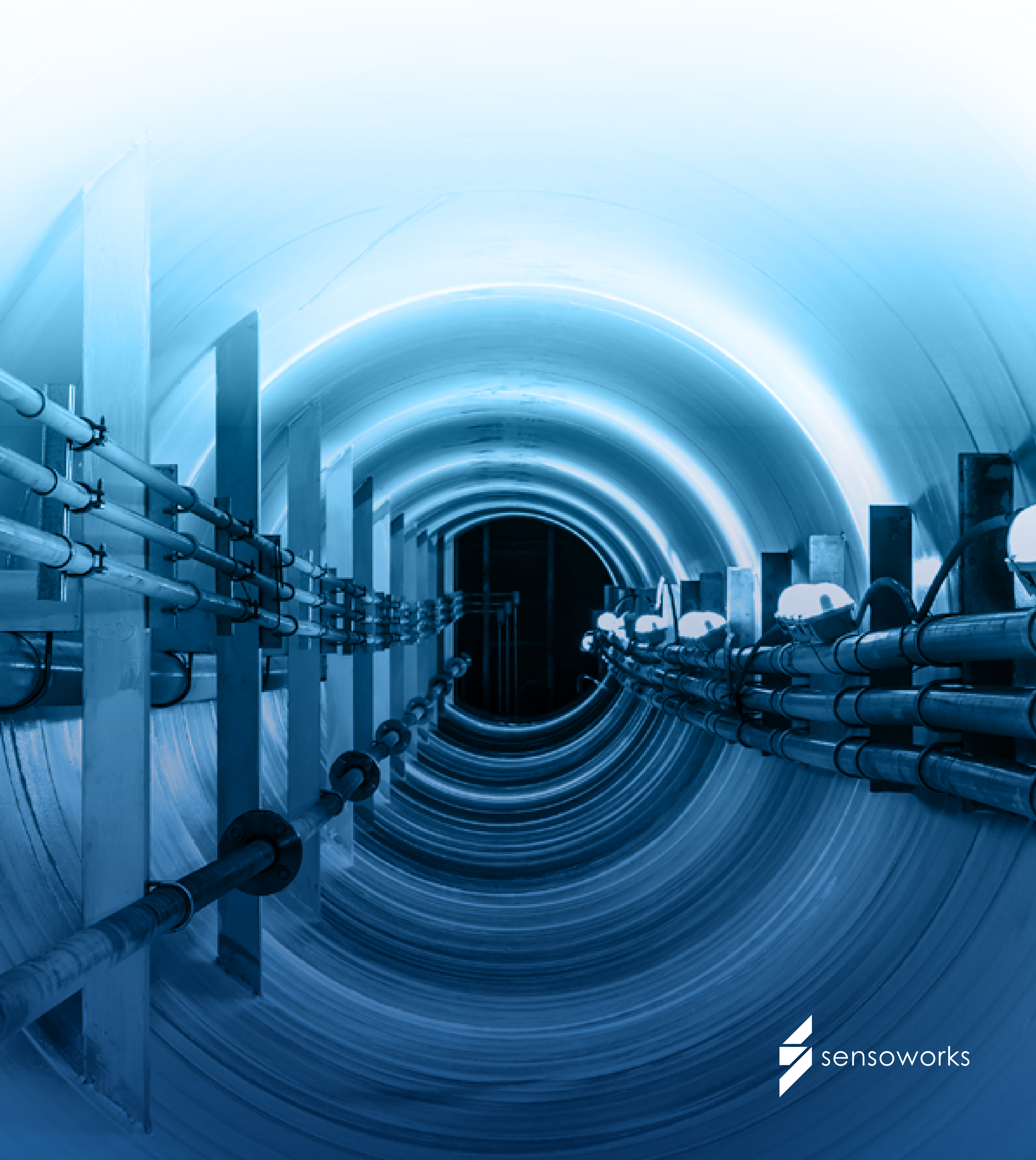
Whitepaper:

