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World Water Day

Digitise with meaning

Technology as leverage in water optimization

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FOREWORD

Accelerating change

It is an indisputable fact that climate change is no longer silent and is having an increasing impact on society by raising water stress level, both in cities and agricultural production, as well as in industrial and energy infrastructures.

I would like to dedicate this issue introduction to commemorate World Water Day, which is celebrated on 22 March. This event coincides with the start of the UN 2023 Water Conference to be held in New York, which will be a unique opportunity to explore for solutions to the current water crisis, to accelerate progress on Sustainable Development Goal (SDG) 6: Water and sanitation for all by 2030, and to set the roadmap for achieving other internationally agreed water-related targets.

Water is a very precious finite resource, and we must aim to work together to acknowledge and optimize its consumption. From Elliot Cloud we want to put on our agenda the mission of contributing to propose solutions through technology to solve water management challenges, collaborating with actors linked to sustainable development initiatives and to digitize water management projects that help us prepare for present and future challenges.

Water relates to us all, so we all need to take action. There is an urgent need to accelerate change, and technology is a tool that will help us to increase efficiency in all integral water cycle processes by minimizing the number of resources expended.

Óscar Ruiz Chicote
ELLIOT CLOUD CEO

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Elliot GIS: the gateway and backbone of companies' operational intelligence

Geographic Information Systems or GIS are a fundamental part of the necessary technological ecosystem for companies to get the most value out of their data, intelligence, and knowledge.
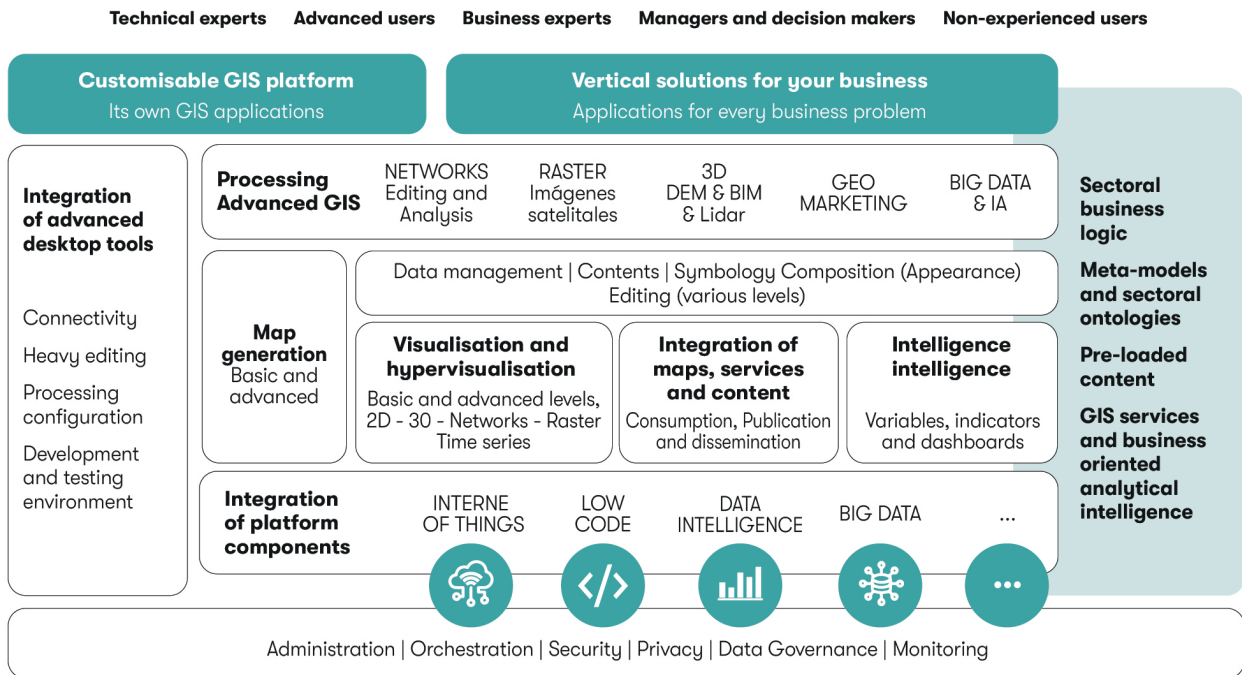
ÓSCAR ORTIZ, ELLIOT GIS MANAGER

E.

GIS

The accelerated digital explosion in which we have been immersed in recent years has made it possible to apply data based advanced techniques in almost any company's processes. In this way, Data Engineering and Data Science have gradually crept into the definition, execution, and implementation of new business applications, starting at technical areas such as operation, manufacturing or logistics, extending to commercial areas of customer management, billing, marketing or customer service, and finally embracing the most organizational areas of the company such as accounting, finance, purchasing or corporate strategy itself.

In this way, the more traditional GIS has been able to evolve towards true geographic intelligence. The key to this evolution lies in the generation of living systems that integrate heterogeneous capabilities by dynamically adapting them as if they were LEGO pieces. Only in this way is today's GIS capable of consuming and exploiting data streams from APIs and IoT sensors, navigating large lakes of data, shaping large point clouds from different technologies such as Lidar, coupling artificial intelligence models and algorithms to its processes, or deftly managing complex multimodal networks. This has been Elliot's goal from the start: to bring this new paradigm of GIS geographic intelligence to people and businesses in a simple way, without having to deal with the enormous complexity lies beneath.

GIS platform solutions

Technical experts	Advanced users	Business experts	Managers and decision makers	Non-experienced users

Customisable GIS platform
Its own GIS applications

Vertical solutions for your business
Applications for every business problem

Integration of advanced desktop tools

Connectivity

Heavy editing

Processing configuration

Development and testing environment

Processing Advanced GIS

NETWORKS Editing and Analysis	RASTER Imágenes satelitales	3D DEM & BIM & Lidar	GEO MARKETING	BIG DATA & IA

Map generation
Basic and advanced

Data management | Contents | Symbology Composition (Appearance) Editing (various levels)

Visualisation and hypervisualisation
Basic and advanced levels, 2D - 30 - Networks - Raster Time series

Integration of maps, services and content
Consumption, Publication and dissemination

Intelligence intelligence
Variables, indicators and dashboards

Integration of platform components

INTERNE OF THINGS	LOW CODE	DATA INTELLIGENCE	BIG DATA	...

Administration | Orchestration | Security | Privacy | Data Governance | Monitoring

Sectoral business logic

Meta-models and sectoral ontologies

Pre-loaded content

GIS services and business oriented analytical intelligence

Democratising geographic intelligence

Those of us who have worked in the GIS world over the last two decades still believe that these systems have not yet reached their full potential. Our obsession has always been to place the geographic component on the same level as its first cousin, the temporal component. For this reason, we cannot conceive any accurate decision process without taking into consideration the associated location of the data in its full extent. Failure to adequately consider the absolute location or relative position between assets, elements, or events, or simply to separate analytic processes according to the nature of the data, whether alphanumeric or geographic, represents a considerable reduction in the business intelligence representativeness and knowledge generation processes that should be the foundations of efficient decision-making processes.

"Not taking the geographic component into account is a significant impairment of companies' intelligence creation and decision-making processes"

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The GIS approach offered by Elliot is based on the premise of bringing this technology to its rightful place. Elliot GIS acts as a gateway to services, content and functionalities exposed in an integrated platform that harnesses the full power of Elliot solutions based on low code, IoT, Big Data and data analytics. Thus, with the vocation of playing a crucial role as the backbone between the different key business processes of a company, Elliot GIS provides a growing range of modular solutions conveniently verticalized by sector and industry.

We create an integrated platform

Through a simple user interface, Elliot GIS offers different solutions that encapsulate in equal parts data models, services, and applications necessary to solve companies' problems around consultation, visualization, management, and integration of their geographic data applied to operation, monitoring and expert analysis of their business processes. These solutions also provide business knowledge in the form of adaptable metamodels and expert digital services that combine the power of GIS with the rest of high-value alphanumeric components such as IoT or data analytics.

Operation-oriented solutions take advantage of assisted management of 2D geographic data generation, light editing, enriched visualization,

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connectivity, and remote action through Real-Time systems. In this area we find solutions for sustainable urban irrigation management, assisted water supply networks management, or assisted urban services management such as lighting, asset management or maintenance work.

These monitoring-oriented solutions take advantage of the geographic intelligence Raster analysis capabilities, repositioning and hyper visualization in the service of a powerful integration with time series, a weak point in GIS systems and online mapping services available on the market today. Elliot GIS provides solutions that meet any sector's needs with a clear demand for reactive alerts to changes, not only in the states or conditions of their assets or elements, but also dependent on their location. Public services and logistics operation, maintenance and monitoring in Industry 4.0 are good examples of this.

Where our GIS platform can bring the most value to your customers is through its extensive analysis capabilities.

In a first stage of analysis, Elliot GIS covers from the most basic needs such as reports or dashboards consumption to obtain a description of the operational situation, to applying the necessary tools for what has happened expert diagnoses execution that can be integrated into future planning or action plans. At this point, we have the capacity to fully integrate with models or simulators such as hydraulic modelling applied to the water sector.

