.

For this reason, governments around the world are promoting policies that encourage digital transformation, aligning with the 2030 Agenda's goals for water resource sustainability. The European Union, for example, launched the NextGeneration funds to modernize traditional policies, such as cohesion and the Common Agricultural Policy as well as to combat climate change (European Commission, Recovery plan for Europe). Italy, in turn, is promoting what it has termed its Recovery & Resilience Plan, with a special focus on enhancing water management as part of the Green Transition. Similarly, Spain's PERTE (Strategic Projects for Economic Recovery and Transformation) initiative is focused on the digital transformation of the water cycle. Meanwhile, some regions in the Middle East are already implementing the Water Security Strategy to improve water sustainability, given the area's delicate situation of water stress.

It is clear, therefore, that the digital transformation of the water cycle has become an essential tool to tackle pressing challenges in sustainability, efficiency, and resilience within water resource management. This approach, which prioritizes technological platforms and smart devices, enables water utilities to optimize operations, integrate systems, and make data-driven decisions in real time. As a result, it bolsters operational efficiency while promoting both economic and environmental sustainability.

However, successful digitalization requires more than just having the right technologies, such as advanced sensors, telemetry, and remote-control systems, to collect data on water quality, flow, and network pressure. This is merely the first step. Real digital transformation takes place with the implementation of a centralized platform capable of extracting data from all devices and consolidating it in one place. This prevents the so-called "spaghetti architecture" or "Frankenstein architecture", optimizing resource management and ensuring a reliable, safe, drinking water supply.

Accordingly, enhancing water resource sustainability requires understanding how device management in utilities improves water cycle efficiency, as well as how to implement a platform to optimize this process.

José Sánchez
Delivery Manager, Europe & Growth Markets
Xylem Vue

Operational intelligence

The implementation of digital platforms in utilities relies on the exploitation of data to optimize water management. This requires operational intelligence (OI), which acts as the backbone of these platforms, enabling the optimization of operations and resources, reducing losses through leak detection, and ensuring the sustainability of water resources.

Operational intelligence therefore refers to the use of real-time data to improve decision-making in operational processes. In the context of the water sector, it involves the collection, analysis and interpretation of information from sensors, SCADA (Supervisory Control and Data Acquisition) systems, IoT (Internet of Things) platforms and other data sources.

Operational intelligence plays a key role in digital water management platforms in several areas:

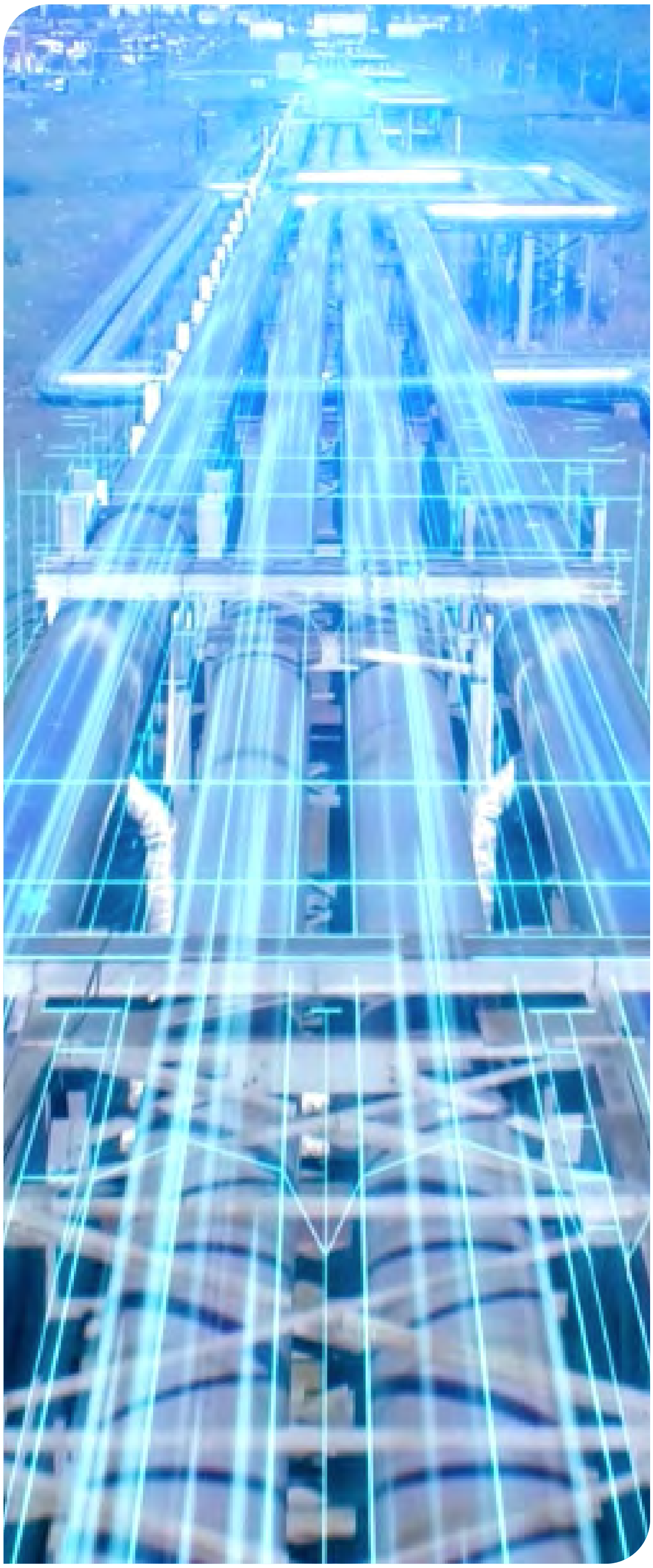
a. It enables real-time monitoring, minimizing risks, and the potential environmental and economic impact they may cause.

b. Platforms can anticipate demand and manage flow by integrating machine-learning algorithms and predictive modelling, resulting in improved efficiency.

c. One of the core strengths of operational intelligence is its ability to transform data into actionable insights. This empowers water operators to make more detailed decisions, which is essential during emergencies such as floods.

d. Finally, applying operational intelligence in digital water management platforms promotes the sustainable use of water by optimizing processes and reducing losses.

Operational intelligence, therefore, is closely linked to the efficiency of digital management platforms and, by extension, to the journey toward a more sustainable and resilient future.



Device management

Integrated water cycle management uses a variety of specialized devices to collect crucial data on water quality, water flow and other relevant parameters. These instruments, in addition to conventional sensors and meters, leverage advanced connectivity protocols to optimize communication between sensors and transmitting devices. These devices encompass a wide range of specialized functions. These include water quality sensors, which measure various parameters such as pH, turbidity and chlorine levels, as well as flow meters, used to monitor water flow in distribution networks. Telemetry and telecontrol systems adapted for SCADA and IoT systems also play a key role by facilitating communication and remote control of equipment and devices from strategically located operation centers.

Device types

The complete water cycle can be categorized into four key stages: catchment and purification, distribution networks for drinking water, sanitation, and water treatment for return to the environment.

Based on this classification, some of the main technological devices used in the digital transformation of the water cycle include the following:

Catchment and purification

1.