# Water Infrastructure 4.0

## Numbers and applications for the new digital revolution



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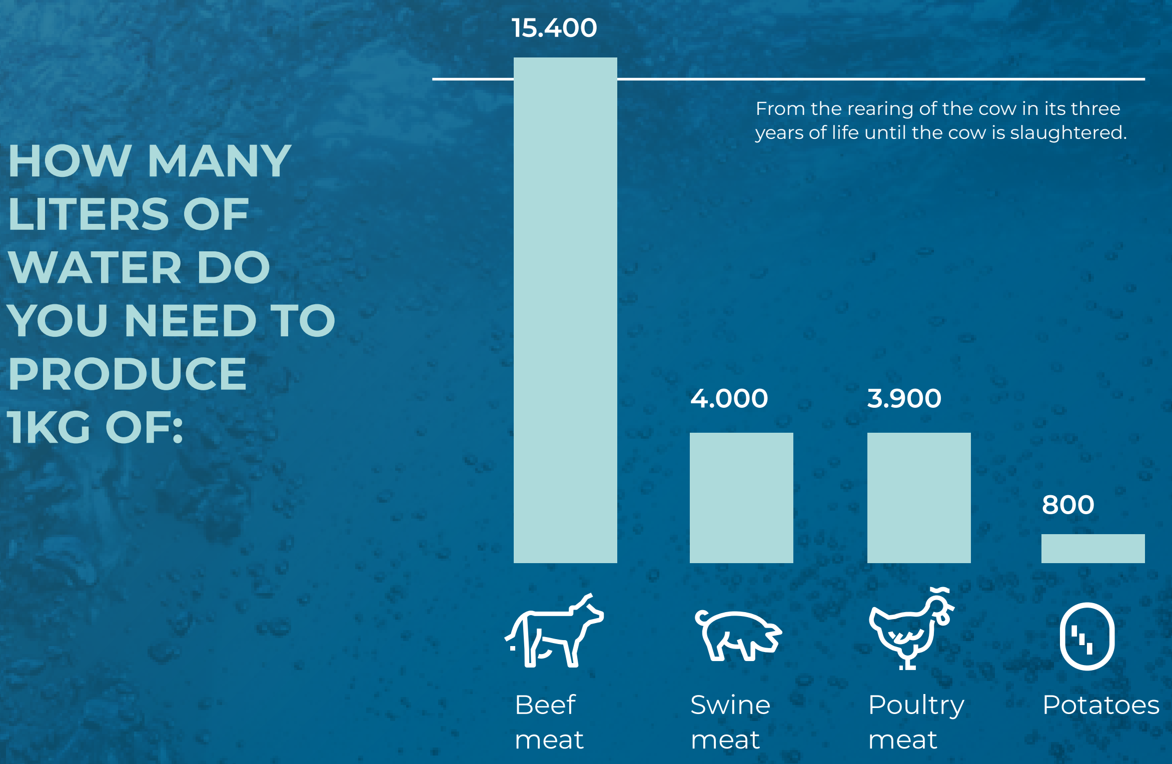
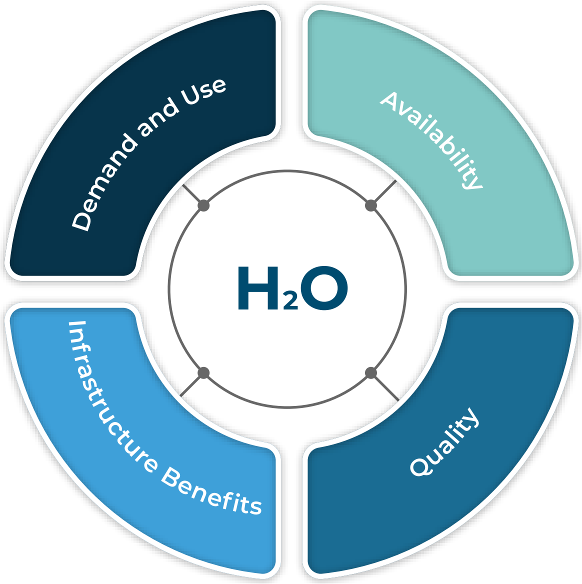
# 1. INTRODUCTION

According to economic theory, the value of a good is determined by the scarcity of the same, that is the gap between limited resources and unlimited needs. There is no doubt that humans use water as if this was unlimited: it is estimated that about 80% of all industrial and urban wastewater is released into the environment without prior treatment.




But fresh water is becoming more and more scarce, day after day. More than two billion people already live in water-stressed areas. About 3.4 billion people, 45% of the world's population, lack access to sanitation facilities that are managed safely. According to independent assessments, the world will face a 40% global water deficit by 2030. This situation will be exacerbated by global challenges such as COVID-19 and climate change.

# 1. THE WATER RESOURCES AND ITS INFRASTRUCTURE




a. **Water demand and use** - Global use of fresh water has increased sixfold in the last 100 years and continues to grow at a rate of about 1% per year since the 1980s (AQUASTAT, s.d.), mainly in the majority of emerging economies, as well as in low and middle-income countries (Ritchie and Roser, 2018). The principal factors influencing the current growth in water demand are mainly the growth of the population, the developing economy, and the changing consumption patterns. Agriculture, which includes activities such as irrigation, withdrawal of water for livestock, and aquaculture, is responsible for 69% of global water withdrawals. This ratio can be as high as 95% in some developing countries (FAO, 2011a). Industry (including generation of electricity and energy) is responsible for 19%, while municipalities are responsible for the remaining 12%. However, most authors agree that water use for agriculture will face increasing competition in terms of demand from industry and energy sectors, but also from municipal and domestic uses, mainly as a function of industrial development and improved coverage of water and sanitation services in developing countries and emerging economies (OECD, 2012; Burek et al., 2016; IEA, 2016).

b. **Availability of water** - Water stress, measured essentially as the use of water as a function of available resources, affects many parts of the world. However, water stress, defined as a condition, temporary or prolonged, of the absence of water, usually lacking at ground level, is often a seasonal phenomenon rather than an annual one. Four billion people live in areas that suffer from severe physical water scarcity for at least one month per year (Mekonnen and Hoekstra, 2016). According to the World Resources Institute (WRI) report, which measured the demand and availability of water in 167 states, the water emergency will be one of the most serious problems affecting our planet, not only in the poor areas but also in the more developed ones. By 2040 there will be as many as 33 states that will have to face "extreme" water stress: among them, about 14 are located in the Middle East area, with serious risks of political instability, but the scarcity of water will also be felt in other parts of the world including even in some areas of Italy and the Balkans.

c. **Water quality** Due to the lack of monitoring and communication, especially in many of the least developed countries, data on the quality of global water remain scarce. However, some trends show how water quality has deteriorated due to pollution in almost all major rivers in Africa, Latin America, and Asia. Globally, it is estimated that 80% of all industrial and urban wastewater is released into the environment without any prior treatment, with harmful effects on human health and ecosystems. This proportion is much higher in less developed countries, where sanitation services and wastewater treatment facilities are severely lacking (WWAP, 2017). Poor management of agricultural runoff is considered also one of the most widespread critical issues related to water quality (OECD, 2017a).

