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SMART CITIES AND THE MANAGEMENT OF WATER CONSUMPTION

by **Francesco ANASTASI**, Researcher at Palacky University of Olomouc (Italia)

*“If yesterday the city was a world, today,
the world has become a city”*

L. MUMFORD¹

Urban history – portrait of collective identity and reference for the environmental and cultural cognitive framework of a territory – is witness to its transformations over time². Significant socio-economic changes both in Europe and worldwide are driving the growth of urbanization at an impressive pace. In this context, the concept of Smart City is considered increasingly strategic for the solution to the questions related to the irreversible urban agglomeration growth.

According to United Nations estimates, the phenomenon today affects more than 50% of the population of the most developed nations in Europe and the world. The projections elaborated by UN Habitat – the United Nations agency in charge of monitoring the phenomenon – show that in 2030 the acceleration in the growth of urban areas will move as much as 68% of the world population living in a city³.

It seems clear, the growing demand of water for civilian use in urban areas is an immediate urgency. The impact and the effects of climate change, however, will determine the availability of water resources, too.

In this context, water security is the capability to ensure water in sufficient quantity and quality for the main anthropic uses, as well as the environmental protection⁴ is a topic of emerging interest in Europe⁵.

The specific events that occurred over the last decade in Southern European countries, including Spain⁶ and Cyprus⁷, have made it

¹ L. MUMFORD, *The City in History*, MJF Books, 1989.

² A.I. DEL MONACO, *Città e Limes*, Edizioni Nuova Cultura, Roma, 2012.

³ AA.VV., *2018 Revision of World Urbanization Prospects*, United Nations, available on: <https://population.un.org/wup/>

⁴ UN-Water Annual Report 2013, available on: <https://www.unwater.org/publications/un-water-annual-report-2013/>

⁵ M. KOSSIDA, KAKAVA, A., TEKIDOU, A., IGLESIAS A., MIMIKOU, M., *Vulnerability to Water Scarcity and Drought in Europe. Thematic assessment for EEA 2012 Report*, ETC/ICM Technical Report 2012/3.

⁶ Cf. *amplius* on this issue, T. ESTRELA, E. VARGAS, *Drought management plans in the European Union. The case of Spain*, *Water resources management*, Springer, 2012

clear that the temporary and/or permanent reduction in water supply, exacerbated by ongoing climate changes, had influenced the correct functioning of the water service.

The application of the principle of resilience is the capacity of the water service to absorb and compensate anthropogenic and natural pressures especially in conditions of scarcity, is fundamental to guarantee water security⁸.

The environmental and climatic changes of recent decades have made the need for an integrated approach between soil and water management even more evident.

The Conference on Climate Change in Paris (COP21) highlighted the decisive role that water resources can play in developing a sustainable development model that is able to counteract the effects of climate change on cities⁹.

§ 1 – THE SMART CITIES: A BRIEF LITERATURE REVIEW ON THE ISSUE

The containment of urbanization problems and the implementation of Smart city are closely linked to the ongoing technological, economic and social innovation process. In contrast, in recent decades, a large part of the innovation literature has highlighted the importance of a close connection between the city and its territory. The first theorization of this one-to-one relationship can be referred to the concept of industrial districts developed since the mid-seventies¹⁰, as a paradigm that later evolved into the theory of industrial clusters¹¹. All these theories identify three main factors of innovation: the concentration of many and heterogeneous experiences in various fields of knowledge and production; a network of cooperation between the actors involved; the presence of catalysts that facilitate the combination of different skills and actors¹².