Quality sensors at collection points
Multiparameter sensors analyze water quality in real time in sources such as rivers, lakes and aquifers. These devices monitor parameters such as pH, total dissolved solids (TDS), conductivity and chlorophyll to guarantee water suitability prior to treatment.

2.

Level and flow meters at intake stations
Ultrasonic, radar and electromagnetic equipment measures water levels and flow at collection points, securing a continuous supply whilst monitoring fluctuations that could indicate problems at the source.

3.

Turbidity and color monitoring systems
These devices assess the turbidity and color of raw water, identifying potential contamination events. Their integration with control processes allows for real-time adjustments in drinking water treatment.

4.

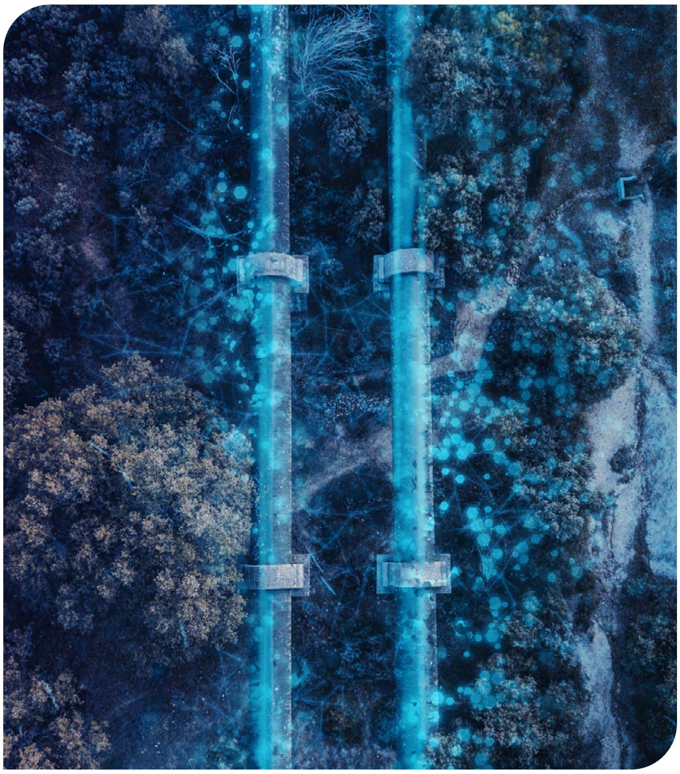
Chemical dosing and control equipment
Automatic systems manage the dosing of coagulants, disinfectants, and other essential chemicals in the water treatment process, ensuring consistent quality while reducing excessive product consumption.

Drinking water distribution networks

1. **IoT sensor systems**
IoT (Internet of Things) sensors collect real-time data on flow rates, pressure, water quality and other key variables in distribution networks. These devices detect leaks, prevent failures and optimize predictive maintenance, reducing interruptions and operating costs.

2. **Smart meters**
Smart meters monitor water consumption continuously and remotely. They use technologies such as LoRaWAN and NB-IoT to transmit data to detect leaks, analyze consumption patterns and guarantee accurate billing. Additionally, their remote management capabilities reduce water waste and improve sustainability.

3. **Advanced communication systems**
Low-power, long-range networks, such as LoRaWAN and NB-IoT, guarantee connectivity between devices over large areas. These technologies provide efficient data transfer, even in remote locations, thus boosting system reliability.



Wastewater distribution networks

1. **IoT sensors for wastewater quality**
These sensors measure parameters such as turbidity, dissolved oxygen, conductivity and levels of chemical and biological contaminants. They detect problems such as unauthorized discharges, infiltrations and blockages in sewer networks, improving proactive responsiveness.

2. **Flow and level meters in wastewater systems**
Ultrasonic and electromagnetic meters monitor the flow and level of wastewater in real time, detecting network overloads and accumulation areas. Their integration with SCADA systems enables events such as floods and accidental spills to be managed holistically.

3. **Hazardous gas monitoring systems in wastewater systems**
These devices measure concentrations of hazardous gases, such as methane and hydrogen sulfide, which can accumulate at critical points in the network. They help deliver safe operations and prevent accidents.

4. **Cameras and robots for manifold inspection**
Autonomous and semi-autonomous equipment performs visual inspections of pipeline conditions, identifying blockages, structural damage and corrosion. These tools facilitate efficient scheduling of corrective and preventive maintenance.

Water treatment

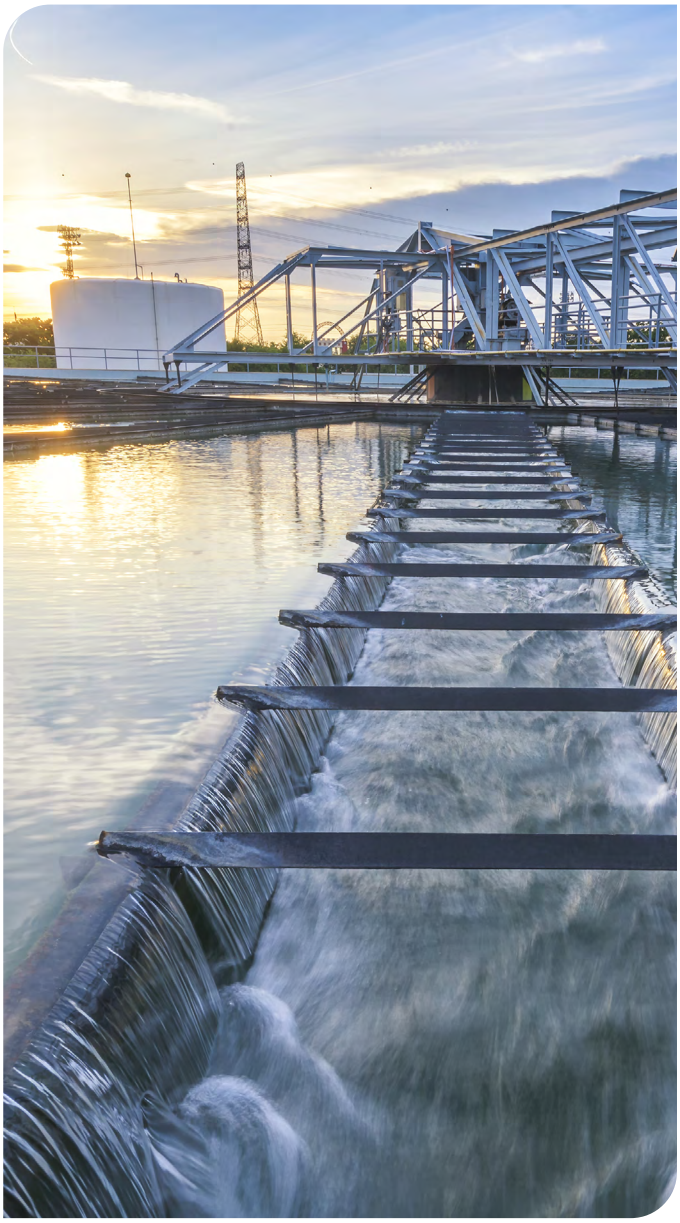
1. **Treated water quality sensors**
These sensors measure parameters such as chemical oxygen demand (COD), nitrates, phosphorus and residual pollutants in the treated effluent. They ensure compliance with regulations before returning the water to the environment or reusing it.