d. **Values of the overall benefits of the hydraulic infrastructures** - Water quality for society is determined by the hydraulic infrastructure that is employed to capture, store or transport it. Hydraulic infrastructure provides significant social and economic benefits. The socio-economic development is limited in those countries that lack sufficient infrastructure to manage water. Approximately 1.6 billion people face water scarcity "economically", which means that while water may be physically available, they lack the infrastructure needed to access that water (Comprehensive Assessment of Water Management in Agriculture, 2007). By 2030, investments in sanitation and water supply infrastructure will have to be about 900-1,500 billion U.S. dollars per year, about 20% of the total requirement needed for all types of infrastructure investments (OCSE, 2017b). About 70% of total infrastructure investment will be in the Global South, with a large share in urban areas undergoing increasing development (GCEC, 2016). In developed countries, there will be considerable investment needed for restructuring and upgrading.

## 2. THE SUSTAINABLE TRANSITION OF THE HYDRAULIC SYSTEM

**Transition to a circular economy model in water use** - It is well known that water underlies most of the aspects of economies and sustainable development. Water scarcity is already a serious problem for several states in the world. According to data released by the Intergovernmental Panel on Climate Change (GIEC), water availability will be seriously affected by climate change. The increase of one degree in the Earth's temperature corresponds, according to scientists, to a 20% reduction in the availability of water resources. It means that, in the absence of decisive measures, by 2030 global water availability could be reduced by 40% compared to today. According to the European Commission, at least 11% of Europe's population and 17% of its territory have

been affected by water scarcity. During the summer season, more than half of the population in the Mediterranean region is affected by water stress. The most recent reports from the European Commission and major international organizations emphasize the need to develop appropriate measures aimed at facilitating the transition from the linear economy model, currently prevailing, toward a circular economy model capable of enhancing the efficient use of resources. This need is universally recognized as particularly pressing for water, an indispensable resource for life and all human activities. In addition to the irrigation reuse of water, the circular water economy aims at the sustainable recovery of material resources and energy contained in wastewater, helping to reduce greenhouse gas emissions and the energy consumption of existing wastewater treatment plants. Managing water resources from a circular perspective requires interventions at different stages of the cycle. The first

line of defense against water scarcity should be a demand management strategy global (for drinking, irrigation, industrial, and energy) that promotes sustainable lifestyles and sustainable production and creates concrete incentives for saving, conservation (counteracting the dispersion in distribution networks) and resilience of water sources and related water infrastructure for derivation and transportation. A second aspect, still little explored, concerns the enhancement and use of unconventional water resources (mainly purified urban wastewater). Wastewater management from a circular economy perspective means the reuse of purified water, mainly in agriculture, and implies sustainable recovery of material and energy resources contained in wastewater, thus transforming sewage treatment plants into bio-refining plants that convert waste substances into useful products, such as biogas and biomethane, fertilizers (nitrogen, phosphorus), organic substances (cellulose, polyhydroxyalkanoates used in the production of bioplastics). For wastewater reuse, attention must be paid to the prevention of pollution at the source through the prohibition or timely control of the use of certain contaminants; to the collection and treatment of wastewater in an effective and widespread manner; to the refinement of wastewater and its distribution to make it an alternative source of water, safe and economic, both for irrigation and for industries and the environment; to the possibility of recovering energy and materials present in urban wastewater, such as nutrients like phosphorus and chemicals such as biopolymers or cellulose, which can be reused in industry or agriculture. For optimal management and valorization of wastewater in terms of a circular economy, treatment processes and methods of

disposal, and reuse of sewage sludge, are important. Sewage sludge should be defined concerning its characteristics and the territorial scope of reference (Critical Raw Materials). Phosphorus is indeed a critical raw material for Europe, because of the almost

total reliance on imports from countries outside Europe and the very low rate of recycling from end-of-life products.

## 3. THE DIGITAL REVOLUTION IN WATER SERVICE 4.0

The water utility has in recent years started its digital transformation journey. However, the adoption of digital technologies is still at an early stage, and for it to fully express the wide potential benefits, it should be supported with concrete actions on several fronts: regulatory, normative, and financial. The combination of digitization and Water Service Integrated is set to grow stronger and stronger.

### HOW DIGITAL CAN SUPPORT THE PROTECTION OF THE ENVIRONMENT

Digital technologies are transforming many aspects of the world we live in, from industries to cities, to everyday life. Digital transformation is among the great forms of disruption, global evolutionary trends destined to change the way things are done, to revolutionize industries, including integrated water service. The concept of "Industry 4.0" understood as "a strategic approach to the integration of advanced Internet-based control systems that enable people and machines to connect anytime, anywhere, with anyone and anything in a single complex system" was first introduced in Germany in 2011 and declined by the German Water Partnership (GWP) for the Integrated Water under the term "Water 4.0." These are terms that describe the industrial digital transformation characterized by the advent of smart devices and the availability of data for effective decision making, combining both the physical and virtual worlds in the cyber-physical systems (CPS) of the Internet of Things (IoT) and Internet of Services (IoS). A major paradigm shift that leads to talking of a fourth industrial revolution. ICT (innovation and communication technologies) is the key to improving water resource management, enabling the development of intelligent monitoring, management and measurement systems, knowledge decision support, and also greater awareness of water consumption and value. In the area of internal processes and infrastructure, the use of digital technologies revolves around the use of data to optimize decision-making processes, streamline service management and improve quality. This is made possible by the so-called "cyber-infrastructures", ie data collection systems - sensors and instrumentation - and storage, processing, and display of the same (smart water network, IoT, data-science techniques, augmented intelligence, blockchain) They allow you to make more informed decisions in real-time. The adoption of remote sensing (e.g., sensors, satellites) and asset management technologies enable water utilities to benefit from immediate knowledge of their network and plant systems through detailed measurements, continuous monitoring of processes and infrastructure involved, as well as automating of some processes and taking remote action. It is a useful aid in the prevention of service interruptions and water leak detection. Effective knowledge of the physical and operating conditions of networks and systems also makes it possible to direct investment spending toward real priorities, plan interventions accurately even in the medium to long term, and optimize maintenance based on knowledge of the state of networks rather than their usefulness. Cognitive analytics-based technologies enable value to be derived from data, guiding decision-making toward the best action with predictive and prescriptive algorithms, predicting potential failures, and automating processes and choices. These applications on physical assets must necessarily complement an appropriate degree of digitization of internal processes: Enterprise Resource Planning systems, Workforce Management, Customer Relationship Management, Project Management, and E-Procurement. Tools needed for utility innovation water utilities and their efficiency (of time and workloads) through the computerization of information flow circulating within them.