"Elliot GIS is a versatile, simple, adaptable and integrated platform with a state-of-the-art ecosystem of expert technologies that bring the full power of IoT, Artificial Intelligence and Big Data to the platform"

In a second stage of analysis, the platform connects with expert analytical systems to provide customers with expert prediction and prescription services based on data sources combination with special emphasis on the geographical component, as well as the possibility of creating their own services by combining Elliot GIS modules and components.

It should be noted that the platform is complemented with a desktop GIS program to which the necessary modules and components have been incorporated for perfect integration and connectivity with Elliot GIS. All these components allow complete management to cover almost any map or GIS format interaction, from the simplest and lightest accessible online resource or within mobile environments, to the most powerful or complex information layers, which should usually be consumed in local environments.

Excellence makes us different

The Elliot GIS platform is a young solution, but with a vocation to meet the increasingly demanding customers' needs, by simple yet adaptable to each scenario tools, without sacrificing maximum functionality and value by integrating GIS with current technologies capabilities. Our advantage over other similar solutions on the market lies in the fact that, since its inception, Elliot GIS integrates these objectives into its DNA. Founded on open-source technologies, we have been able to design and develop a platform that delivers value to our customers through concrete solutions that respond to specific problems. This makes customization as easy as possible, maximizing adoption speed and avoiding customers' need to become experts in order to get the most out of the platform.

We are aware that our more versatile, simple, adaptable and integrated GIS platform with the latest generation expert technology ecosystem is a paradigm shift in the way companies have been consuming and integrating 'maps' into their processes. But this is the trend of what is to come, true integrated geographic intelligence. At Elliot, we help companies make the transition to the next GIS level, seamlessly, without any surprises or headaches. Because this, as excellence, is also in our DNA.

The faces
of water

Accelerating digital transformation for more efficient and circular cities management, ensuring sustainable growth

Tele-reading is an essential technology for citizen services digital transformatio, as it improves efficiency, quality, and user experience.

GUILLERMO PASCUAL, DIRECTOR OF OPERATIONS AND DIGITAL TRANSFORMATION AT AGBAR

Agbar

IoT *(Internet of Things)* devices today represent a great lever of digital transformation, as they are one of the main data generators.

At Agbar, the most widespread device we manage is the meter; the moment we convert this meter into digital, i.e., into an IoT device that can send data remotely, a world of possibilities opens up based on this data, which can be transformed into useful information. If we only think that, thanks to remote reading, we will receive in a single day the same information that we would traditionally receive in four to six years, it is easy to understand the potential that these solutions offer us, based on these data.

Agbar's remote metering, Dinapsis for Water Metering, makes possible to promote a facilitating and sustainable environment, committed to quality services for the well-being of citizens. Likewise, it drives the integral water cycle digital transformation, fundamental for pursuing efficient, green, clean, and collaborative management; all thanks to the use of the large amount of information it provides, useful information for management when appropriately used. It is, therefore, essential that it not only serves to read and invoice in substitution of manual activities, instead, it brings a higher lever towards management digital transformation based on data transformation of into relevant information.

The main benefits that can be pursued and promoted are summarized below.

Consumer/citizen

Better service to citizens

1. 24-hour / 7-day online information on consumption for citizens.
2. Early information on leaks or anomalous consumption (prevention of high bills, etc.).
3. Respect for the privacy of the home (internal meters).
4. Elimination of consumption estimates (complaints, etc.).
5. Elimination of the obligation to provide meter readings.
6. Choice of billing frequency.

Water service

Water resource management

1. Daily monitoring of hydraulic performance.
2. Reduction of physical losses (leaks in the network min flows and balances).
3. Reduction of apparent losses (dim. GGCC meters, stopped/stopped meters, reverse installations, metrological improvement of the park).
4. Control of consumption at strategic/non-billable/bonified/deficient supply points.
5. Improvements in the planning of the distribution network.
6. Improvements in the development and calibration of modelling tools for exploration operation.

City Council / smart city

1. Image of urban and water service modernisation.
2. Exhaustive control of consumption of municipal facilities: 24x7 online information and warnings (offices, parks, gardens, schools, etc.).
3. Transparency / Contribution of municipal Open Data portals (tourist occupation, etc.).
4. Help in the design of new tariff structures (time slots / daily / penalties for overconsumption, etc.).
5. Own communications infrastructure.

Society / SDG goals

1. Encourage responsible consumption and environmental protection (SDG6).
2. Reduction of accidents and accidents at work (SDG 8).
3. Reduction of CO2 emissions (SDG 13).
4. Providing data to social institutions such as telecare (SDG 3).

Efficiency of commercial process

1. Control of water supplied and improvement of consumption forecasts (habits, segmentation, etc.).
2. Improvement in the reading process (accessibility of the int. inst., elimination of displacements, errors, etc.).
3. Improvement in the billing process (estimates / re-invoicing, verifications of readings, errors, change of billing frequency, etc.). Errors, change of billing frequency, etc.).
4. Improvement in the Customer Service / Contracting process (registrations / cancellations, special customers, etc.) / Complaints and claims (detailed info in Q&R management).
5. Control of potential fraudulent actions (negative consumption, manipulations, etc).

Reducing risks associated with pandemics (blocking activities, etc.)

Administration/society

For citizens, these include, among others, a higher quality service availability in terms of reading process simplification and flexibility and improved consumption and anomalies control in almost real time through warnings and alarms. In addition, new technologies allow us to think of new services that enrich the customer experience. An example of this is

the recently launched enhanced customer care service: thanks to the exploitation of historical reading data, in the event of high consumption that raises awareness of a potential leak in the customer's internal network, a series of preventive telephone calls are made (generally robotized, and personal in the case of customers in a vulnerable situation). In addition, the charge in the case of direct debit customers is blocked for a certain period, to make it easier for the customer to contact us and manage it before receiving any charge. This shows that Agbar makes tangible, with specific initiatives, its interest in putting the customer at the center.

At the administrative level, the most important aspects include greater transparency towards citizens through data access and management and the possibility of promoting new services for citizens generated from present available data consumption.

"The data economy is a driver for improving the services provided by urban water cycle management companies, and the boost being given to water sector digitalization is an opportunity"

Finally, for the water operator, there is increased efficiency in water resource management and its associated costs in terms of reduced physical losses (e.g. through real-time monitoring of hydraulic performance) and commercial losses (e.g. through detection of anomalous consumption) of water. Also, a clear benefit resides in increased efficiency in commercial processes and their associated costs.

Undoubtedly, to reach the situation described above, there are challenges and difficulties that must be faced. The main challenge lies in managing the volume of information generated by the array of smart meters, sensors and other data sources, and thus the need to treat them with the right algorithms and artificial intelligence to get the most out of them. With the right method and the help of algorithms, AI and even other technologies, remote metering works as a great lever for digital transformation.

Digital transformation in water treatment plants

Agbar's strategy towards water treatment plants management (purification, drinking water or desalination plants) is very clear: the operational transformation of these plants to move from a linear industrial model to a circular sustainable model that contributes to society improvement (guarantee of discharge quality, regenerated water on demand, energy

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balance and self-production, waste elimination, democratization and objectification of investments...), in which data and the consequent digital transformation are the channellers of this cultural and organizational transformation of the company. Therefore, Agbar's strategy consolidates the objectives of digitizing assets and processes, providing a hypervision of multilevel information aggregation plants, optimizing operating and asset management processes, and improving decision-making based on measurable and objective criteria. All of this enables the transformation of the operation from the current model to an advanced management model.

The main pillars on which Dinapsis for Water Plants' value proposition rests are the following:

- Integral installation digitization (operation and asset management).
- Centralized visualization on a single user-friendly digital twin based web platform (from the simplest to the most complex side of the process).
- Data veracity guarantee and knowledge immediacy.
- Information Aggregation and availability of a multi-level and multi-profile dashboard.
- Online and near real time monitoring and alert generation.
- Operation optimization and asset management processes through the application of simple and complex algorithms.
- Secure remote access from any device with an internet connection.

Treatment plants benefits resulting from this approach are as follows:

- Information integrity and validation.
- Facility data standardization.
- Reporting automation.
- Improved decision-making with objective criteria data and performance indicators based.
- Improved productivity and efficiency leading to greater sustainability of the installation.
- Reduction of operational risk.

Reform proposals to accelerate transformation

One of the levers to accelerate the transformation is access to European Next Generation funds. In this context, the Spanish government's firm commitment to water digitalization represents a great opportunity to improve water management for both irrigation and urban cycle, promoting management efficiency, use of water resources greater sustainability and the improvement of the services provided, contributing to supply and hydraulic infrastructures security.

On the other hand, the 'Aporta' initiative, stimulated by the Spanish Government, aims to foster the opening of information and the reuse of public sector information, with special attention to the State Public Sector, and in coordination with the rest of Spanish regional and local Administrations, promoting the creation of new products and services, in collaboration with the private sector and civil society, and for the benefit of the later. In this ecosystem development, supportive to new data-based products and services creation, it is necessary to consider actions such as establishing a favorable regulatory framework, developing public-private cooperation, or carrying out actions to support technological innovation and business models, among others.

In the water sector, involving the relevant water administrations in this action plan is essential to establish a governance and co-creation model to extract the maximum value from open data to benefit both community and environment.