2. **Flow meters in treatment plants**
These meters monitor inflow and outflow at various treatment stages, such as sedimentation, filtration and disinfection. They help optimize processes and detect any operational inefficiencies.

3. **Sludge monitoring systems**
Specialized equipment analyzes the concentration and quality of the sludge generated during treatment to ensure more efficient management and final disposal. Some sensors monitor specific properties, such as solids and organic matter content.

4. **Aeration control systems in biological reactors**
Dissolved oxygen monitors and automatic control systems adjust aeration levels in biological processes, optimizing energy consumption and securing efficient pollutant removal.

5. **UV equipment and advanced disinfection systems**
Ultraviolet (UV) and ozone disinfection devices eliminate pathogens and persistent contaminants in the final stage of treatment. Their integration with IoT platforms enables remote control and dynamic adjustments.



Communication protocols

As we have seen, real-time or near real-time data capture and transmission are key to optimum water cycle management. The technological infrastructure that connects field devices with analysis and control platforms employs robust, secure and scalable communication protocols, which are essential in operational technology (OT) and industrial Internet of Things (IoT) environments, such as:

Advanced protocols for OT and industrial IoT

In OT, protocols such as **MQTT** (Message Queuing Telemetry Transport) and **OPC UA** (Open Platform Communications Unified Architecture) are widely used. They stand out for their flexibility, interoperability and advanced encryption capabilities. They enable:

Bidirectional and asynchronous data transmission: facilitating communication between sensors, actuators and analysis platforms, even in heterogeneous networks.

Scalability: supporting thousands of IoT devices distributed over large geographical areas.

Cloud integration: connecting OT environments to cloud-based platforms through gateways for advanced real-time analytics.

Protocols such as **AMQP** (Advanced Message Queuing Protocol) and **CoAP** (Constrained Application Protocol) are also gaining traction in applications where energy efficiency is crucial, such as in IoT systems that use battery-powered devices.

Traditional protocols in SCADA and industrial automation

In more traditional infrastructures, standard protocols are used. They include:

Modbus: commonly used for field devices such as PLCs (Programmable Logic Controllers) and sensors. The TCP variant helps with integration into IP networks.

DNP3 (Distributed Network Protocol 3): designed for SCADA systems, offering efficient, secure transmission in distribution and sanitation networks.

Profibus and Profinet: Siemens-specific protocols, common in pumping stations and treatment plants due to their high reliability and speed.

EtherNet/IP: ideal for integrating field devices into IP networks, enabling high speed and flexibility in distributed architectures.

Leading protocols for IoT and Industrial IoT networks

The digital transformation of the water cycle has driven the development of IoT technologies, resulting in protocols and networks designed for low-power, wide-coverage scenarios, such as:

1. **LoRaWAN (Long Range Wide Area Network)**
   - Data transmission over long distances with low power consumption.
   - Ideal for sensors in remote locations that monitor flow rates, pressure and water quality.
   - Supports the integration of thousands of devices in distributed networks.

2. **NB-IoT (Narrowband IoT)**
   - Operating in licensed cellular bands, guaranteeing coverage in difficult-to-access areas.
   - Compatible with devices that require continuous monitoring, such as smart meters and quality sensors.

3. **Sigfox**
   - A low-power protocol designed for periodic data transmissions.
   - Best suited for applications where critical data does not require high frequency, such as reservoir level monitoring.

Emerging protocols and cutting-edge technologies

The adoption of advanced technologies has led to the implementation of new protocols that improve interoperability and efficiency:

TSN (Time-Sensitive Networking): guarantees deterministic real-time communications, which are essential for critical applications such as pumping station operations and valve control.

IO-Link: standard communication protocol for sensors and actuators, enabling remote configuration and diagnostics, thus optimizing maintenance.

gRPC (Google Remote Procedure Call): an ultra-fast protocol used for communication between services in microservice architectures and hybrid OT/IT environments.

Complementary communication networks

Wi-Fi 6 and 6E: next-generation WLANs offer higher speeds and lower latency, and can handle multiple connected devices simultaneously, making them ideal for treatment plants.

Private LTE/5G networks: provide high-speed connections, low latency and higher data throughput, enabling real-time monitoring in large distribution systems.

Mesh Networks: IoT device mesh networks that extend coverage and improve redundancy in distribution and sanitation systems over large areas.

Cybersecurity

Cybersecurity is a critical aspect of managing devices in the water sector, where technology plays a central role, a phenomenon that underscores the strategic importance of this sector for the economic and social progress of many regions. Since the first cyber-attack on a water utility in Queensland, Australia, in 2000, these incidents have continued to grow. Recent examples, such as the 2020 attack on the water supply in Israel and the 2021 attack on a water treatment plant in Florida, highlight the increasing vulnerability of these infrastructures.

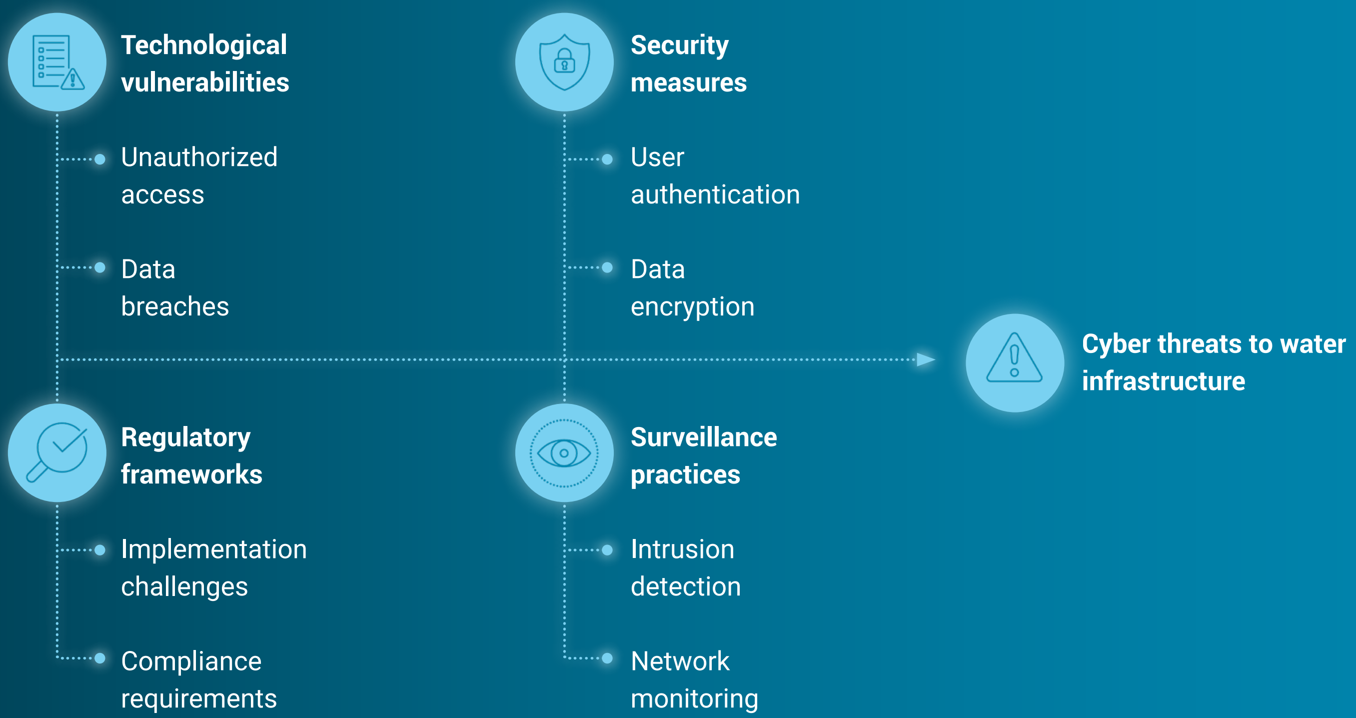
In response, governments and other relevant organizations are strengthening legal measures to address the situation. Regulations such as ACN in Italy for cloud services, ENS (National Security Scheme) in Spain for information security, ANSSI in France for product certification, and BIO in the Netherlands for information system management are just a few examples.