## THE NEW OPPORTUNITIES CREATED BY WATER 4.0

Given the nature of monopoly service that characterizes water service, the relationship with the user becomes a key strategic asset to convey the role and spillover effects of its operations in the relevant territory. In more recent years, there is a growing need to strengthen the relationship of trust with the citizens. Digitization in user relations offers a unique opportunity to create engagement greater, made of transparent communication and immediate, simplifying the completion of end-to-end administrative practices. Through notifications from digital applications (Apps) and instant messaging, communication can be made more immediate, smooth, and direct. Notices of service disruptions, outages, and scheduled resets, as well as information on open construction sites and initiated work, can be communicated in real-time, as can outcomes resulting from unpredictable events. Online services and personal web user areas can facilitate supply management through user self-managed procedures, sending self-readings and complaints, activating practices and services such as web billing or booking appointments, as well as making users more aware of their consumption and the quality of tap water (organoleptic properties and its healthfulness), reassuring them that they are consuming an environmentally preferable resource. In one stroke, this privileged relationship has beneficial effects on the internal organization of the Water Company, simplifying administrative and user management processes; on the other, it allows for a more conscious use of public water, saving the entire society concerning the lower use of bottled water with its lower impacts on the environment. Users' expectations of sustainability are already changing their behavior: the more water service will rely on digital assets, the more users will be able to participate as prosumers in the conservation and reuse of water. In this transformation, one of the first opportunities for water service operators is the implementation of the so-called digital twin, the digital representation of the infrastructure that makes up the water system, whose information can be used to plan interventions of optimization and efficiency. This scenario sets the stage for the application of data-science technologies, including those based on artificial intelligence, big-data analysis, machine learning, and deep learning, which can help address two main needs.

The first need: derive value from data and perform or automate in a predictive and prescriptive manner. Basically, not only monitor the water system, but provide, for example, decision support, automated control, risk prevention, and preventive planning.

The second need: is to process and manage large amounts of data from different sources (different components of the network or treatment plants), reducing the time needed to process them, as well as the risk of errors and delayed decisions.

# 4. THE DIGITAL APPLICATIONS IN THE INTEGRATED WATER SYSTEM

### CONSUMER-FOCUSED SERVICES

- Improved experience in dealing with Customer Care (complaints, information, feedback of intake, and resolution of problems)
- Transparent and immediate communication, simplifying the completion of paperwork administrative (activation, vulture, termination)
- Online desks and personal web user areas to facilitate supply management through user self-managed procedures
- Tips on water saving in the household

### BENEFITS IN THE RELATIONSHIP WITH USERS' CUSTOMER EXPERIENCE

- Increased satisfaction with service
- Simplification and speed for the completion of practices
- Awareness of customs and proactivity in reducing them
- Increased user involvement and responsiveness to their requests

### DEDICATED SERVICES FOR MANAGERS

- Increased satisfaction with service
- Simplification and speed for the completion of practices
- Awareness of customs and proactivity in reducing them
- Increased user involvement and responsiveness to their requests

### UTILITIES

- Focus on affordability
- Increased resilience to climate change
- Public safety
- Improved service quality and environment protection

### BENEFITS FOR THE COMMUNITY

#### Focus on affordability

- Improving the long-term affordability of the fee structure
- Greater transparency in the use of revenues of water tariffs

#### Long-term resilience

- Increased operational flexibility in the face of climate and demographic changes
- Improved safety through rapid user involvement in case of public health risks
- Easily test and adopt cutting-edge technologies

#### Improved quality of service to protect the environment

- Reducing the risk of an overflow of wastewater into the environment
- Reducing greenhouse gas emissions
- Improvement of conservation and management of resources
- Reducing the risk of water quality non-compliance
- Increased service continuity

## 5. THE ROLE OF TECHNOLOGY IN THE EFFICIENCY OF THE SUPPLY LINE

Obsolete infrastructure along with the inefficiency of the water system necessitates massive investment in technology to improve service. The Value Water Community has identified 4 pillars for water sector efficiency:

1. Minimize the use of fresh potable water for activities and sectors that might use non-potable water;
2. Increase recycling and reuse of water and wastewater;
3. Reduce the production of wastewater from the extended water supply chain;
4. Efficient monitoring systems to keep consumption under control by adopting energy efficiency policies.