In short, together (society, public sector, water users and operators), we have the possibility to build better intelligence in water management that allows us to make data supported decisions and evidence, and to create sustainable development opportunities and assure preservation and restoration of our ecosystems and water bodies.

Boosting the data economy

Data economy promotion is one of the priorities of the European Union and Spain, and the water sector is the subject of specific development programs in this area. This mobilization of public funds acts as a driving force in the water sector, promoting infrastructures and water supply networks technological modernization.

Therefore, the data economy is a driver for improving the services provided by urban water cycle management companies, and the boost being given to digitalization in the water sector is an opportunity.

In this context, Agbar is a key player given its positioning both technologically and in terms of know-how. Agbar's commitment to operational intelligence application to information management is clear: it generates knowledge based on data and improves decision-making.

With a vocation to serve citizens and administrations, the generators of the information are, at the same time, the main beneficiaries of its application,

"We have the opportunity to build better water management intelligence that allows us to make decisions informed by data and evidence"

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both through resources dedicated to the water cycle optimization and environmental services extension that contribute to the improvement of the resilience of urban ecosystems.

Agbar's desire is to create healthier, more livable, resilient, and environmentally friendly environments. For this reason, Agbar's work is aimed at achieving more efficient and circular management of cities, thus guaranteeing sustainable growth.

At all times, with the utmost rigor and care in the handling and data protection, guaranteeing its appropriate use and the highest standards of privacy and security.

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Geographic information systems in water supply and sewerage networks management

Since its foundation in 1982, Tracasa Global has been working in territorial data management and land use planning and, since the early 2000s, in geographic information systems. Today, the company continues to focus on the integration of geographic information systems and business processes digital transformation.

ALFREDO ALONSO, HEAD OF BUSINESS DEVELOPMENT AT TRACASA GLOBAL

tracasa global

This precise year, Tracasa Global has concentrated on network and installation maintenance centers related processes, which are particularly relevant for water companies, as they directly affect public water supply.

It is a fact that geographic information systems (GIS/GIS) have positioned themselves as backbone and linking tools for water managers, bringing a "giscentric" vision to companies. Through these systems, companies can inventory, manage, and integrate ever-increasing volumes of information. This evolution comes hand in hand with the digital transformation of the sector and advances in infrastructures sensitization. All of this, with the final goal of more efficient and effective management of the treasure they administer -water-.

In general terms, GIS offer solutions to many problems within the sector, but in these lines, I would like to focus on the help they provide in field operations and sectorization.

Companies that manage the full water cycle take care of large numbers of different characteristics assets that are geographically dispersed; a complex database that runs above and below ground, in both urban and rural environments, which ultimately allows them to operate water supply and sanitation networks and respond to customers' needs.

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Geographic information systems are critical systems for of all assets management, both indoors and outdoors, where digital transformation allows optimizing numerous operations in a timely manner. In this sense, mobile applications that allow field teams to access, collect and edit data are at the heart of this transformation, helping companies to:

- Make it easy for field teams to navigate and locate assets.
- Automatically collect data, taking into account location and registration time.
- Access information from the system, reducing the need to return to the office for additional data.
- Send real time data information to the system to facilitate decision making.
- Provide real-time information for the entire organization.

Following this approach to facilitate the organization of work and maintain high data integrity, at Tracasa Global we have developed numerous applications. Among them, a web application that allows managers and team leaders to manage the work carried out by operators in the field from their offices. The tool divides the work into daily tasks, prioritizes and arranges them, and allows these to be viewed on a map with all the associated information.

On the other hand, we have also developed an application for mobile devices so that operators working in the field can see any assigned tasks from the office with the above-described application. This tool also allows operators to manage tasks and incidents, collect data, allocate hours, and produce work reports.

In general, our applications are continuously evolving and constitute a very important milestone in water companies' network and facilities maintenance centers processes digitalization.

"Geographic information systems (GIS/GIS) have positioned themselves as backbone tools for water managers"

On the other hand, regarding networks sectorization or, in other words, the process of dividing the network in order to operate it more easily and thus facilitate problems identification and improve corrective measures application speed, the final objective is focused on reducing non-revenue water, i.e. losses or leaks, improving hydraulic performance and control over parameters that affect water quality.

In this area, both sectorization and network sectors design require the use of geographic information systems (GIS), as well as equipping all sectors with all kinds of assets: meters, pressure gauges, chemical indicator meters, regulating valves, meters... This organization allows progress to be made in better decision-making and, ultimately, in better supply and sanitation networks management.

Francisco Bernabeu

**PROJECT MANAGER 'SANEAMENTO 4.0' PROJECT
BY ELLIOT CLOUD FOR SABESP**

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*Investments
in water networks
telemetry solutions
will be boosted in all
water utilities
to meet regulators
and municipalities
requirements"*

Francisco Bernabeu has extensive experience in promoting innovative projects focused on Industry 4.0 and IoT (Internet of Things). He currently operates on three main fronts to provide technology as an opportunity for different organizations: cybersecurity, integrations for Industry 4.0 and technological solutions for the digital transformation of companies and administrations.

Bernabeu is working on a project at one of the world's leading water companies, Sabesp, which operates in the state of São Paulo in 368 municipalities, serving approximately 27 million people, providing 98% of treated water and 75% of collected and treated wastewater. The goal of the company, which celebrates its 50th anniversary this year, is to universalize sanitation in operated and new municipalities with 100% treated water and 95% of wastewater collected and treated by 2030.

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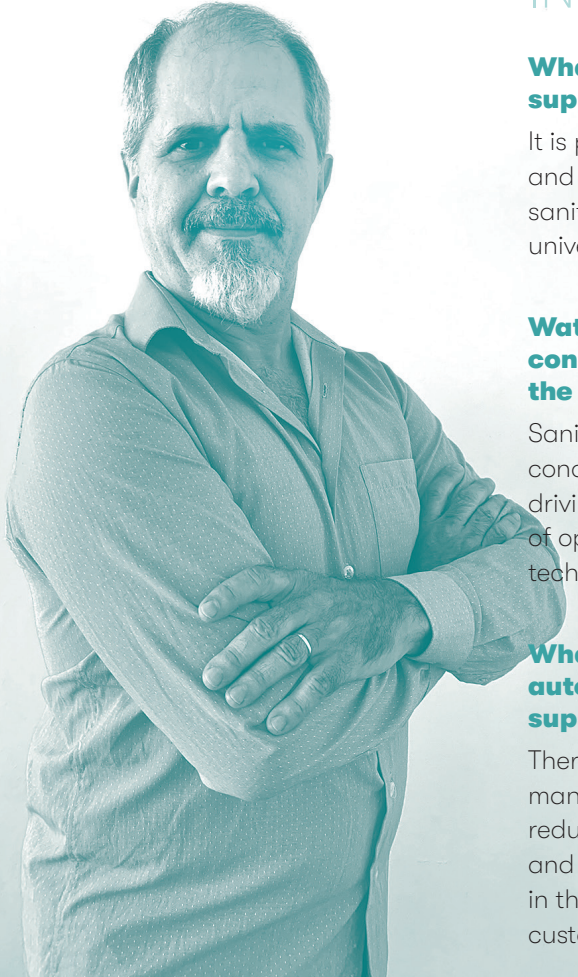
INTERVIEW

What is your assessment and vision of the sanitation and supply situation in Brazil?

It is pessimistic, due to possible changes in the regulatory framework and the performance of the National Water Agency (ANA), as sanitation privatization does not arrive at adequate speed to meet universalization targets.

Water is a finite commodity and projections for growth in consumer demand suggest that it will increase steadily, is the sector technologically prepared to cope?

Sanitation companies are still in an evolutionary process towards the concepts of automation and individualized metering, but they are driving projects that seek to accelerate the digital transformation of operational processes through disruptive and value-adding technologies.

What are the benefits of implementing integrated automation, telemetry, and analytics solutions in a water supply network?

There are several benefits, but I would highlight the effective management of the operation, quality assurance, energy efficiency, reduction of losses, effective control of losses in the water network and in the customer and/or consumer, agility in solving problems in the event of a lack of supply, incidents in the network, improved customer satisfaction and the company's image.

From your experience and involvement with the company, what would you say are Sabesp's main objectives?

The main challenges would be generalizing access and addressing sanitation legal framework. There is no doubt that technology use is a fundamental aspect and competitive differential for an excellent water cycle management.

Sabesp has made a commitment to the future of Sao Paulo's citizens by incorporating Elliot Water into its management. How did you identify the need to implement a smart grid?

The solution was implemented for smart sanitation (sanitation 4.0) in the Capivari / Jundiaí Business Unit, which serves 13 municipalities and supplies more than 400,000 people. This implementation was necessary to improve integral water cycle management, in all raw water process transformation stages into treated water, and supply and distribution reserve. Thus, through network distributed sensors in this production chain, operational services improvements, water losses reduction, better energy efficiency and customer satisfaction were obtained.