Rigorous security measures are also being implemented in utilities to safeguard data integrity and confidentiality. This includes the application of advanced user authentication and data encryption technologies to prevent unauthorized access and protect sensitive information.

Additionally, continuous network monitoring procedures, supported by intrusion detection and behavioral analysis technologies, are harnessed to proactively identify and respond to potential cyber threats. These systems alert utilities to any suspicious activity or unauthorized access attempts, enabling immediate action to mitigate risks.

Regular audits and penetration tests are conducted to ensure the device management system remains robust. These periodic assessments identify potential security gaps and weaknesses in the technological infrastructure, prompting the deployment of corrective measures and continuous security protocol improvements.

Strengthening Cybersecurity in Water Management



Trends in device management

Operational management in the water sector is undergoing a profound transformation, driven by the uptake of disruptive technologies and the enhancement of existing tools, such as IoT sensors, SCADA platforms, decision support applications, GIS tools for asset inventory and geo-positioning, and advanced business applications. This transformation aims to optimize the collection, analysis, and use of data, driving the sustainability, operational efficiency, and resilience of water systems.

A key factor in this evolution is the centralization and monitoring of operational data in real-time, bringing all available data together in a single digital environment. This approach ensures end-to-end visibility of operations so organizations can:

Prioritize critical actions

Optimize resource allocation

Reduce duplicate data collection

Strengthen cooperation between technical and administrative teams

Centralization also fosters operational resilience by providing tools to respond quickly to critical events and ensure service continuity. Consolidating monitoring on a single platform not only enhances operational efficiency but also bolsters the sustainability of operations, helping utilities better navigate both present and future challenges.

Device management in the water sector is also being transformed through the uptake of disruptive technologies and advanced protocols. This change seeks to optimize data collection, analysis, and use, strengthening the sustainability, operational efficiency, and resilience of water systems.

Automation and advanced analytics using AI and machine learning (ML)

Artificial intelligence (AI) and machine learning (ML) are redefining how devices and data are managed in real time. These technologies enable:

1. **Early detection of anomalies.** Advanced algorithms identify deviations in parameters such as pressure, flow and water quality, enabling proactive actions to prevent failures.

2. **Predictive optimization.** ML models analyze historical and real-time data to forecast demand, schedule maintenance and streamline the operation of complex systems.

3. **Intelligent automation**. AI works hand-in-hand with SCADA and distributed control systems to automatically adjust processes such as chemical dosing and pump regulation, reducing costs and ensuring efficient supply.

Advanced connectivity and emerging protocols

Connectivity is the backbone underpinning the interoperability of heterogeneous devices in OT (Operational Technology) and IT (Information Technology) networks. Recent trends include:

- **Highly efficient protocols**: MQTT, OPC UA and gRPC protocols enable bidirectional, asynchronous and secure data transmission, facilitating integration between systems from different manufacturers..
- **Protocols for IoT and IIoT environments**: technologies such as LoRaWAN and NB-IoT provide long-range, low-power connectivity, which is ideal for sensors in remote and hard-to-reach locations.
- **IO-Link in field sensors**. This digital standard is revolutionizing communication between sensors and actuators, enabling remote configuration, real-time diagnostics and more accurate data collection.

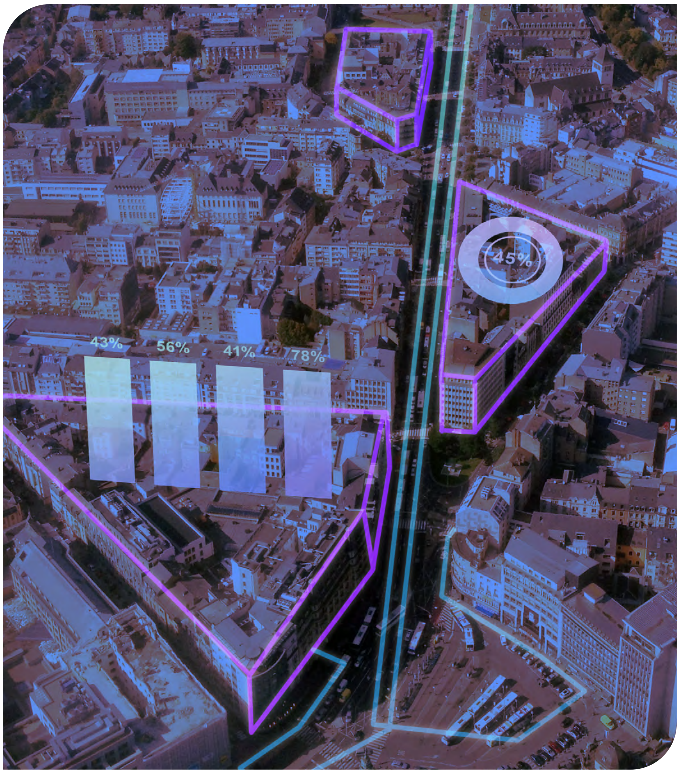
Smart sensors and digital twins

Advances in sensors are enabling more accurate, real-time data capture to feed advanced digital models:

1. **Multi-parameter IoT sensors**: these devices are capable of simultaneously measuring pH, turbidity, residual chlorine and other key parameters, reducing the need for multiple pieces of equipment.

2. **Digital twins**: these are virtual representations of water infrastructure and processes that simulate operations, predict behavior and assess the impact of operational decisions in real time.

3. **Autonomous cameras and systems**: these are robots equipped with visual and thermal sensors that inspect pipelines, tanks and other critical assets, enhancing maintenance management.



Cybersecurity and resilience in OT/IT networks

Cybersecurity has become a top priority due to the growing connectivity and reliance on digital devices:

- **Segmented networks and Zero Trust strategies**. These measures limit unauthorized access through robust authentication and granular permission control.
- **AI-based threat detection**. Real-time analysis of data traffic identifies suspicious patterns.
- **Regulations and certifications**. Compliance with standards such as ISO 27001 and the National Security Scheme (ENS) helps to protect critical infrastructure.

Private networks and 5G

The use of private LTE and 5G networks is revolutionizing device connectivity in the water cycle:

- **Ultra-low latency**: enables real-time synchronization of critical systems such as pumping stations and treatment plants.
- **High density of connected devices**: facilitates the management of thousands of IoT sensors in a single environment.
- **Increased bandwidth**: supports intensive data, such as images and video in remote inspections.