The management of scattered water networks is complex. Many of the components of the networks' physical system are not easily accessible such as pressure or flow sensors. The convergence of IT (Information Technology) and OT (Operation Technology) is vital. The intersection of IT and OT alone, however, is not enough, which is why enabling technologies such as mobility, connectivity, and IoT need to be implemented.

Hydraulic modeling solutions, and their digitalization, enable accurate simulation of performance at key points in the network. Virtual sensor techniques make it possible to calculate flows and pressures where real sensors cannot be included.

To make water networks resilient, efficient, and sustainable, it is essential that management, monitoring, and control are automated (including the remote ones). The goal is to respond in real-time to water demands and, to ensure the safety of plants and the water delivered itself, by moving to a service based on predictive instead of reactive systems.

To be efficient you need data; to manage, analyze and return it understandably, you need software and digital services: from reactive systems to predictive systems.

The digital transformation of the industry will ensure, including through artificial intelligence systems, cyber safety, and new technologies, a digitalized and efficient "smart water" system.

## 6. THE ROLE OF BIG DATA AND IOT IN RESOURCE OPTIMIZATION, WASTE MANAGEMENT, PREDICTIVE ANALYTICS, AND THE SATISFACTION OF THE CONSUMER

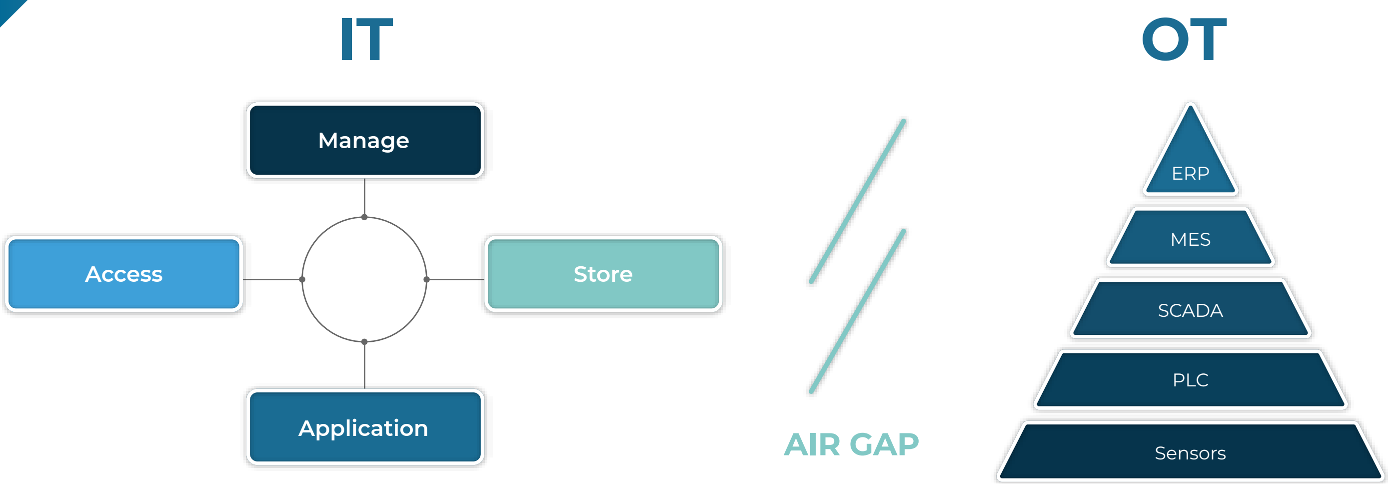
Another aspect of digital transformation, the Industrial Internet of Things (IIoT), allows various control systems, such as sensors, to be accessible throughout the network and connected anytime, anywhere. This implies that water companies engage in two fundamental actions:

- Equip resilient and efficient Safety systems to ensure that all parts of the infrastructure are protected from cyber-attacks;
- Having a digital structure that can collect, process, manage, and return an ever-increasing amount of data in an easily readable manner.

More quality and better-managed data can increase the efficiency of the entire network, use less energy, anticipate and reduce outages: and as a result, services for citizens will be improved.

We often talk about Smart City: in the case of water, "Smart" is about making water supply and distribution smart with the Internet of Things (IoT) technologies, so that it can connect and communicate with other parts of the system and the city.

Smart water systems use IoT-activated sensors to collect real-time data and generate the so-called "digital twin" of the physical infrastructure on the ground and enable its modern and optimized management. This enables optimization of water