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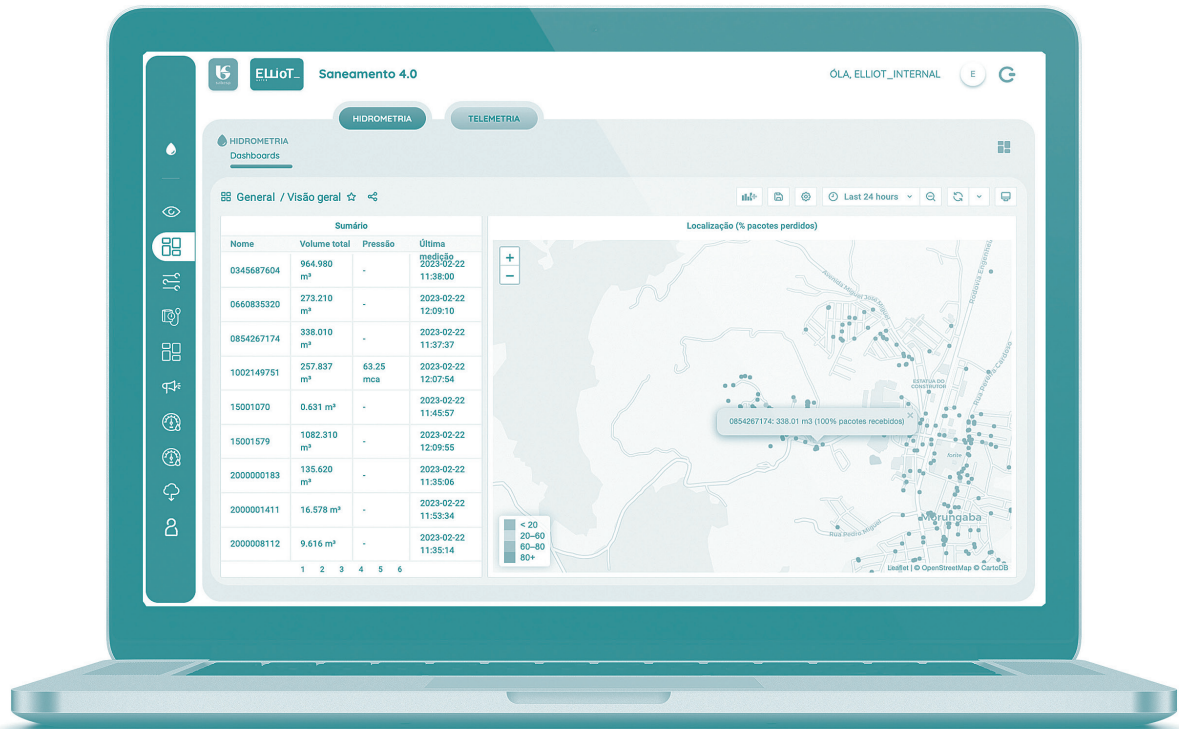
"Sanitation companies are driving projects that seek to accelerate operational processes digital transformation through disruptive and value-adding technologies"

How has water management changed since this technological solution implementation?

Today the implemented solution has become a reference at Sabesp and it intends to extend the solution to all its business units over the next 5 years.

The company promotes sustainability as one of its strategic areas. Along these lines, why would you encourage another organization to invest in water digitalization?

There are innumerable solutions developed for basic sanitation that require information technologies to be an integral and complementary part, allowing the company to remain competitive in the market and to meet regulatory bodies and municipalities requirements.

What challenges does the sector face in relation to technology application to the full water cycle management?

Main challenges are undoubtedly the absence of investment and operational processes; obsolete equipment, lack of connectivity, disaggregated performance between Information Technology (IT) and Operational Technology (OT), sanitation sector undefinition specific standards and norms and standardization of automation solutions.

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> *"Through sensors distributed along the water network, Elliot Water has enabled improved operational services, leakage reduction, energy efficiency and customer satisfaction."*

How do you see the management of the full water cycle from a digital perspective in the medium-term future?

I foresee that those investments in automated solutions for consumption measurement, water and sewage treatment automations, and networks telemetry will be boosted in all sanitation companies as a way to meet regulatory bodies requirements, such as sanitation framework, like municipalities demands for the services provided, to boost water availability and quality for the population.

Digitalisation is the only way to improve water cycle efficiency

The water cycle is at a critical point in its history: water requirements in many parts of the world are already equal to, and moderately even in some cases, exceeding existing reserves. In the past, we have been able to regulate water for human consumption availability over time, thanks to dams and reservoirs construction, or any other elements to store large reserves of the liquid element.

Today, however, it is no longer a question of saving water for a few weeks or months from now, but of quantifying all losses, all needs and being able to make every drop count as much as two, or at least more than it did before. We have reached a technological development verge where many physical processes have been optimized to virtually their theoretical maximum. Water supply cutoffs are not compatible with the current economic activity development, nor society is receptive to constraint measures.

So how can the performance of the water cycle be improved? Digitalization is the only way:

- **1. The first step is measurement:** A process that is not measured cannot be quantified and nor improved.

And we are precisely in the era of the data access and analysis revolution, as the last two decades have democratized access to sensors, making possible to read and connect them in real time to huge data reservoirs.

- **2. The next step is the analysis of this data:** There is no point in filling up terabytes of information if it is not grouped and linked together. It is necessary to move from millions of irrelevant data to trends, averages, progressions, etc.

This task has also become possible, as since the year 2000, the processing capacity has been multiplied by 1000[1]. There are solutions on the market that are capable of digesting, reviewing, cleaning, gathering, monitoring, parameterizing, associating, correlating, analyzing, graphing and, of course, using artificial intelligence to aggregate individual data. With the analysis we will know where we are and the possible margin for improvement (up to a theoretical performance or 100% maximum effectiveness).

PALOMA BATANERO, BUSINESS DEVELOPMENT – INDUSTRY ADVISORY HYDRAULIC SECTOR AT ELLIOT CLOUD

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- **3. Finally, intelligence, whether human or artificial,** joined with continuous improvement, feeding back the system in real time as changes are made.

This is the real differentiation compared to the traditional way of asset management, which is usually based on a fixed snapshot, at a given time and provides a single solution, which is not able to adapt over time. But if we have a continuous data flow of reality, managed on a sufficiently powerful platform, and connected to processes digital twins to be operated and optimized, we will be in possession of a tool with a practically unlimited capacity to learn and continuous improve our system.
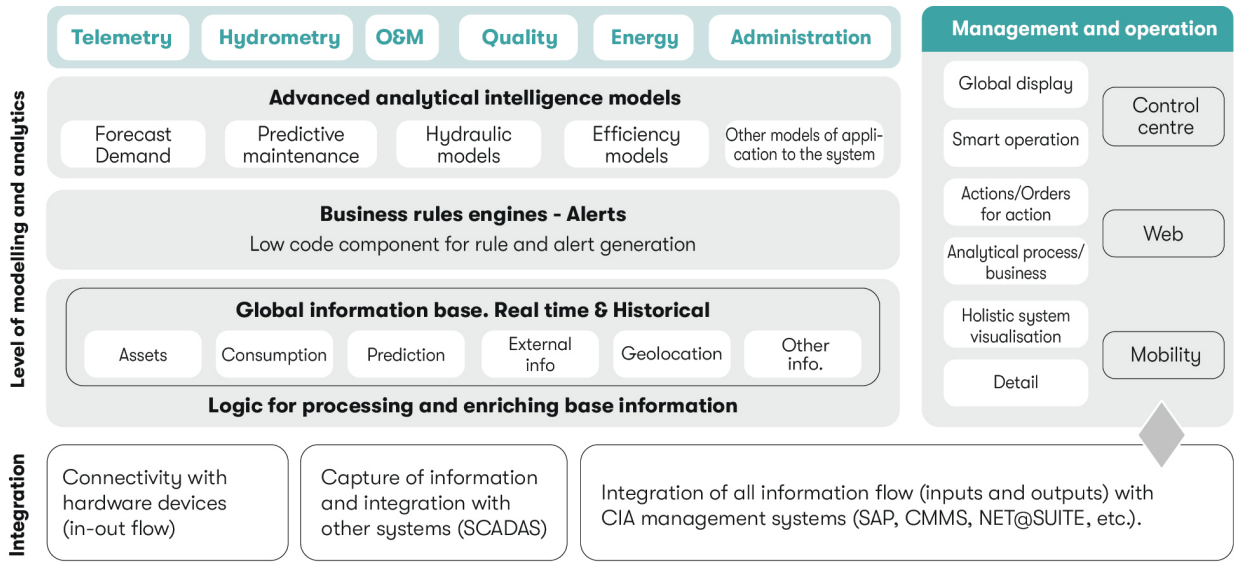
Solutions available

Digitalization platforms, which are successfully used in many other sectors, such as energy, marketing, business development, financial management, etc., are a powerful gadget that can help both to quantify and identify any water use consumption and trends, and to plan, correlate and better understand the processes that has to be reviewed, in order to establish automatic corrections and improvements by applying artificial intelligence tools, making continuous optimization possible.

These platforms can carry out the following operations:

- Incorporate all available sources. They are technology agnostic.

- Connect in real time all systems, being able to check, discard and clean erroneous data, subsequently filling in the data sets once the signal is re-established within the sensor.

- Collect and translate external information in the data repository, such as temperature, precipitation, tweets, news, dates, or relevant events.

- Integrate powerful visualization tools, customized for each user and easily configurable for non-IT profiles.

- Analyze individual and joined variables to find relationships between variables, including powerful enough threads to handle large volumes of data.