Energy sustainability and carbon footprint reduction

Trends are also focusing on ways to optimize energy in device operations:

- **Low-power sensors**. Technologies such as LoRaWAN and Sigfox minimize power consumption, extending the battery life in remote sensors.
- **Integrated renewable energy**. Devices powered by solar panels or micro-hydro turbines ensure sustainable operations.
- **Process optimization**. AI and ML are being used to reduce energy consumption in pumping and treatment stations.

The future of device management in the water cycle, therefore, revolves around technological convergence that combines advanced analytics, secure connectivity, and sustainability. These trends are reshaping utility operations, securing more reliable and efficient access to water. By combining AI, advanced protocols, and smart sensors, the sector can proactively manage challenges today while preparing for a resilient and sustainable tomorrow.

Implementation of a management platform

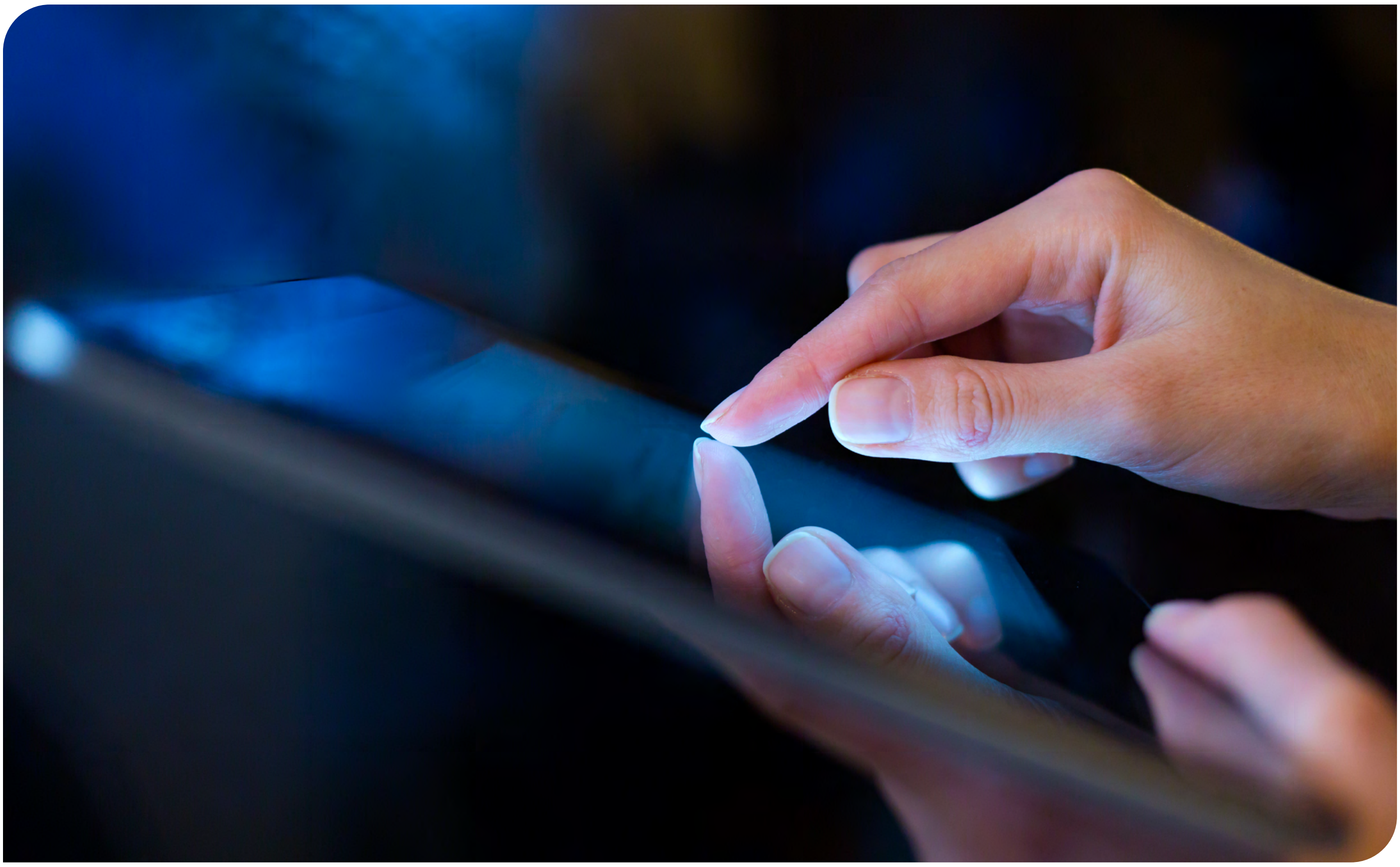
A truly comprehensive water cycle management platform must address every aspect of a water utility's operations, from the supervision and control of supply and sanitation networks to catchment, drinking water treatment, and purification. It should also optimize asset management, streamline processes, and enhance collaboration among departments and teams responsible for water resources.

A holistic water cycle management platform should serve as a powerful tool for early anomaly detection and proactive event management, reducing downtime and water losses while improving workflows and operational dynamics.

In addition, the platform should enable real-time data analysis and harness anomaly detection algorithms, as well as machine learning and artificial intelligence models. This empowers organizations to successfully identify and resolve operational challenges efficiently, minimizing disruptions to water supply and other critical processes.

From a technical standpoint, an integrated water cycle management platform should feature a modular, scalable architecture tailored to each utility's needs. Key components should include data acquisition systems for the OT network (IoT devices) and the IT network to obtain data from business applications, centralized databases, analysis and visualization tools, and specific applications for various areas of water management.

The platform's architecture must be highly flexible and adaptable, enabling seamless integration with diverse monitoring and control systems. In addition, it must meet the highest standards of security and reliability, ensuring data integrity and confidentiality at all times.



Key profiles for implementation and their main functions

Implementing a digital water cycle management platform is a complex process that requires a structured, well-coordinated approach. This approach must seamlessly integrate advanced technologies, optimized operational processes and skilled human teams. Success depends on balancing technical, organizational and operational aspects, while leveraging specialized expertise in each key area of the project.

IT Leads and Project Managers

These roles oversee project planning, organization and rollout. Their responsibilities include:

- **Coordination**: managing multidisciplinary teams and allocating resources to align technical and operational objectives.
- **Supervision**: monitoring project timelines and ensuring key deliverables are met.
- **Risk management**: identifying and mitigating challenges related to technology integration and staff uptake.
- **Quality assurance**: safeguarding compliance with regulations, quality standards, and strategic objectives.

Infrastructure Architects

Infrastructure architects are responsible for designing the technological foundation of the platform, bringing long-term feasibility and reliability. Their main responsibilities include:

- **Technological design**: developing scalable, resilient solutions tailored to the organization's needs.
- **Interoperability**: ensuring seamless integration between existing systems (SCADA, GIS, ERP) and IoT/OT technologies.
- **Strategic migration**: planning transitions that minimize operational disruptions.
- **Operational continuity**: establishing high-availability frameworks and disaster recovery strategies.