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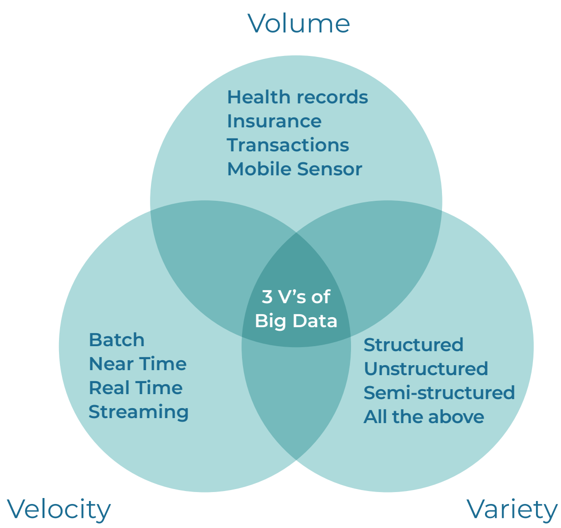
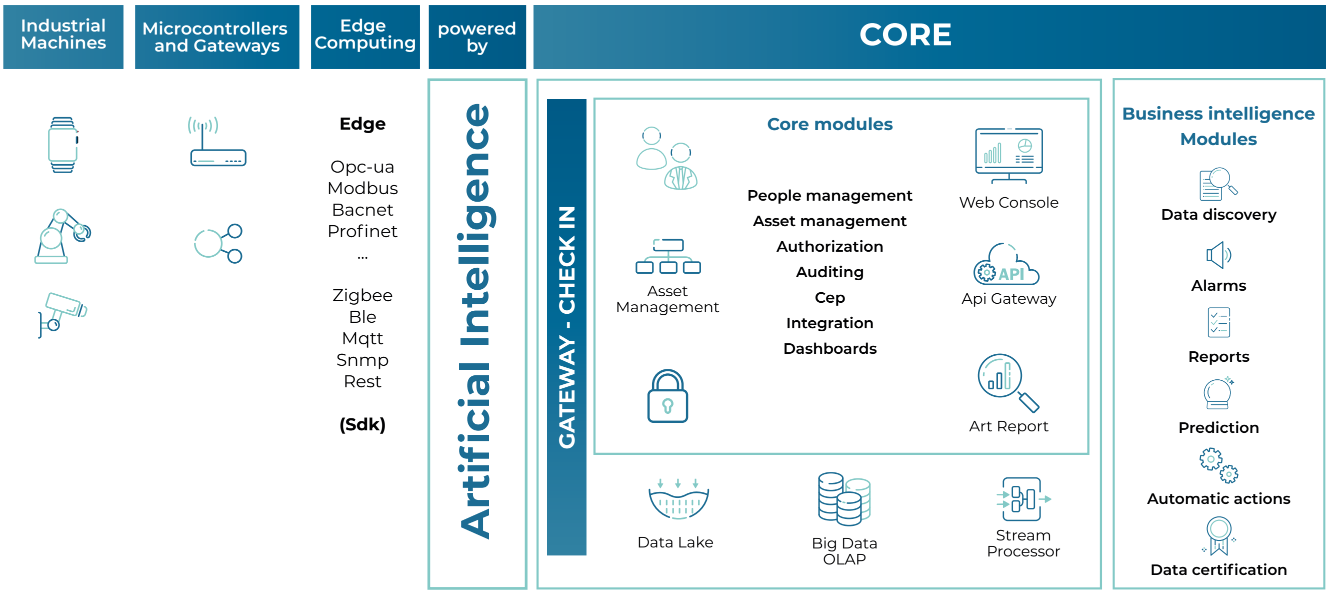
facilities by detecting leaks in the network, leaks to utilities, flow rates, pressures, or control of water distribution on the network and enables operators to make more informed decisions about water resource management. The processes currently used in many water services for the district and water networks are based on a growing awareness of resources and increasingly refined processing of data that generate.

With Integrated Solutions, leaks in pipelines can be detected, the behavior of networks can be predicted in the face of future expansions, new allotments, changes in operating pressure or pipeline diameter, etc., and structural problems can be identified in advance and adaptation investments can be planned accurately and on time.




Such data are even more valuable when they're shared: watershed management teams, for example, can use predictive technologies to understand when and in which areas a greater likelihood of flooding exists before it happens. Transportation managers, by sharing this information, can warn people about the risks and divert traffic. The predictive intelligence made possible by IoT and big data will have a huge impact on cities, saving time and conserving resources.

These facilities, connected and integrated through IoT-native, will result in significant water savings by reducing losses due to malfunctions and ruptures. In addition, they will result in bill savings for the private citizen and a reduction in waste, a fundamental issue in an increasingly populous world that, until now, has treated natural resources as if they were infinite and guaranteed. They will also enable private citizens to save money and reduce waste, a key issue in an increasingly populous world that, until now, has treated natural resources as if they were infinite and guaranteed.




## BENEFITS

1. Automation and **Continuous Monitoring** of operational processes
2. **Information sharing** and **transparency**
3. **INTEGRATION** with your business tools

## FROM REACTIVE TO PREDICTIVE MANAGEMENT

The leakage problem greatly plagues water systems that are inefficient and unreliable.

Analyzing the water infrastructure sector and, in particular, the water services sector, it appears that although our country is rich in water overall, the demand for drinking water is not fully met, at least in some areas.

This inconsistency is due in part to the continuous increase in water demand, linked to economic development and higher quality of life, and in part to a series of structural, managerial, and maintenance (ordinary and extraordinary) deficiencies in water systems that result in significant losses representing, in Italy, 40% of the resources withdrawn from the environment (latest data provided by the Committee for the Supervision of the Use of Water Resources).

This is water lost from the adduction and distribution networks and, consequently, already equipped with hygienic and organoleptic requirements suitable for human consumption.

Water leaks from pressurized water pipes are very sensitive because any leaks, in addition to causing economic damage from wasted water, risk far more serious and dangerous consequences including seepage, landslides, flooding, or land subsidence.

Recovering an aliquot of the significant volumes of wasted water would both alleviate the problem of the frantic search for new sources of supply initiated by the utilities and save costs from addiction and treatment. All this, together with the indications of the legislation concerning the water resources sector, has raised the awareness of operators towards the issue of leakage, resulting in the development of studies aimed at estimating, controlling, and, therefore, reducing it. In particular, operators and multi-utilities have decided to focus on predictive maintenance. The goal is to identify the points in the infrastructure where network failure is most likely. This makes it possible to intervene with the replacement of the pipeline at risk before the damage occurs. To this end, artificial intelligence algorithms are being tested precisely to identify the highest-risk spots so that investments and interventions can be planned in an increasingly timely and targeted manner.

The basic idea is to develop an artificial intelligence algorithm with "supervised learning" and "dynamic weights."