- Apply artificial intelligence, discovering relationships between variables and proposing changes to improve system performance, or making predictions of future behavior and comparing with a possible improvement, indicating where to act.

- Incorporate the economic variable to quantify any possible improvement in both CAPEX and OPEX.

- Connect with network operation and allowing an extremely fast application, feeding new data back into the data lake.

- Be independent of third-party solutions to ensure its stability over time.

Schematic of a data management platform capable of optimising the performance of connected systems

Telemetry	Hydrometry	O&M	Quality	Energy	Administration

Management and operation

Level of modelling and analytics

Advanced analytical intelligence models

Forecast Demand	Predictive maintenance	Hydraulic models	Efficiency models	Other models of application to the system

Business rules engines - Alerts
Low code component for rule and alert generation

Global information base. Real time & Historical

Assets	Consumption	Prediction	External info	Geolocation	Other info.

Logic for processing and enriching base information

Global display

Smart operation

Actions/Orders for action

Analytical process/ business

Holistic system visualisation

Detail

Control centre

Web

Mobility

Integration

Connectivity with hardware devices (in-out flow)	Capture of information and integration with other systems (SCADAS)	Integration of all information flow (inputs and outputs) with CIA management systems (SAP, CMMS, NET@SUITE, etc.).

Digital twins, as computer representation of specific processes that occur in real life, by applying physics laws and defining all the elements that make up a system, such as supply network pipes, or a watercourse geometry running through a city, can provide identical results as the real system, when receiving the same inputs.

It should only be noted that, as deterministic models, they require a stable data source to obtain consistent results, and therefore must pass through data management platforms filters beforehand, implementing an additional input for the analysis and optimization process of water management.
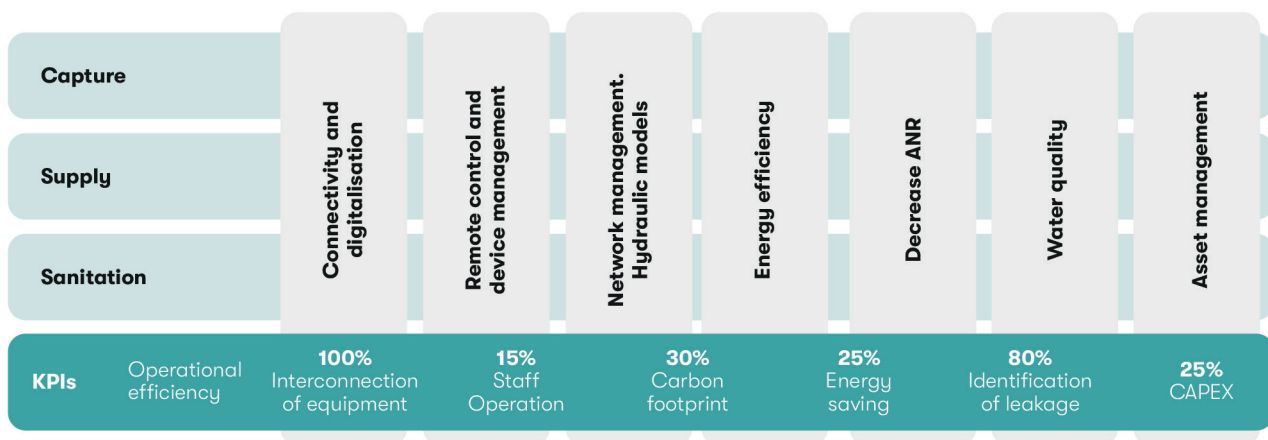

Example of a digital twin of an urban sewerage and stormwater network.

Therefore, digital twins represent an almost infinite value as a very reduced cost testing field, compared to what a real system test would entail; when combined with data digitization platforms, they become an utensil that cannot be ignored.

Merging both technologies -digital twins plus data digitization platforms- gives unlimited possibilities, such as when making prognoses of the effects on the system of certain conditions or changes[2], without having to carry them out in the real system, consequently saving a great deal of time and money.

And this is not science fiction, although it may seem so, as joint solutions for analysis, visualization, inference, simulation, optimization, and even operational decision support have already been implemented in many urban and rural water management organizations, generating immediate and quantifiable benefits. Those organizations that incorporate these into their daily operations will see how overall expenditure is reduced, progressively achieving further improvements in their performance and operation, both on a regular basis and in the event of emergencies.

Digitisation of the water cycle: components, processes and expected improvement KPIs

		Connectivity and digitalisation	Remote control and device management	Network management. Hydraulic models	Energy efficiency	Decrease ANR	Water quality	Asset management
Capture								
Supply								
Sanitation								
KPIs	Operational efficiency	100% Interconnection of equipment	15% Staff Operation	30% Carbon footprint	25% Energy saving	80% Identification of leakage		25% CAPEX

The time is ripe to solve the water problem once and for all, as we have the technology, highly specialized roles, and knowledge, in a context of active collaboration of government agencies[3].

What are you waiting for to change the chronicle of the water cycle?

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[1]https://www.xataka.com/componentes/ley-moore-se-resiste-a-morir-asi-como-ha-conseguido-no-solo-seguir-viva-sino-continuar-plena-forma
[2]https://www.iahr.org/library/infor?pid=19559
[3]https://www.miteco.gob.es/es/ministerio/recuperacion-transformacion-resiliencia/perte/default_PERTE_agua.aspx

Fernando Morcillo

Aeas
Asociación Española de
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Agua y Saneamiento

PRESIDENT OF THE SPANISH WATER SUPPLY AND SANITATION ASSOCIATION (AEAS)

The Wastewater Directive draft is setting out some fundamental conditions linked to sewerage networks, such as untreated water control overflows"

Fernando Morcillo, civil engineer with a degree in environmental engineering and postgraduate studies in business economics, that has worked throughout his professional life both in the private and public sector, as well as in industrial and urban business.

He was captivated by service engineering while working for Canal de Isabel II on producing installations, renovation works, exploitation systems, etc. He also became part with The World's Water for ten years and since 2014 he has been president of the Spanish Water Supply and Sanitation Association (AEAS), an urban water sector professional reference group in Spain.

INTERVIEW

AEAS is celebrating its 50th anniversary this year. What is the main role of AEAS?

It was constituted in 1973 as a non-profit professional association for the promotion and development of the scientific, technical, administrative, and legal aspects of urban water supply and sanitation services.

The association includes managing entities - municipal and public services, private and mixed companies - as well as water sector related technological companies, public agencies, and individual experts.

Therefore, it can be described as a forum for technical meetings and experiences interchange, which tries to defend services efficiency values and to improve the service brought to citizens. That is what is written in our statutes and in our founding charter.

Digitalization is a term that is now on everyone's lips. What does it mean for AEAS?

Our sector specific conditions, which has its assets typically widely spread throughout the territory and having to manage numerous infrastructures located far away from urban centers, there have always been required elementary communication awareness, not only in terms of remote management, reading and signal reception, but also of remote command, because it was necessary to act on systems established many kilometers away. Addressing this sole necessity, which today seems very elementary, at the time, saved a great deal of costs for citizens and taxpayers.

Companies are entities that handle an infinite amount of data, because practically all citizens are water users. In fact, now in Spain, we have almost half a meter per person, some 20 million meters, which generate a large volume of information. All of this has created the imperative need for asset management itself: to know where connection nodes, pumps, tanks are, etc. This has also conditioned and encouraged AEAS to have a strong focus on information management and deployment.

Today it is what we call digital twins, but in the past, these were known as simulation models. It is a commodity that has evolved a great deal, at first in large cities, but it has recently started to be consumed as well in many towns within Spain, in other words, we can already see that managing data to provide the best solution gas become an essential capability.

In fact, there have been typically two stages of this transformation. The first, in the 1960s, with the deployment of civil infrastructures, which began to resemble industrial units, such as drinking water treatment plants (DWTP), where drinking water is "manufactured" from natural water through highly industrial processes such as filtration or chlorination. The second, in the 1980s, started the same process with wastewater plants.

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Therefore, we have a lot of infrastructure that is spread out in the territory, that can be compared to small-volume hydraulic equipment and productive industrial plants units that should be exploited and maintained as an industry.

And right now, how would you rate the current state of water supply and sanitation networks digitization?

The problem we have in our country is the extreme heterogeneity that exists among big sector leaders and those populations with less technological capacity, which are still, on the other hand, in many cases, the responsibility and are under town councils' direct management, which is a problem because it requires a high specialization level and, quite often that is not their case.

Water industry leaders are very well positioned, because, since the 1990s, our business has gone abroad with a lot of power and strength. We have a very long history in this area and, therefore, considerable technical competence, like in desalination. If you look at the Spanish industry, you could state that we don't manufacture any of the necessary components of a desalination plant. We don't produce membranes, we don't make pressure pumps, we don't supply energy recovery systems, but we know how to integrate them, and we know how to provide a solution by buying the best available to guarantee these plants' operation. We are magnificent integrators with solutions oriented towards what the client wants, which in the end is to have water for human consumption and, of course, for irrigation. We have very cutting-edge organizations that have experienced global development.

The Spanish sector is prepared for these technological leaps. We know how to provide suitable solutions.