OT and IIoT experts

These specialists focus on the integration of field devices and IoT technologies to improve operational efficiency. Their key responsibilities are:

- **Integration**: connecting field devices using advanced protocols and maintaining their operability.
- **Validation**: assessing the compatibility of existing infrastructure with newly implemented solutions.
- **Operational optimization**: ensuring collected data is accurate, relevant, and useful for real-time analysis.

Advanced analytics and IT data integration experts

This team is responsible for extracting actionable insights from collected data and tailoring the platform to specific operational needs. Their key functions include:

- **Platform configuration:** aligning technology solutions with operational requirements.
- **Data integration**: designing data flows using ETL (Extract, Transform, Load) technologies and ensuring seamless interoperability across IT applications.
- **Analytical modeling**: developing advanced analytical tools to boost real-time decision-making and optimize operational performance.

Cybersecurity Specialists

As connectivity expands, securing technology infrastructure and data becomes essential. These specialists focus on:

- **Protection strategies**: design security frameworks based on international standards such as Zero Trust and AI-based threat detection.
- **Vulnerability assessments**: pinpointing weaknesses and implementing proactive security measures.
- **Risk mitigation**: developing policies and deploying tools to minimize potential cyber threats.

Bringing together these specialized profiles, each with clearly defined responsibilities, delivers a comprehensive and efficient implementation process aligned with the organization’s strategic goals. A multidisciplinary team with complementary expertise not only guarantees the successful integration of technology but also strengthens the long-term sustainability and resilience of operations.

Steps for platform implementation

1. Needs assessment and initial planning

Successful deployment begins with a comprehensive analysis of the organization’s requirements, including:

- **Technical and operational audits**: evaluating the current status of existing IT/OT infrastructures, field devices and management systems (SCADA, GIS, ERP, etc.).

- **Definition of clear objectives**: specific goals such as operational optimization, water loss reduction, regulatory compliance, and sustainability improvements.

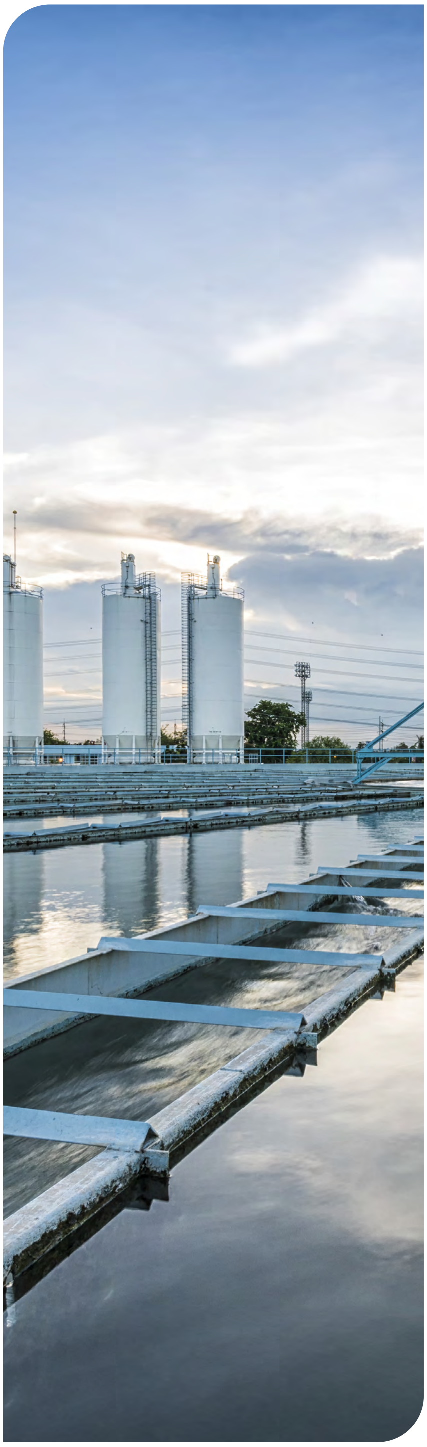
- **Risk analysis**: identifying potential challenges, such as technology incompatibilities, cybersecurity vulnerabilities and staff resistance to change.

2. Platform architecture design

The platform’s infrastructure must be scalable, resilient, and secure. This phase includes:

- **Modular and scalable infrastructure**:
  - Hybrid architectures (on-premise and cloud) to guarantee flexibility.
  - Storage systems such as data lakes for integrating historical and real-time data.
- **Integration with existing systems**:
  - Use of middleware for interoperability between SCADA, IoT and enterprise databases.
  - Communication protocols such as OPC UA, MQTT and gRPC to unify data.
- **Integrated cybersecurity**:
  - Segmented networks with industrial firewalls.
  - End-to-end encryption using TLS.
  - Continuous threat monitoring systems.

- **Cutting-edge tools**: platforms such as Kubernetes for container orchestration, ensuring high availability and adaptability to variable loads.



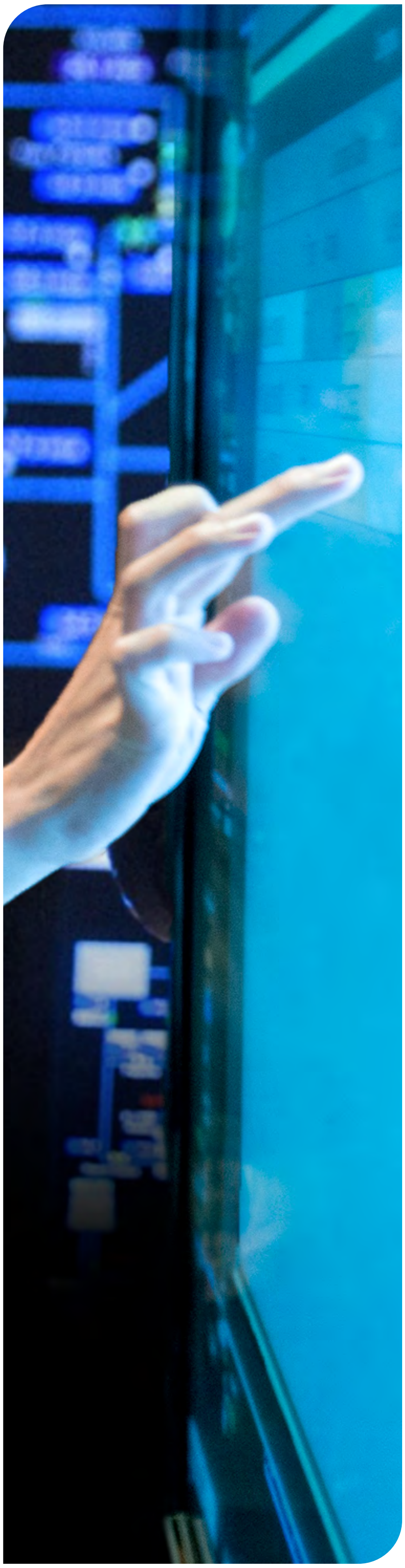
3. Documentation and validation of data sources

Before data ingestion begins, rigorous procedures must be established to guarantee data quality and reliability:

- **Source documentation**:
  - Identifying IoT devices, enterprise databases, SCADA and GIS and other relevant sources to build a digital twin, a tool with growing demand in Industry 4.0.
  - Mapping available data, defining parameters such as update frequency, accuracy and format.

