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CONCEPT NOTE

SESSION 6 « DIGITALISATION AND NEW SOLUTIONS FOR RATIONAL USE OF RESOURCES »

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The problem of managing conventional and non-conventional water resources is a vital issue for mankind and the environment, but above all it is particularly complex to tackle because of (i) the specific nature of each territory, (ii) the qualitative and quantitative needs of each use, whether domestic, urban, agricultural, industrial, leisure or recreational, (iii) the spatio-temporal variability, often sudden, of the availability of resources, which often contradicts the needs of the various uses, particularly during periods of drought, (iii) the spatio-temporal variability, often involuntary, in the availability of resources, which often contradicts the needs of the various uses, especially during periods of drought, and (iv) the absolute need to preserve and restore all ecosystems, if only to preserve the ecosystem services they provide.

This sustainable management is made more complex by population growth, rapid urbanisation, the impact of climate change and pollution. To meet these challenges, it is clear that innovative solutions such as digitisation, AI, new technological solutions and the contribution of human and behavioural sciences will play an essential role in the rational management and preservation of water resources.

As we follow the water diagonal, we can see every day how innovative solutions are providing relevant answers to the challenges facing project owners and decision-makers:

- Solutions for monitoring water resources and their evolution over time or geographically are developing. They now offer predictive models, often quantitative, and more recently qualitative. The impact of climate change on the flow of a body of surface water, on the level of a body of groundwater and on changes in water quality at decadal intervals will be an integral part of the range of solutions that catchment managers will need to take on board;

- Solutions for monitoring the efficient transport of water have been mastered in urban areas, and will become more widespread in rural areas. The development of sensors and inspection robots will facilitate the management of multi-use rural networks, just as they are changing the management of intra-city networks;

- Mastering the knowledge of water uses, their temporality and seasonality, is absolutely essential if we are to achieve the virtuous objectives of saving water resources. In rural areas, or on the scale of a catchment area, mastery of a 2-dimensional vision is vital. In this respect, the contribution of remote sensing will become a major tool for monitoring water use in a catchment area, and for providing decision-making aids to the various players involved.

- Finally, we are all seeing the emergence of solutions for analysing the overall impact of our water schemes, often based on multidisciplinary approaches. The development of Life Cycle Analysis, which has been perfectly mastered in the building industry and in the management of the water cycle, is proof of this. To feed such an analysis, it will be necessary to master the data, both in time and space.

Solutions are becoming increasingly digital, and there are five main areas of development:

- *Data collection and monitoring*

Real-time data collection and monitoring of water resources is essential for understanding consumption patterns, environmental conditions and demand trends. Connected sensors, satellite data and Internet of Things (IoT) technologies can be used to collect accurate data on water quality, reservoir levels, rainfall and other relevant parameters. This data can be analysed to model the state and evolution of resources in real time, so that informed decisions can be made and potential problems anticipated.

- *Intelligent distribution networks*

Good management of water resources necessarily involves constantly improving the efficiency with which they are used, particularly in urban areas (56% of today's population), which are growing at a rate of more than 2% a year and where water requirements are very high. In these urban areas, it is therefore essential to be able to develop and implement intelligent water networks, using advanced communication technologies to monitor and manage them. These systems will need to be able to detect leaks quickly, identify health risks (water pollution) and remotely control devices (valves, pumps, etc.) to optimise water delivery according to demand and usage. By using predictive or optimisation AI, it is possible to improve the overall performance of networks in terms of their water footprint, CO2 emissions and operating and investment costs. These urban applications are now being deployed on rural projects, where such digitisation was often lacking. Examples include the development of connected agricultural meters, the use of AI to control the behaviour of farmers, and the use of remote sensing to determine, for example, annual irrigated areas or the seasonality of irrigation in a given area.

- *Decision support for agriculture*

Agriculture is one of the biggest consumers of water. Digitalisation and information technology can help optimise irrigation and reduce water consumption in agriculture. For example, soil sensors and remote sensing systems can measure soil moisture, rainfall and other factors to determine the optimum time for irrigation and the amount of water needed for different types of crops and soils. Drones, GIS and satellites can provide images and data to map crops and identify areas of water stress.

- *Water demand management*

As with agriculture, it is important to minimise all water use to what is strictly necessary, in what is known as sober use. Digitalisation, with the support of the human and behavioural sciences, also offers opportunities for managing water demand by encouraging the adoption of more sustainable behaviour. For example, and at lower cost, in urban areas, and following the example of what is already being done for energy, mobile applications can be developed to raise awareness and educate users about their water consumption, providing them with personalised advice on how to reduce their water footprint by gently encouraging, but never coercing, better choices.

Smart water meters allow users to monitor their consumption in real time and receive alerts if set thresholds are exceeded.

Another example in rural areas is the deployment of on-board solutions for farmers, providing them with real-time information on the water requirements of their crop, depending on the crop profile and their yield targets.

- *Waste water treatment*

All water treatment operations (drinking or waste) will be subject to increasingly stringent quality and reliability requirements, particularly with the introduction of loops for the reuse of treated wastewater. They will also be implemented in a much more decentralised way than has been the case to date. The operation of these processes is often complex, due in particular to the coupling of biological, chemical and physical processes.

Digitalisation and Artificial Intelligence can therefore also improve the efficiency and reliability of the operation of wastewater treatment facilities in order to optimise treatment processes, reduce energy costs and improve the quality of the water treated.

In addition, real-time monitoring of treatment and operating parameters coupled with specific and adapted models should also enable anomalies to be detected and corrective measures to be taken quickly through the development of specific and dedicated dynamic optimisation and associated control-command tools.

Through this presentation, we can clearly see all the possibilities offered by innovative, often digital, solutions for more rational and sustainable management of water resources in a complex, multi-scale systems approach.

However, it is also essential, in an interdisciplinary and cross-sectoral approach, to ensure the harmonious integration of these technologies with strong governance, increased awareness and collaboration between stakeholders to maximise the benefits and meet the challenges of water management in a digital context.

All these aspects will be discussed in this session along the five axes presented, based on examples, achievements and projects carried out and set up around the Mediterranean.

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