However, there is still a big gap between leaders and small companies, especially when they are not grouped together. Municipalities' groupings are important to achieve economies of scale that allow them to be more efficient and technologically capable of tackling this great revolution that is taking place.

The rural world, which has much less population and fewer resources, is more dispersed in the population centers and this is the main challenge we must face. How can we overcome it? What strategies do you think are possible to solve this gap?

Basically, the way to do it is through the concentration or integration of municipalities in different systems. These can be associations of municipalities, provincial companies, regional councils, etc. All of this brings great advantages when it comes to distributing the efforts of citizens because, logically, the service in a small municipality is more expensive than in a large capital city, be it in terms of customers, cubic meters served or any other ratio. Therefore, only by grouping together can it be efficient and equalize cost and technology conditions, thanks to a minimal critical size that these kind of facilities and services should have.

"Robotic systems are key in sewerage networks for preparation, monitoring and observation, but also for irrigation to avoid possible water leakage over long distances"

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And can you dimension this minimal critical size?

We believe that there are very good experiences above one 100.000 or 150.000 inhabitants. It is not defined, perhaps in some places there may be an entity that is efficient with a grouped population of 50.000, due to economic situation and environment conditions.

There are always exceptions, but an ideal entity would be placed around that boundary, and if this joined entity is formed by smaller nucleus and a large city (a big conurbation), it will work even better. This is the example of the Madrid Region, which provides good services to very small municipalities in the mountains. This allows for economic scale and adjustments, but also for the provision of quality service, comfort, and safety, much better than if it were delivered by individualized nuclei.

Private companies offered solutions are sometimes equivalent, since they would often not require municipalities' grouping to belong to the same territory, administration, region, or autonomous region, but rather, thanks to new technologies, it allows for scale economies with isolated municipalities, but with a certain joined population. These are integrated operational solutions that do not have to do with regional, administrative, or territorial connections and that, in the end, have an ideal size to provide adequate technological solutions.

Have the phases taken place in water sector digitalization been determined by necessity or by the rapid incorporation of technological advances? In other words, has the distribution and sanitation sector been able to quickly integrate technology?

In the absence of a competitive market around them, but rather a competition for prestige, it has advanced more slowly than other sectors. And, in short, many technologies are imported from other sectors, they are developed in other areas that are more advanced for competitiveness reasons, but they reach the water vertical, albeit cautiously. We could be more advanced, no doubt about this.

I would like to give an example about our country progress in Non-Revenue-Water; a KPI that helps to measure networks operation. In the 1990s we were between 33 and 35% NRW – this is leakages, fraud, metering errors, etc. aggregation -. Today, we are at 23.5%, but in 2008 we were able to reach 22%. However, the lack of investment after 2008 crisis, has deeply affected the water sector, because we are investing four or five times less than what it as spent in the previous period, therefore this ratio has worsened.

In 2012, digital leakage control technology started to become a little bit more widespread and from then on, NRW percentages have been quite stable. Obviously, the scenario will not improve until we renew more infrastructure, which is the basis, but digitalization in this field offers a very rapid diagnostic capacity, which allows to speed up decision-making and favors active action, either preventively or correctively in the event of an incident.

All water networks implemented current technology is making it possible to maintain a status that might not be the best, but which has prevented to come back to values above 30%. The 23.5% that we have today in our national study for the year 2022 is an average and, like all averages, we must be carefully handled. There are systems in Spain that have 60% NRW, while large cities are close to 10%, or even below that value. In other words, there is a tremendous results dispersion, on losses in the networks due to their malfunctioning.

In all this context of continuous improvement, do you think that the PERTE for digitalization of the water sector will solve the current problems, or will it be a push that, if it is not maintained, will bring us back to the starting point?

At this moment, we are experiencing a very powerful evolution of the water European legislation, I think that this will be retained, because Europe is much more stable than us regarding rules and regulations decisions and monitoring of the former.

Last January, Royal Decree 3/2023 was published, which is the transposition of the Drinking Water Directive, a European directive from two years ago, which transposes an obligation to report on the efficiency conditions of our networks by 2026, although the parameters are yet to be defined.

In addition to all countries reporting, there will be delegated acts to set targets in each country, which will impose an obligation on practically all municipalities of a certain size. So, we will evolve a lot and well in that sense and it will require the provision of digitization mechanisms.

The PERTE has come at an ideal time for this because it identifies the European required conditions. In addition, we have in the pipeline the draft of the Wastewater Directive, which will also take a couple of years to arrive, which is setting some fundamental conditions linked to sewage networks, such as the control of overflows of untreated water.

This is going to generate very powerful requirements for something that nobody is looking at today, which are wastewater and sewerage networks and which, thanks to civil engineering, have a lot of inertia and do not require much to function. Furthermore, our greatest public assets in the urban water cycle are in the sewerage networks. On the other hand, they are very old and deteriorated, with serious problems, let's say in terms of functioning, but they provide good service after many years.

Do you foresee any other aspects in the future of digitalization or in the water cycle future?

The European Reuse Regulation has also been approved, which is exclusively for irrigation, for agricultural irrigation water. Europe has reached a common conclusion on how this should be done and, therefore, this regulation has arisen, which we must comply with.

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"Digitalization in the field of leakage control offers a very fast diagnostic capability, which allows for faster decision-making and favors active action"

This is also going to condition us and requires the deployment of digitalization for compliance.

In recent years there has been an important transformation in terms of sensorization and quality. Today we have many physical parameters such as pressure, humidity, or temperature, sensorization but quality is going to end up imposing itself because today networks can be very sensitive to quality incidents, and it is essential to assure good quality service to citizens. Water is one of the most controlled ingestion elements, but even so, given the distribution system, the network will have to be populated in the coming years with quality mechanisms, devices, and sensors. We will have to look for any mechanisms that provide an explanation of a possible incidence or deterioration of water quality.

And then, on the other hand, in a country like ours, which is very dry, with a heterogeneous water distribution, a fundamental element is the water administration itself. We still have a somewhat nineteenth-century administration. In the 1980s there was a very large deployment of river control, water abstraction and quality systems, which were intended to be very powerful, but which are now obsolete and outside the typical parameters that digitalization requires today, in terms of sensorization, communications, data integration and analysis.

In relation to digitization, it is no longer enough to have just a control panel and a SCADA system where an alert over a failure is notified. Now there are artificial intelligence or robotics systems that allow decisions to be made online and almost in real time. Robotic systems are key in the sewerage network for preparation, monitoring and observation, but also for irrigation to avoid possible water leaks over long distances, for example, drones help to monitor very long lengths of pipes and to detect with cameras an excess in humidity that should not be present at certain points.

Finally, let's talk about the role of cybersecurity in the digitization of the full water cycle, what is your vision?

Personally, I am very concerned about the cybersecurity issue, and this is what we have forwarded to the Ministry for Ecological Transition and Demographic Challenge. The fundamental foundations of computer and electronic security must be laid from the very foundations, otherwise they will all be about patches and bad solutions. It is necessary to start by having a clear vision of being as secure as possible because there is a lot of data and if it is manipulated it can lead to very wrong diagnoses. That is why we need to take this into account and include them in the cost aggregation, in the specialization and in the further development to avoid getting it wrong.

Trial Reservoir: a sustainable source of resources for innovation in Brazil's water and sanitation sector

Víctor Arroyo, Director for Latin America at Isle Utilities
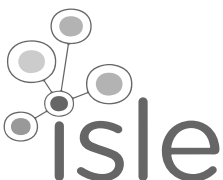
Brazil's Trial Reservoir, Isle Utilities' new initiative that provides technology companies with a risk-free fund to adopt innovative technologies, was launched in 2022.

Isle Utilities is a global team of scientists, engineers, business, and regulatory experts with a common drive to achieve positive social, economic, and environmental impact through the advancement of innovative technologies and related practices.

Isle's mission is to be recognized as a leading catalyst in bringing together technology, end users and investors, fostering the adoption of emerging technologies and innovative practices that create value for our stakeholders and a positive impact on the world around us.

Following the success of Isle Utilities' Climate Change Trial Reservoir program, the new Brazil-focused fund follows a similar process to make it easier for water technology innovators to access funding for pilot trials.

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Political impetus for sanitation in Brazil

The social impacts of water supply and sewerage services on people's quality of life and the environment are increasingly on the political agenda in Brazil. In addition, the economic impact of the sector on the productive chain, with employment and income generation, is also recognized.

Despite its undeniable economic importance, Brazil has a deficit in these services. According to the National Sanitation Information System (SNIS), about 35 million Brazilians do not have access to water supply, and only 55% of the population has sewerage service.

Faced with this situation, the Brazilian state committed itself to universalizing sanitation services, guaranteeing access to treated water to 99% of the population and 90% to sewerage services (collection and treatment of wastewater generated). To achieve these goals, a significant amount of investment was required.