⁷ Cf. *amplius* on this issue, I. IACOVIDES, *Water resources in Cyprus: Endowments and water management practices*, in *Water resources management*, 2011, Springer; C.N. CHARALAMBOUS, *Water management under drought conditions*, Desalination, Elsevier 2001

⁸ Cf. among other on the resilience of the system of water management cf. F. HOSSAIN (edited by), *Resilience of Large Water Management Infrastructure*, Springer, 2019; in the same sense, cf. F. ANASTASI, *The Resilience of Administrative Instruments to protect the water resources*, in *Olomoucké právnické dny 2019, Sborník z mezinárodní vědecké konference* (edited by B. VÍTOVÁ, M. ČERNÝ), Olomouc: Iuridicum Olomoucense, 2019

⁹ COP 21 Paris Agreement, available on:

https://ec.europa.eu/clima/policies/international/negotiations/paris_en. On the same issue cf. A. Robbins, "How to understand the results of the climate change summit: Conference of Parties21 (COP21) Paris 2015", *Journal of Public Health Policy*, 2016, Vol. 37. R.S. DIMITROV, "The Paris Agreement on Climate Change: Behind Closed Doors", in *Global Environmental Politics*, Vol. 16, issue 3, 2016 ; R. Kinsley, "Climate Change after Paris: from turning point to transformation", *Journal Climate Policy*, Vol. 17, 2017.

¹⁰ Cf. A. BAGNASCO, "Tre Italie: la problematica territoriale dello sviluppo italiano", in *Il mulino*, 1977; more recent, in the same sense cf. M. SAVINO, *L'insostenibilità territoriale della "Terza Italia"*, FrancoAngeli, 2005.

¹¹ Cf. M. E. PORTER, *The Competitive Advantage of Nations*, Michael E. Porter, 1990

¹² S. AUCI, L. MUNDULA, "Smart cities and a stochastic frontier analysis: A comparison among european cities", *SSRN Electronic Journal*, 2012

At the beginning of 1990, the technological paradigm of industrial districts was replaced by the National Innovation System¹³, which studies the macroeconomic factors underlying the technology transfer process.

After 2000, the focus shifts to the local dimension of the phenomenon with research on Learning Regions, Regional Innovation Systems and Local Innovation Systems¹⁴.

In this theoretical framework, the awareness arises that, although the production of new knowledge is available on a global scale, innovation, understood as the application of knowledge, develops essentially on a local scale.

In fact, it is on a restricted territorial basis, the city, that the processes of collaboration and diffusion between individuals are triggered.

In 2000, following the gradual dematerialization of infrastructures, the progressive digitalization of information, new forms of online learning and the advent of more virtual technologies, a new approach to innovation emerges on a regional basis: "the intelligent region". The latter corresponds to an area characterized by innovation systems connected with IT infrastructures and digital services¹⁵.

The "Three Ts" model demonstrates that Technology and Talent are not enough to generate innovation and growth, but it is also necessary to consider the presence of "Tolerance", meaning a significant social cohesion, to develop knowledge¹⁶.

Starting in 2005, these models are complemented by many works that focus on the role of creativity in sustainable development in an urban context¹⁷, both from the point of environmental and social view¹⁸. However, the current global economic policy is characterized by positive and negative changes.

¹³ Cf. B.A. LUNDVALL, *National Systems of Innovation: Towards a Theory of Innovation and Interactive Learning*, Anthem Press, 2010; also cf. R. NELSON, *National Innovation System: a retrospective on a study, Industrial and Corporate Change*, Vol. 1, Issue 2, 1992.

¹⁴ Cf. P. COOKE, M. HEIDENREICH, H.J. BRACZYK, in *Regional Innovation Systems*, Routledge, 2004.

¹⁵ In this context, two interesting theoretical paradigms have been developed: the "Triple helix" theory and the "Three T" model. The first identifies the relationship between University, Industry and Government as a complex of independent institutional spheres that overlap and complement each other, in a process that leads to innovation *amplius*, cf. R. DE SANTIS, A. FASANO, N. MIGNOLLI, A. VILLA, *Il fenomeno Smart Cities*, in *Rivista italiana di economia, demografia e statistica*, January 2014; L. LEYDESORFF, *The Triple Helix*, in *Glycoconjugate Journal*, vol. 14, January 1995; L. LOMBARDI, *Modelling the smart city performance*, The European Journal of Social Science Research, 2012.

¹⁶ F. FLORIDA, *The Rise of the Creative Class: And How It's Transforming Work, Leisure, Community and Everyday Life*, Basic Books, 2002.