- **Data validation**:
  - Applying consistency rules to eliminate duplicates, correct null values and standardize formats.
  - Using tools such as Apache Nifi and Talend to automate data validation and cleansing processes.

- **Pilot tests**:
  - Conducting controlled data loads to verify data quality and system behavior.
  - Identifying potential integration issues before full-scale deployment.



4. Platform configuration and customization

This step ensures that the platform is tailored to the organization's specific needs.

- **Customized parameterization**:
  - Configuring dashboards based on operational requirements.
  - Integrating machine-learning algorithms for prediction and optimization.

- **Device integration**:
  - Connecting IoT sensors, smart meters and SCADA systems through interoperable gateways and protocols.
  - Implementing digital twins to simulate and optimize processes.

- **Alarms and notifications**:
  - Setting up alerts for critical events such as leaks, pressure drops and water quality anomalies.

- **Load and performance testing**:
  - Verifying the platform's ability to process large volumes of data in real time.
  - Simulating extreme usage scenarios to maintain system stability and optimum responsiveness.

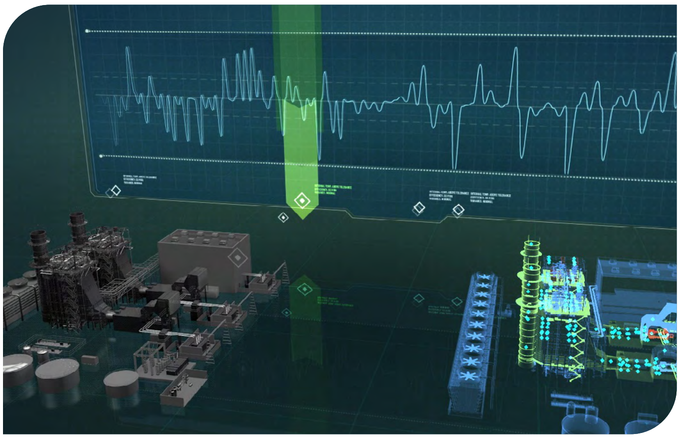
Change management and training

Successful implementation of a technology platform relies heavily on effective change management and comprehensive training. Engaging all levels of the organization, from operational staff to senior management, is essential for ensuring smooth uptake and maximizing the platform's potential.

Change management involves clearly communicating the platform's benefits and objectives while actively involving employees in decision-making and planning. Fostering a collaborative and supportive environment helps staff feel motivated, confident, and empowered to integrate the new technology into daily operations.

Staff training is equally critical to ensure that employees fully understand how to use the platform and take advantage of all its functionalities. This may include face-to-face or virtual training sessions, detailed user manuals, online tutorials, and ongoing technical support.

In addition, utilities need to establish continuous feedback and improvement processes to maintain long-term effectiveness. Regularly collecting user input allows for refinement and feature enhancements, ensuring the platform remains relevant and adaptable to evolving operational needs. This iterative approach maximizes the value of technological investment and promotes overall efficiency.



Smart Water Engine

Many water utilities struggle to gain comprehensive, real-time insights into their infrastructure's efficiency and operational status. Managers and operators often contend with fragmented data streams from multiple sources, making it difficult to assess overall system performance, implement broad improvements, respond swiftly to unexpected events, simulate scenarios, and predict future outcomes.

The Xylem Vue platform, developed by Idrica and Xylem, provides an integrated solution powered by advanced software and analytics, helping utilities optimize investments, boost operational efficiency, and safeguard a continuous, affordable service for communities.

At the heart of this technology is the **Smart Water Engine**, an intelligent system that eliminates data silos by unifying and standardizing data from diverse sources into a single, comprehensive model. It harnesses cutting-edge algorithms to enable utilities to monitor and analyze every aspect of their systems.

Consolidated data is accessed through specialized water applications built into the Xylem Vue platform, each designed to address key water management challenges.

By centralizing information and eliminating reliance on disconnected technologies, the Smart Water Engine delivers real-time insights, enabling faster, more effective decision-making for water system operations.

The Smart Water Engine creates a single source of standardized data so utilities can:

- Monitor operational processes.
- Run what-if scenarios in real time.
- Geolocate assets using GIS library tools.
- Set up device management and performance alerts.
- Build hydraulic models of digital twins.
- Design operational dashboards.

Benefits and advantages of an integrated water management platform

Implementing a comprehensive water management platform delivers significant technical and operational advantages, including:

- Significant reductions in operating and maintenance costs
- Improvements in service quality and customer satisfaction
- Enhanced operational efficiency
- Faster response times
- Minimized risk of supply interruptions
- Better planning and decision-making
- Performance evaluation of facilities
- Identification of areas for improvement
- Optimized resource allocation for maximum efficiency and profitability

The implementation of a water management platform offers numerous advantages for water utilities, making it a crucial consideration.

First, the platform should provide a **holistic, real-time view** of water processes, enabling **more informed and agile decision-making**. Utilities that have instant access to real-time data can swiftly identify issues and implement corrective actions, minimizing supply disruptions and boosting enhancing service quality.

Additionally, it must incorporate **advanced analytics and predictive tools** to detect patterns, anticipate potential problems, and optimize infrastructure operations. By leveraging **machine-learning algorithms and predictive analytics**, utilities can proactively prevent issues before they arise, significantly reducing maintenance costs and improving operational efficiency.

Furthermore, **centralizing data on a single platform** increases coordination across different departments and streamlines operations. Organizations can eliminate redundant efforts and foster seamless collaboration between teams by consolidating information from multiple sources.

Finally, the platform must be **highly scalable**, ensuring it can adapt to changes in the size and complexity of the water distribution network. If it has **both vertical and horizontal scalability**, it can accommodate growing organizational needs, support large data volumes, and handle multiple concurrent users efficiently.

Success stories

Success stories serve as specific examples of the technical advantages gained through the implementation of this type of platform.

The following cases illustrate how water utilities that have adopted the platform, Xylem Vue in this case, have achieved significant improvements:

Global Omnium (Spain)

Global Omnium's expansion in Spain, beyond the city of Valencia, marked a pivotal paradigm shift. The utility faced the challenge of managing up to 400 different services across a widely dispersed geographical area.

Additionally, due to the public service concession model, the utility needed to integrate a variety of systems, sensors, and communication protocols already present in the infrastructure it managed.

The **utility's digital transformation** was a major challenge, but its successful implementation ensured the delivery of services with the highest standards of quality and efficiency

Hot Springs (USA)

The **City of Hot Springs** has leveraged multiple digital solutions to boost operational efficiency, enhance network performance, and reduce water losses. The utility manages a network of 14 sectors, nearly 1,500 km of water mains, 43,000 AMI meters, 11 elevated storage tanks, and two water treatment facilities.

This project involves the deployment of the Xylem Vue Leak Detection application, other Xylem digital solutions (Sensus Analytics, Revenue Locator and Water Loss Management), the Sensus Flexnet communication network and Sensus meters..

Yorkshire Water (United Kingdom)

Yorkshire Water implemented Xylem Vue to bolster its non-revenue water management and monitor field operations, process efficiency, and the effectiveness of leak detection technologies. The versatility of the BI Panel enabled customized information flows within the platform, tailored to cater for Yorkshire Water's operational needs.