In this sense, the use of innovative technologies is identified as an opportunity to do things better, reducing investment costs and generating opportunities to improve efficiency and quality of services.
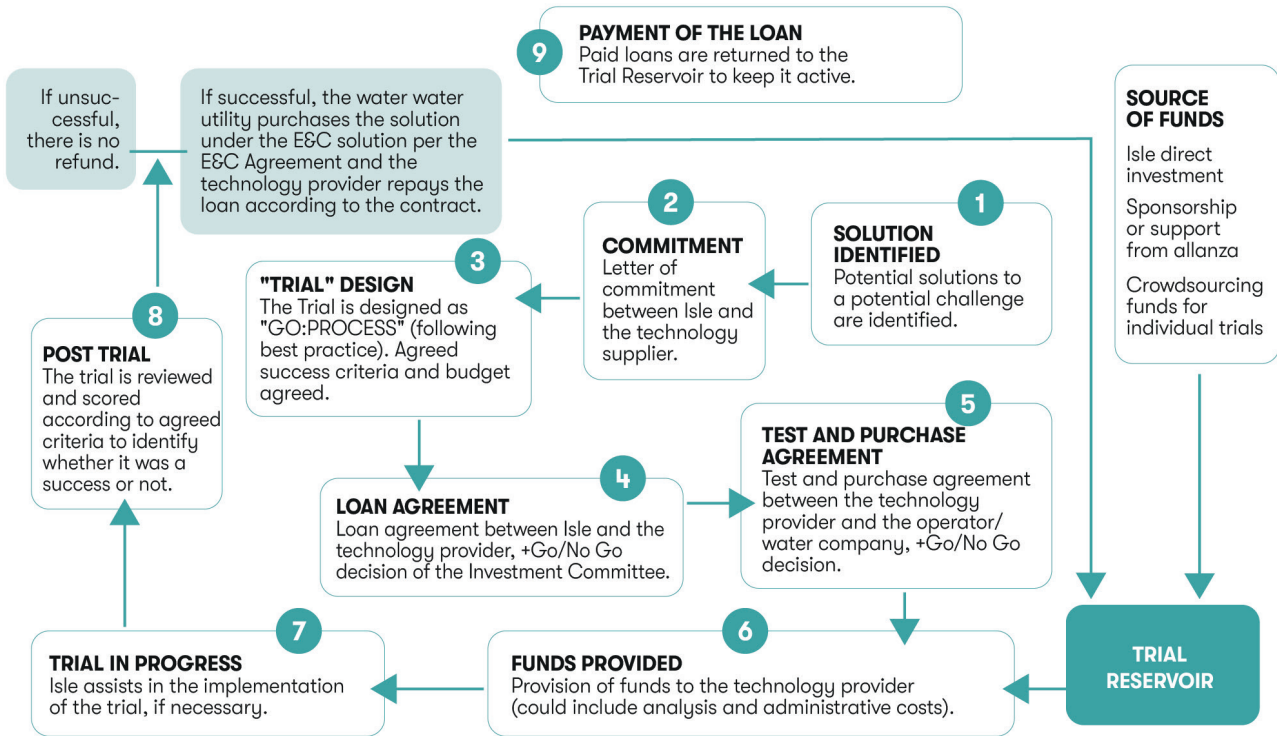
What is Trial Reservoir?

The Trial Reservoir program promoted by Isle Utilities is a funding mechanism that provides technology companies with a risk-free fund to test and adopt innovative technologies. The aim is to increase and accelerate the application of innovation for the purpose of climate change mitigation. The model combines loan financing with technology acceleration and support for market penetration of innovations in the water and renewable energy sectors.

A total of nine pilot projects have been launched and five of these have been completed, of which four have been successfully concluded, meaning that the fund has facilitated the commercialization of four technologies within the water industry. In addition, the potential of this unique initiative has been recognized, with the model winning the Innovation in Decarbonization category of the WEX Global Awards 2022 in Valencia, Spain. The judges were looking for case studies that show significant energy potential, reduce greenhouse gas emissions, and make water infrastructure efficient and resilient.

The recognition was a great thrill for Dr Jo Burgess, Trial Reservoir Manager at Isle Utilities, who said: "It is a great honor to win this award because it is a reflection of the hard work and dedication of everyone involved.

"The water sector is a major contributor to global greenhouse gas emissions and more needs to be done to help the sector invest in and accelerate the

Trial Reservoir Programme Model

9 PAYMENT OF THE LOAN
Paid loans are returned to the Trial Reservoir to keep it active.

If unsuccessful, there is no refund.

If successful, the water water utility purchases the solution under the E&C solution per the E&C Agreement and the technology provider repays the loan according to the contract.

SOURCE OF FUNDS
Isle direct investment
Sponsorship or support from allanza
Crowdsourcing funds for individual trials

1 SOLUTION IDENTIFIED
Potential solutions to a potential challenge are identified.

2 COMMITMENT
Letter of commitment between Isle and the technology supplier.

3 "TRIAL" DESIGN
The Trial is designed as "GO:PROCESS" (following best practice). Agreed success criteria and budget agreed.

5 TEST AND PURCHASE AGREEMENT
Test and purchase agreement between the technology provider and the operator/water company, +Go/No Go decision.

8 POST TRIAL
The trial is reviewed and scored according to agreed criteria to identify whether it was a success or not.

4 LOAN AGREEMENT
Loan agreement between Isle and the technology provider, +Go/No Go decision of the Investment Committee.

7 TRIAL IN PROGRESS
Isle assists in the implementation of the trial, if necessary.

6 FUNDS PROVIDED
Provision of funds to the technology provider (could include analysis and administrative costs).

TRIAL RESERVOIR

adoption of technologies that contribute to achieving carbon neutrality, which is why the Trial Reservoir project has been so enthusiastically embraced by a sector hungry for change".

The Trial Reservoir aims to drive the adoption and scale-up of novel technology-based solutions that can help water and sanitation service providers achieve efficiency and reduce their emissions. The technologies implemented will have a significant impact on climate change adaptation, reducing water consumption and mitigating CO_2 emissions.

The model proposed by Isle Utilities has become a proven success in the industry, with many ongoing trials and a promising future. Given the current context in Brazil, and the presence of Isle Utilities in this market, a strategic decision has been made to establish a fund with an exclusive focus on the country with the support of the Inter-American Development Bank (IDB) and IDB Lab.

Brazil's Trial Reservoir not only presents a new breakthrough opportunity for innovation, but also a partnership to join forces in support of Brazil's water sector between Isle Utilities and the Inter-American Development Bank Group's innovation lab (IDB Lab), which co-funds Trial Reservoir in the country.

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Why Brazil?

Derived from the context mentioned at the beginning of this article, it appears that the speed of adoption of innovation is not fast enough or at the scale needed to effectively address the water sector problems. Frequent extreme weather events add to uncertainty about the availability of water resources and water quality, impeding progress in filling gaps in service provision. These problems disproportionately affect less developed and vulnerable communities, which have little access to high quality services. Many of these problems can be addressed by incorporating new technologies; however, speed of adoption is often the biggest obstacle, and we hope this initiative can help overcome this.

In this context the Brazilian Trial Reservoir proposes a pool of funds for financing available to commercial-stage technology companies, enabling them to carry out pilot projects for technology adoption in Brazilian water utilities. If the trial is successful and the technology has won commercial contracts with end-users, the interest-bearing loan will be repaid to Isle Utilities. If the trial is unsuccessful, despite everyone's best efforts, the funding will not have to be repaid, providing a risk-free opportunity for technology companies wishing to participate in pilot trials.

This feature makes Trial Reservoir a unique mechanism to facilitate the market entry of innovative technologies in Brazil, at a special time when Isle Utilities is already working with important players in the sector and to which it intends to bring more value and support in their innovation and technology adoption processes.

"The Trial Reservoir programme combines loan financing with technology acceleration and market penetration support for innovations in the water and renewable energy sectors"

Trial Reservoir Brazil is open to technology providers with interest and capacity to serve the Brazilian market. The only requirements are that technology has an interest to actively participate in projects with the Brazilian water industry and that it is has to be a technology ready to be implemented on a commercial scale with a water company.

For more information on the Trial Reservoir initiative, please visit: https://www.isleutilities.com/services/trial-reservoir

Francisco Javier Sánchez

DEPUTY DIRECTOR GENERAL FOR WATER PROTECTION AND RISK MANAGEMENT, GENERAL WATER DIRECTORATE, MINISTRY FOR ECOLOGICAL TRANSITION AND DEMOGRAPHIC CHALLENGE

SECRETARÍA DE ESTADO DE MEDIO AMBIENTE

DIRECCIÓN GENERAL DEL AGUA

MINISTERIO PARA LA TRANSICIÓN ECOLÓGICA Y EL RETO DEMOGRÁFICO

GOBIERNO DE ESPAÑA

After the pandemic, all administrations have turned to digitalization to facilitate the development of remote work"

Francisco Javier Sánchez Martínez is Deputy Director General for Water Protection and Risk Management at the General Water Directorate, a body within the Environment State Secretary of the Ministry for Ecological Transition and the Demographic Challenge.

After finishing his studies as a Forestry Technical Engineer, Public Works Technical Engineer, and Environmental Sciences Graduate, and passing the competitive examinations, first in the Corps of Public Works Technical Engineers and then in the Scale of Senior Technical Experts of the Ministry of the Environment, he started working as a civil servant for the Ministry of the Environment, always related to digital issues, such as Geographic Information Systems.