¹⁷ A. MARKUSEN, *Urban Development and the Politics of a Creative Class: Evidence from a Study of Artists*, *Environment and Planning*, Vol. 38, 2006; L. FUSCO GIRARD, P. LOMBARDI, P. NIJKAMP, *Creative Urban Design and Development*, *International journal of sustainable development*, Vol. 12, 2009

¹⁸ Cf. on this issue, S. SASSEN, *Elements for a Sociology of Globalization*, W. W. Norton & Company, 2007; also cf. S. SASSEN, *Cities in a World Economy (Sociology for a New Century Series)*, SAGE Publications, 2018

In fact, on one hand, economic development and technological innovation have made mass production possible and have contributed to the globalization of trade; on the other, they have contributed to the creation of forms of social inequality, also due to the use of flexible and precarious employment relationships. In this context, the hypothesis of the development of a “pluriactive” society takes shape and forms of participatory democracy at the local level are also spreading¹⁹.

From the sociological point of view, the local dimension represented by the city and the dimension of the liveability improvement find explanations in the request of increasingly Smart Cities.

The Smart Cities paradigm is declined within a complex set of visions that are based on the need to give a new social, ethical and environmental dimension to economic development and growth, also in the context of issues related to social innovation and well-being²⁰.

Social innovation, for example, takes shape and originates from different sectors and areas of interest that in society give rise to a process whose knowledge flows are not only vertical but also horizontal; it embraces articulated social and environmental challenges, ranging from social entrepreneurship to design, technology, public policies, urban development, social movements and, in general, community development²¹.

The interest in wellness, in 2008, assumes a peculiar centrality also through the report of the Commission on the Measurement of Economic Performance and Social Progress²² which offers a new systematization of a vast set of theoretical results.

The essential sociological conclusions concern the need to shift the emphasis from economic production measures, such as Gross Domestic Product (GDP), to more ambitious welfare indicators.

¹⁹ M. PACI, *Nuovi lavori, nuovo welfare. Sicurezza e libertà nella società attiva*, il Mulino, 2005.

²⁰ On this issue, cf. *amplius* S. E. BIBRI, “On the sustainability of smart and smarter cities in the era of big data: an interdisciplinary and transdisciplinary literature review”, *Journal of Big Data*, 2019

²¹ G. DOMINICI, “Why Does Systems Thinking Matter?”, *Business Systems Review*, Vol. 1, No. 1, 2012.

²² AA.VV., *Report by the Commission on the Measurement of Economic Performance and Social Progress*, 2009 available on:

<https://ec.europa.eu/eurostat/documents/118025/118123/Fitoussi+Commission+report>

§ 2 – THE EUROPEAN THE REGULATORY LANDSCAPE

A) The City as a Founding Element of Europe

The European thinking on the city²³, on its evolution and on the new needs started with the communication *The urban problematic: guidelines for a European debate* of 1997²⁴.

In this document, the European Commission moves precisely from the city traditional role as a motor of socio-cultural development and at the same time from the ascertainment of the growing difficulties deriving from the dimensions that contemporary urbanism is assuming to face.

It seems clear that the fragmentary and episodic approach followed until then showed all its inability to return to urban areas the natural function of centres of socio-cultural integration, of source of economic prosperity and sustainable development as well as of democracy itself²⁵.

On these premises, the problems of European cities can be traced back to the demographic growth linked to the process of urbanization of society, unemployment and social marginalization, to the imbalances of the European urban system arising from the advantage of the metropolitan areas located at strategic and well equipped nodes respect to the centres located in the suburbs²⁶.

Also it is linked to the quality of the natural and physical environment of urban areas, to the need to promote forms of social integration especially through the preparation of instruments for participation in the local democratic process.