Monterrey Water and Drainage Services (Mexico)

Thanks to the implementation of the platform, SADM gained the ability to monitor, analyze, and make informed decisions on the operations of its hydraulic network. This enabled the utility to set day and night setpoints for regulation equipment, providing greater control over user consumption. Furthermore, the platform helped identify anomalies in nighttime consumption, signaling potential visible and hidden leaks.

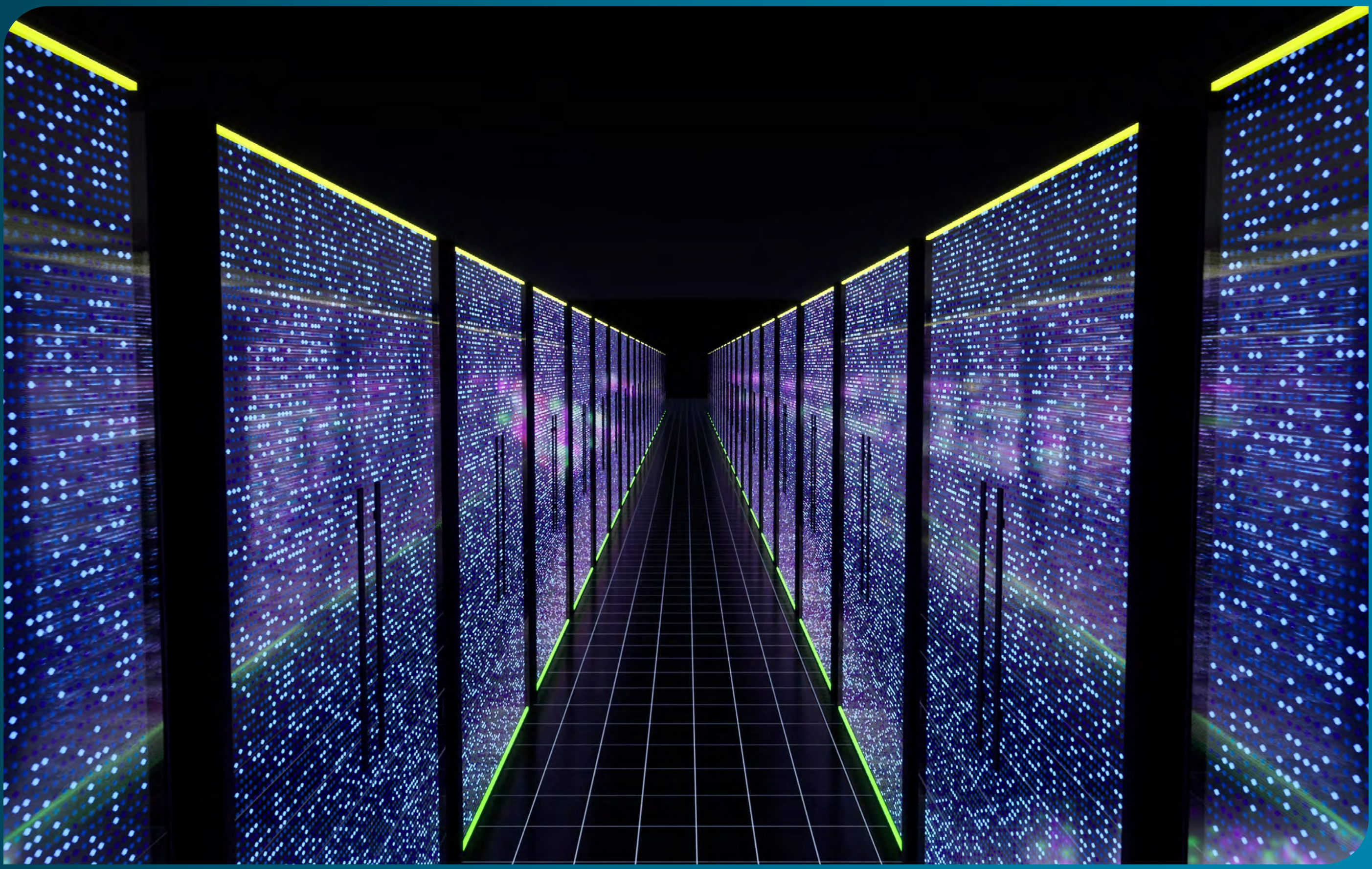
As a result, substantial reductions in average consumption were achieved across several macro-sectors and circuits, with reductions ranging from 34% to 37% following corrective actions.

Electricity & Water Authority (Bahrein)

The Electricity and Water Authority (EWA) is a government organization that supplies electricity and water across the Kingdom of Bahrain, serving residential, commercial and industrial customers.

As part of Bahrain's Fiscal Transformation Program, EWA seeks to increase its efficiency while ensuring a reliable, high-quality water supply that supports the country's sustainable development. A key initiative to achieve this is the reduction of non-revenue water (NRW) to economically acceptable levels.

The objective of the project was to reduce water losses in 10 designated DMAs through the deployment of the Xylem platform along with the Portal, Leak Detection, Work Orders and BI applications.



Conclusions

The digital transformation of the integrated water cycle is a strategic imperative to address the challenges of sustainability, efficiency and resilience in water resource management. Advanced technologies such as IoT, big data, artificial intelligence and digital twins are transforming the way data is collected, analyzed and used, enabling utilities in the sector to optimize their operations and ensure a reliable and sustainable water supply.

Implementing an integrated water cycle platform, supported by data from connected devices, is an essential step towards achieving more efficient and sustainable utility management. With the right technical approaches, utilities can fully leverage this innovative technology to ensure a secure, long-term water supply for future generations.

By prioritizing technical aspects such as platform architecture, configuration, and cybersecurity, utilities can successfully implement their management platform.

In addition, by leveraging the platform's technical benefits, such as real-time insights, advanced analytics and early anomaly detection, organizations can improve operational efficiency, reduce costs and minimize operational risks.

However, implementing these technologies requires a holistic approach that combines the deployment of technology platforms with staff training, organizational change management and a strong commitment to cybersecurity. Success stories have already demonstrated that these solutions not only boost operational efficiency but also deliver substantial economic and environmental benefits.

As water stress and demands on this vital resource continue to increase, businesses, governments and communities must work together to accelerate this digital transformation, ensuring a more resilient and sustainable future for water.

Xylem |ˈzīləm|

1) the tissue in plants that brings water and nutrients upward from the roots.
2) a leading global water solutions company.

Xylem is the connective tissue and system in plants which cleanses and transports water from the root to where it is needed most to sustain life.

And this is the essence of Xylem as a company. We are committed to driving sustainable impact by ensuring our connected technologies and solutions support our customers and the communities they serve, to tackle the water challenges that matter most to them.

For more information on how Xylem can help you, visit xylem.com.

xylem vue

Xylem Vue is the result of the partnership between Xylem, a global leader in water technology and Idrica, an international pioneer in water data management, analytics and smart-water solutions. Through this partnership, Xylem and Idrica bring together their technology, innovation, and expertise to solve the world's most critical drinking water, wastewater and other water-related challenges.

Our single, integrated software and analytics platform – built by utilities, for utilities – enables utilities to take digital transformation to the next level, maximize investments, identify and solve problems more quickly, operate more efficiently and deliver water more effectively and affordably to their communities.

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