He was one of the first pioneers in the Water Directorate General to work with Geographic Information Systems (GIS), carrying out for example the inventory of dams and their relation to the geoportal in 2001. He has worked on dam safety issues, flood zone mapping and the implementation of the national flood zone mapping system (SNCZI)[1]. With the latest restructuring of the Ministry, in which the General Water Directorate became responsible for hydrology and management of the Automatic Hydrological Information Systems

(SAIH)[2], they are responsible for all the non-urban water cycle public digitalization. Because of all this experience, its director, Teodoro Estrela, entrusted them with the conception, organization, and management of PERTE[3] for water cycle digitization.

INTERVIEW

For how long has the General Water Directorate been present? And how many professionals work in it?

It started when all Ministries were formed, at first it was called the General Directorate for Hydraulic Works, then renamed the General Directorate for Hydraulic Works and Water Quality, and then the General Water Directorate, which employs between 150 and 200 civil servants.

How long has MITECO been working with Geographic Information Systems?

We started working with geographic information in 1998, when we acquired the first ArcInfo license and published the first geoportal in 2000. Today we work with both ArcGIS and QGIS.

Which are its competencies regarding Catchment Authorities?

Although Catchment Authorities are autonomous entities, a large part of the actions are agreed with them, and the General Water Directorate is the one that finances the actions and the hydrological plans, as well as planning and coordinating these actions with them.

What does digitization mean for the General Water Directorate?

It means knowledge and transparency.

For example, the first successful case of digitization was the publication of the yearbook of rivers gauging stations in 1911, with the great advance it meant in terms of having all Spanish rivers flow rates information available together for any user.

What is the current Spanish water sector digitalization state, what has this digitalization been like, is it

"We should all have the "water app" on our mobile phones, and it should be a tool that will allow to qualify among those users who manage water well and those who still do not. Rewarding those who have the better practices"

homogeneous, where and why are there differences in the sector?

The state is uneven. Not all areas and territories are at the same level. Each territory and the different administrations have evolved little by little, in a heterogeneous way depending on its economic budget, problems and concerns of each region, reaching a series of natural and asymmetrical milestones in each region.

For example, in the north of Spain, digitization has traditionally advanced more in wastewater discharges, given that they suffer problems in this regard, due to the large amount of water resources that existed before the impact of climate change, while in the south it has advanced more in the supply side and clean water resource, due to its scarcity.

Each region will therefore invest more effort in those areas of the water cycle where there is a stronger need, based on its requirements.

What are the major benefits of digitization?

The first is transparency. The second is savings. Because everything that is not measured, is not accounted for, and is not valued. When we know what we are spending, we automatically start to spare it, which is very relevant when it comes to water.

What are the difficulties against progress in this regard?

In administrations, change is complicated, mainly in the procurement model, due to administration internal brakes, as we were used to tender a project, finish it, and finally approve it. Therefore, models must change, as well as the internal IT structure, which must be adapted, to go to the cloud, the current servers are no longer useful, and therefore the previous procurement way changes, which increases internal friction.

And externally, the procurement itself, which is different, as it contracts a technology or a service for years, and it is not the type of service that public servants are used to tender, so it is complicated to explain to financial controllers, for example, or to those responsible for the computer systems, with new knowledge that has to be incorporated; on top of the lack of personnel, as the professionals who hold the knowledge have a lot of work and there is certain collapse in their activities.

How can institutions support this digitalization and is PERTE an appropriate driver for this digital transformation?

They can, with plenty of projects, such as the PERTE of water cycle, which is favoring digitalization at all levels. In fact, after the pandemic, all administrations are turning to digitalization to facilitate remote work development.

What external factors have favored this digitization?

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The main factor has been the possibility of working and managing remotely many territorial areas from home without the need to travel. In addition, the possibility of being able to operate an infrastructure from a workstation without having to be there makes it an enormously useful tool, breaks down barriers and borders and is the closest thing there is to teleportation. The circumstances are ripe for transformation and savings.

What does the General Water Directorate foresee in the future of the digitalization of the water cycle?

We are going to try to work as hard as possible to promote the care of this resource and improve its management through knowledge of the water cycle. Everything that happens to water will be known, from catchment in rivers and aquifers, the use of water in the city, discharges in real time, with data on volume, flow, characteristics and quality, days of rain, what has been collected in drainage systems, what has been treated and released into the environment, the circulating flows of all watercourses in a single centralized website in real time, connection with AEMET to have seasonal and weekly forecasts. In the field of irrigation, all irrigators will be provided with information on the resource they have, what they are using, as well as on the excess nitrogen, phosphorous and pesticides discharged into the environment, and in the field of industry, so that they have greater guarantees about the quality of the water they are going to collect.

We want a fully 21st century management model, so the plan must help to bring as many water users as possible into the 21st century, given that water cycle management has not reached everyone equally.

In smartphones we are missing the "water app", which is the one we don't have yet. We should be able to have the urban cycle, water consumption in our homes and the amount that reaches the large operators, as well as being available to irrigation users and water resource holders.

We should all have this "app" installed on our mobile phones, and it should be a tool that will allow to qualify among those users who manage water well and those who still do not. Rewarding those who have the better practices.

It is a very holistic and inclusive idea, so that we can all participate in the water cycle according to our capabilities and individual or corporate responsibility.

> *"The main factor that has favored digitalization has been the possibility of working and managing many territorial areas from home without the need to travel"*

[1]https://www.miteco.gob.es/es/agua/temas/gestion-de-los-riesgos-de-inundacion/snczi/ [2]https://www.miteco.gob.es/es/agua/temas/evaluacion-de-los-recursos-hidricos/saih/
[3]https://www.miteco.gob.es/es/ministerio/recuperacion-transformacion-resiliencia/perte/default_PERTE_agua.aspx

Conclusions

CONCLUSIONS

Universalizing sanitation

It is paradoxical that, on a planet with three quarters of its surface area made up of water, currently more than 2 billion people lack access to safe drinking water and basic sanitation, according to a United Nations (UN) uniform on Water Resources Development.

Access to safe drinking water and sanitation is a human right. Technological progress and the advent of digitalization in the integral water cycle management represent a substantive boost to achieve the sanitation targets set in the Sustainable Development Goals on access to adequate sanitation and hygiene services.

Universalizing sanitation is not an option, it is a necessity. We have a common challenge and technology at our fingertips, and we must harness it to succeed on water and sanitation accessibility, with a special focus on places like: Latin America, the Middle East, Southeast Asia and Africa.

Attracting funds for water digitization

Integrated water cycle management digital transformation is a necessary step to achieve optimization and sustainable management of water resources worldwide. Investment in technology enables more efficient management and more informed decision-making at all water cycle levels, as well as to all stakeholders along the chain, from the individual user to the water supply manager.

Investing in digitalization helps saving costs and improves long-term water supply systems resilience. As global water demand increases and the effects of climate change become more pressing, it is crucial that public and private sector join forces in driving water digitization to ensure this vital resource sustainability.

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The value of GIS systems

Geographic Information Systems (GIS) are one of the most indispensable tools for water management companies. GIS systems enable more effective decision-making and improved understanding of water network issues, as well as provide better visibility on water use and water resource depletion.

Geographic Information Systems (GIS) are invaluable tools for tackling water scarcity and climate change. Gaining a better understanding of geographical location related problems, as well as better water use, and water resources depletion visibility, allows for an up-to-date status view of the water network and possible adverse climatic events predictions.

When these GIS systems are linked to hydraulic modelling systems and advanced data analytics algorithms, the range of solutions to address all different sector challenges and problems will increase exponentially.

R+D+I. The seed for expanding technological solutions

R+D+I (Research, Development and Innovation) are key factors in expanding and improving technological solutions in the water sector, as it enables the development of new technologies and methodologies to optimize water management, efficiency, sustainability and service quality.

In this sector, R&D&I can cover a wide range of areas, from new water treatment technologies development, water distribution and sewerage infrastructures improvement, to data management and use of water resources optimization.

R&D&I serves as a driver for European and national funds to incentivize and accelerate the adoption of innovative technologies in the water sector. The PNRR with the PERTE, the Next Generation funds, investment groups and other actors, move a large volume of funds that, if well managed, can represent a substantial differentiation in the digitization of the sector.

All this, with the ultimate purpose of moving firmly towards a more sustainable and efficient management of the water cycle with a global modernization and digitization.

Digitalization with meaning

Having a holistic view of companies' and administrations' business in that manage water resources to help them working in a more efficient and sustainable way is the main objective of a meaningful and successful digitization.

The proximity and cooperation with the customer to understand their business model, their problems, and challenges to improve the operation of these companies is a basic and essential point. The different existing technologies should simply be used as a lever to help improve these companies and administrations. The sense and success of digitalization by this technology is based on business knowledge and the user's proximity to solve each company problems and needs and establishing a collaborative process with them.

If company's business, problems, and needs are not understood, it is very difficult to establish a successful digitalization process, no matter how much technology is used. Technology that, in many cases, is incorporated without need or without a clear objective of improvement and, therefore, becomes implementations that do not provide the expected value.

It is essential to digitize in a meaningful way. This means using technology strategically and responsibly to achieve specific objectives and to improve or solve companies' problems and needs, as they themselves know better than anyone their business and the processes they want to improve.

In this respect, it is important for water companies and public administrations to identify the key areas where digitization can offer the greatest benefits and to ensure that technology is used in a responsible and ethical manner. In short, we must digitize in a meaningful way.

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