In the Communication the Commission converges on the need for an urban perspective in the various policies of the European Union²⁷. In others terms, since the latter has a political competence in a plurality of sectors that influence the development and quality of life of urban centres, it is necessary for it to play a complementary role in dealing with urban issues,

²³ On EU urban policy see L. GRAZI (ed.), *Cities and the European Union. The urban dimension between historical paths and Europeanization dynamics*, Il Mulino, 2012. On the city as a founding element of Europe, cf. I. D., *Europe and the cities. The urban question in the European integration process*, Il Mulino, 2006

²⁴ Communication of the European Commission “Towards an urban agenda in the European Union of 1997”, available on:

https://ec.europa.eu/regional_policy/sources/docoffic/official/communic/pdf/urban/urban_197_en.pdf

²⁵ Previous and preparatory to the communication of 1997 was the The Aalborg Charter approved by participants in the European Conference on Sustainable Cities held in Aalborg on May 27, 1994, with which the signatory European cities promoted by the end of 1996 the consensus on Agenda 21 adopted at the Earth Summit held in Rio de Janeiro in June 1992 through the drawing up of plans at local level for development, precisely, lasting and sustainable.

²⁶ Cf. C. NAPOLI, *La Smart city tra ambizioni europee e lacune italiane: la sfida della sostenibilità urbana*, Le Regioni, Fasc. 2, 2019.

²⁷ Communication of the European Commission “Towards an urban agenda in the European Union of 1997”.

by doing so that the Union's action contributes most to the development of cities.

In this regard, the image proposed by Enrico Carloni on the European city is suggestive of an environment in which the rights of citizens established in the 2000 Charter of Nice are realized and effective²⁸.

The follow-up to the European debate, which was therefore formally launched in 1997, consists of a substantial succession of documents, among which a highly relevant position is occupied by the 2007 Leipzig Charter, the 2010 Toledo Declaration and the 2016 Amsterdam Pact²⁹.

The Charter on Sustainable European Cities³⁰ was adopted at the informal meeting of the Ministers for Urban Development and Territorial Cohesion held in Leipzig on 24 and 25 May 2007. It takes its moves from the definition of European cities in terms of economic resource, social and cultural value, invaluable and irreplaceable, as well as the sharing of complementarity, with the purpose of achieving sustainable development, of three dimensions: economic prosperity, social balance and a healthy environment³¹.

Since urban areas in Europe present demographic difficulties, social inequalities, inclusion problems, lack of accessible and adequate housing and environmental problems, the possibility for them to continue to play the natural role of driving social progress and economic growth is conditioned by the maintenance of social balance, protection of cultural diversity, and the guarantee of a high quality in urban planning, architectural and environmental sectors.

To achieve this purpose, the Ministers recommend a greater use of the strategies of an integrated urban development policy³² and a special attention to the degraded neighbourhoods in the urban

²⁸ It refers mostly to the right to a healthy environment (art. 37), independence and participation of the elder class (art. 25), autonomy and social inclusion of the disabled (art. 26), well-being and protection of children (art. 24), protection of human health (art. 35), which, "together with the objectives of the Treaty and the European social model, outline the contours of a welcoming and inclusive, sustainable and healthy urban environment" cf. E. CARLONI, M.V. PIÑEIRO, "Le città intelligenti e l'Europa. Tendenze di fondo e nuove strategie di sviluppo urbano", in *Le Istituzioni del federalismo*, 2015.

²⁹ The intermediate steps between the 1997 European Commission Communication and the Leipzig Charter are: i) the Lille Declaration (11-12 September 2000); ii) the Conclusions of the Presidency at the European Council meeting in Gothenburg on 15 and 16 June 2001; iii) the Conclusions of the informal Council of Ministers responsible for territorial cohesion gathered in Rotterdam on November 29, 2004, also known as Urban acquis; iv) the Bristol Agreement Establishing Sustainable Communities in Europe on December 6-7, 2005 cf. C. NAPOLI, *La smart city tra ambizioni europee e lacune italiane: la sfida della sostenibilità urbana*, Le Regioni, Fasc. 2, marzo-aprile 2019.

³⁰ Leipzig Charter on Sustainable European Cities, available on: https://ec.europa.eu/regional_policy/archive/themes/urban/leipzig_charter.pdf

³¹ Cf. C. NAPOLI, *La Smart city tra ambizioni europee e lacune italiane: la sfida della sostenibilità urbana*, Le Regioni, Fasc. 2, marzo-aprile 2019.