In supervised learning, the network is given a set of inputs (training set) to which known outputs correspond. By analyzing them, the network learns the connection between them. Thus it learns to generalize, that is, to compute new correct input-output associations by processing inputs outside the training set. As the machine processes output, it is corrected to improve its responses by varying the relative weights (dynamic weights) to the connections between nodes.

The algorithm starts from the study and analysis of the factors endogenous (age, material, and diameter of the pipeline) that can determine the rupture of a pipeline, and then goes on to identify the acoustic characteristics of the signals recorded by the accelerometers installed near the pipelines. The "training" phase of the algorithm includes the input, for the neural model, of power spectra calculated through the application of the Fast Fourier Transform to the acceleration time histories recorded in the case of real losses.

In the absence of the dispersion noise signal, there is generally no significant energy change in the spectrogram, and the flow noise energy is distributed almost evenly.

In the presence of leaks, on the other hand, it is possible to see a noticeable change in the distribution of energy in particular bands which indicates with good certainty the presence of ruptures within the pipes. Spectral analyses then allow for the detection of the predominant frequencies (frequency peaks) identified in the event of a leak; these peaks will naturally be a function of several parameters related to the type of rupture (shape, bore, etc.), size, geometry, the material of the pipe where the leak occurred, velocity and pressure of the fluid, and the presence of catchments or pumps near the point of rupture.

Once the neural model training activity is completed, the training data can be compared with the data collected in the field to detect and classify any incidents.

Many things can be done to improve and maintain high levels of service and customer satisfaction. An integrated water network management system can identify problems before they occur. In this way, both those who manage and those who use the water network can be informed of potential problems in a proactive way.

**Descriptive Algorithms** | **Predictive Algorithms** | **Prescriptive Algorithms**

| | | | | | | |
|---|---|---|---|---|---|---|
| MILP/MIP optimization method | Feedforward NN | Long-short term memory LSTM | Storm algorithm | Genetic algorithm | Boosted tree LSTM | Linear Regression |
| Convolutional neural networks (CNN) | Decision tree LSTM | Principal component analysis PCA | T-SNE Clustering | k-means | Spectral clustering | |

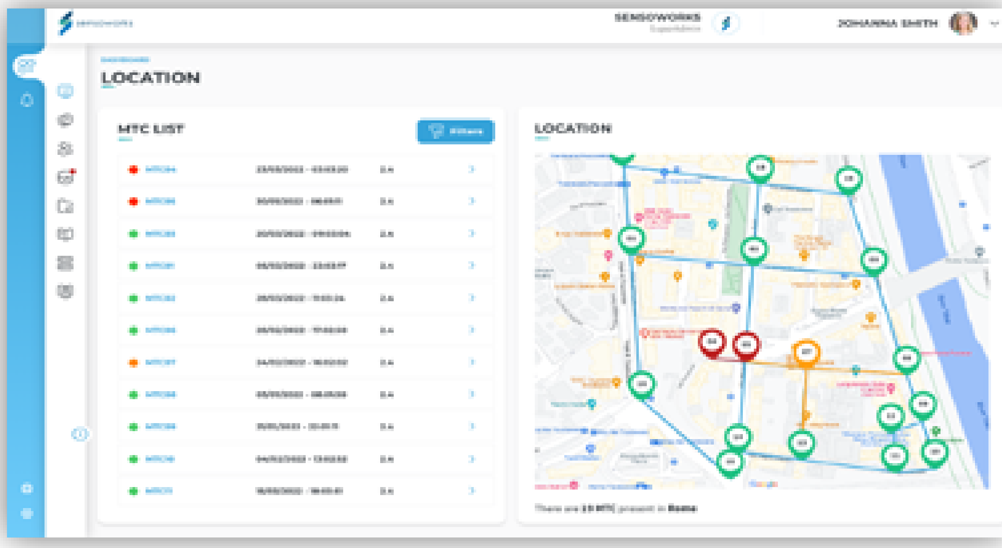
# 7. THE SAFETY AND MANAGEMENT OF WATER NETWORKS (PHYSICAL AND CYBER)

Internationally, most water utilities in industrialized countries are beginning to consider cyberSafety as an integral part of their modernization process. However, the level of cybersafety in water networks does not correspond yet to the level of risk faced by the entire sector. In developing countries, however, cybersafety is not at all a priority for water utilities. The challenges in these areas are diverse: water shortages, water treatment, distribution network efficiency, wastewater disposal, etc. And when it comes to inequality and scarcity, conflicts naturally arise over control of this vital resource. An economic and political situation that is now a breeding ground for cyber attacks. Today's water infrastructure depends on geographically distributed architectures and remote maintenance of systems. Maintaining the integrity of exchanged commands and data is therefore essential to ensure the quality of this resource until the end of the distribution chain. The water industry has no choice but to think about how to secure its systems if it wants to optimize its water treatment and distribution processes in an IoT or IIoT. To this end, the industry mostly adopts strategies of segregating each of its facilities by separating the IT world (PCs, servers, users) from the OT world to isolate the operational part of the supply chain in case of attacks. However, especially in this area, "universally valid" solutions often prove insufficient.

To ensure the cybersafety of water networks, it is necessary to constantly verify the reliability and legitimacy of data and commands transmitted via both network and OT protocols in real-time. Two extremely relevant issues emerge such as the PSA (Piano di Sicurezza delle Acque, "Water Safety Plan" in English) and Water Leakage Management.

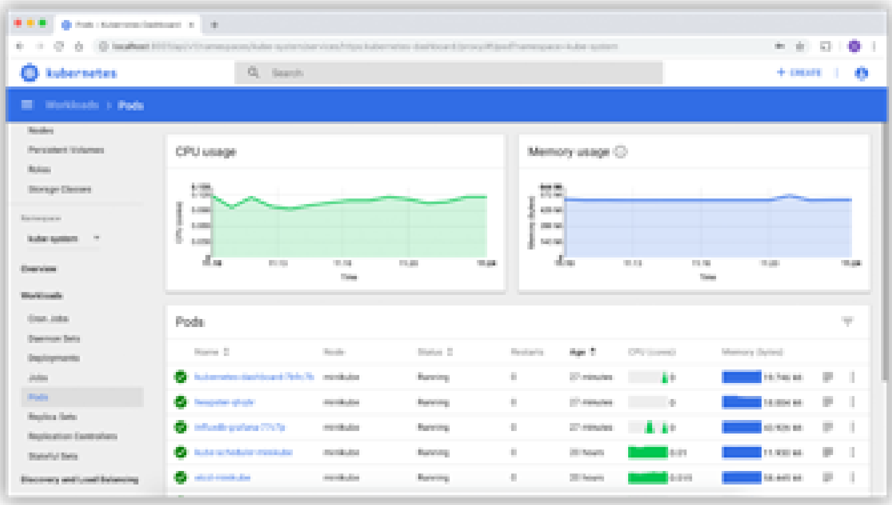
Regarding the first point, the PSA, the World Health Organization has for more than a decade introduced the model of Water Safety Plans as the most effective means of systematically ensuring the safety of a drinking water system, the quality of the water supplied, and the health protection of consumers, users, and citizens.

In Italy, there are still few aqueducts that have been equipped with a PSA, and the Ministry of Health, through Istituto Superiore di Sanità, has made available documents and experts who actively deal with this issue. The industrial landscape is changing rapidly and in a deep way: economic challenges, information overload, staff training or the intrusion




of new technologies, the proliferation of intelligent systems and devices, the extensive use of process data, and data versus time and time series. The visible effects concern the consolidation of systems, the increase of IT influence, skills in vertical sectors, Cloud and operational mobility, faster adoption of technologies, and the use of social media. And in this context, systems of HMI/SCADA control and remote control are changed.

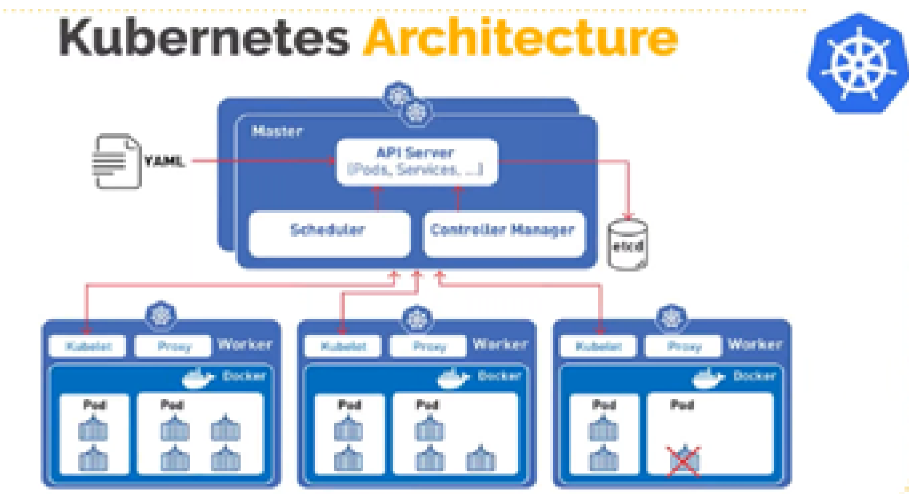
Just think about the role played by the controls room. Until yesterday there were important physical places of operational knowledge, towards which the information flows from different sources and within which the Staff gathered to analyze the data. Today - and increasingly




in the future – thanks to mobile devices, connectivity and cloud services will be intangible spaces, which geographically distant subjects can access at any time and from any place. The paradigm shift is evident: the continuous availability of data - even sensitive ones - and the possibility of operating at any time and from anywhere bring enormous advantages, but also equally great risks if you do not take the appropriate precautions. And this is valid for mobile devices that are configured as the elements through which you access information and operate whether for those tools such as sensors, actuators, or communication protocols designed before the Internet era or at an earlier stage when IT risk was much less compelling.

Thinking about addressing the safety issue of industrial systems with the same approach used so far in business solutions would be a mistake. If in the field of IT (Information Technology), the basic principles of cyber safety define secure data when the CID (Confidentiality, Integrity, Availability) criteria are met, in an OT environment (i.e Operational Technology, which represents the set of all "intelligent systems" that manage plant information), the order of these three factors must be read in reverse: the essential characteristics are Availability and Integrity, while Confidentiality is almost an accessory parameter. A system must be functional at first, moreover, considering the use of the system itself (more or less critical), it has to allow the Fault Tolerance. **This means having hot redundant systems, working in parallel, and a minimised start-up time.**

Data Integrity, however, can only be achieved by adopting software solutions designed and developed to ensure reliability in the data management chain, complete access traceability, and accurate registration (possibly also with systems of a double electronic signature or similar) in case of changes or correction of data or values (also with a log and Audit). A logical consequence of these principles is that integrated solutions must be used in the industrial field specifically designed for this purpose. The best approach for achieving an effective and functional protection system is now defined as holistic or capable of looking at cybersafety from a global perspective.



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