³² To be implemented through the quality of public spaces, the modernization of infrastructure networks and the improvement of energy efficiency, the implementation of active policies in the field of innovation and education.

context³³. In this way, they want to start a political debate in the respective States on the follow-up to be guaranteed to the same landings of Leipzig in national, regional and local development policies.

The later Declaration on Integrated Urban Regeneration adopted in Toledo on 22 June 2010 focuses on two specific areas: the potential of urban regeneration and its strategic role for sustainability in European cities, as well as the need to support an European Urban Agenda for the future³⁴. The smart, sustainable and inclusive growth suggested by the Europe 2020 strategy, in fact, can only pass through the city and to this extent³⁵.

The "urban regeneration" has play a decisive role in urban development itself: the European agenda on urban matters is a necessary step to ensure continuity and coordination in the way to schedule formal appointments to discuss urban issues in a multi-level perspective³⁶.

The European urban agenda has been effectively established with the Amsterdam Pact of May 30, 2016. It has developed, in a multi-year perspective, with the joint activities of the Member States, the European Commission, the European Parliament, the Committee of the Regions, the European Economic and Social Committee, the European Investment Bank, representatives of European urban authorities and other interested parties³⁷.

The agenda aims to reach the objectives of the Union through the achievement of the urban areas maximum potential, by promoting territorial cohesion and reducing the socioeconomic gaps recorded in urban areas and regions.

The development of a series of partnerships for the identified urban challenges is the heart of the agenda³⁸. Member States, EU institutions and in general stakeholders can collaborate in the

³³ To be realized through the improvement of the physical environment, the strengthening of the local economy and labour market, the implementation of proactive education and training policies for children and young people, the promotion of efficient urban transport at affordable prices.

³⁴ Following the signing of the Leipzig Charter, was signed the Marseille Declaration on The Sustainable and Cohesive City of November 25, 2008.

³⁵ The Toledo Declaration sets out urban integration regeneration available on: https://www.ccre.org/docs/2010_06_04_toledo_declaration_final.pdf

³⁶ During the year 2010 the document *City of the future. Challenges, ideas, anticipations* drawn up on the sidelines of some workshops attended by representatives of universities, national institutions and associations. It underlines the importance of the territorial dimension in cohesion policy and of an integrated, coherent and global approach that involves all sectors, administrative levels and territories and concludes symbolically that "the future of Europe depends on our cities of the future":

https://ec.europa.eu/regional_policy/sources/docgener/studies/pdf/citiesoftomorrow/citiesoftomorrow_summary_it.pdf.

³⁷ Urban Agenda for the EU Pact of Amsterdam, available on:

https://ec.europa.eu/regional_policy/sources/policy/themes/urban-development/agenda/pact-of-amsterdam.pdf

³⁸ Urban development in the European Union :

https://ec.europa.eu/regional_policy/en/policy/themes/urban-development/

elaboration of common solutions for the improvement of urban areas in Europe³⁹.

B) The European Regulation Framework on Water Resources

The European Union has addressed these issues in various directives, with which it is proposed to member states to develop an integrated approach to overcome the problem of sectoriality and decision-making fragmentation.

It is in fact necessary to coordinate urban planning tools with policies for energy efficiency, for agriculture, for the environment and for the management of water resources, in order to develop projects able to direct local development towards sustainability objective. In particular, the issue of storm water management in urban areas is one of the main problems related to water resources.

The European Union, on this specific topic, promotes the search for integrated solutions capable of introducing systems of technological innovation and environmental protection measures⁴⁰.

In more densely populated areas, moreover, only a holistic approach can contribute to the definition of effective strategies that can address the issue of hydraulic safety within an overall environmental protection strategy.

1) The role of the Commission

In 2012, the Commission launched the European Water Resources Safeguard Plan, a long-term strategy aimed at ensuring a qualitatively adequate water supply for all legitimate uses, improving the implementation of current European water policy, integrating the objectives of water policy into other sectoral policies and filling the gaps in the existing framework. This plan provides for the development, by the Member States, of an accounting of water resources and water efficiency objectives, as well as the definition of European standards for water reuse⁴¹.

Union policy has established two main legal frameworks for the protection and management of freshwater and seawater resources through a holistic ecosystem-based approach, namely the

³⁹ *Ibidem*.

⁴⁰ R. FERRARA, "The Smart City and the Green Economy" in *Europe: A Critical Approach*, Energies, 2015

⁴¹ A Water Blueprint – taking stock, moving forward, available on https://ec.europa.eu/environment/water/blueprint/index_en.htm; for a comment of the Commission Activity cf. J.G. Carter, *Spatial planning, water and the Water Framework Directive: insights from theory and practice*, The Geographical Journal, Wiley Online Library, 2007

European Water Framework Directive and the Environmental Strategy Framework Directive marine.

The European Union has always been very sensitive to the planning of water resources and has promoted water resources planning instruments to guarantee essential water quality levels⁴².

At present the main problems concerning the management of water resources are due to the lack of public investments for the efficiency of the water network, as well as to consumption and dispersion by private individuals both in the performance of economic activities and for domestic use.

However, at present Europe seems to be very oriented towards accentuating the individual dimension of the right to water, to the detriment of the collective or communitarian right. Observing environmental litigation, it is noted that there is no room for popular actions other than those related to compensation for damages.

Therefore, the European legal system does not offer new ideas in the conception of common goods.

In more detail, the right to water is assumed to be linked to the human fundamental rights on which the Union is founded (Article 2 TEU) and indirectly linked to the environmental protection referred to in art. 37 of the Charter of fundamental rights of the European Union and also in art. 191 TFEU, dedicated specifically to the European Union's environmental policy⁴³.

The first Council Directive, n. 75/440/EEC on the quality of surface water was intended for the production of drinking water in the Member States, emphasized in the preamble “the need to protect human health and to exert control over surface water intended for the production of drinking water and on the treatment of such water purification”⁴⁴.

In 1980 the Council adopted a directive on the quality of water intended for human consumption, which was then repealed by Council Directive 98/83 with the aim of protecting “human health from the adverse effects of contamination of water intended for human consumption, ensuring its healthiness and cleanliness”⁴⁵. EU water law had therefore initially developed in a

⁴²Cf. also P. URBANI, *Il recepimento della direttiva comunitaria sulle acque: profili istituzionali di un nuovo governo delle acque*, in Riv. giur. amb., 2004; G. CORDINI, *La tutela dell'ambiente idrico in Italia e nell'Unione europea*, IVI, 2005; also L. GAROFALO, “Osservazioni sul diritto all'acqua nell'ordinamento internazionale”, in *Analisi Giuridica dell'Economia* vol. 1, 2010; cf. C. JOACHIM ET L. MAZEAU, “Between risk and complexity: European water protection law issues”, in *Journal international de bioéthique et d'éthique des sciences*, 2017

⁴³ Cf. S. HENDRY, *Frameworks for Water Law Reform*, CUP, 201; also S. DE VIDO, *Il diritto all'acqua nella prospettiva europea*, in *Il diritto all'acqua, atti del seminario di studio svoltosi a Milano il 26 novembre 2015* (by L. VIOLINI and B. RANDAZZO), Giuffrè Editore, 2017.

⁴⁴ Directive of the Council, n. 75/440/CEE.

⁴⁵ Directive of the Council n. 91/676/CEE.

fragmented way, focusing on the different forms of water use and pollution, on issues of implementation and subsidiarity⁴⁶.

The breakthrough in EU policy on this matter was achieved by the Directive of the European Parliament and of the Council known as the *Water Framework Directive*⁴⁷.

The Directive is innovative from many points of view. It conceives the water management referring to the “river basin” (art. 2, 13) according to an integrated approach. It also proposes to regulate the management of fresh water combining quantitative and qualitative aspects including both surface and underground waters⁴⁸.

However, the Directive merely states, in a general way, in the first paragraph of the preamble that water is not a commercial product on a par with others, but a heritage that it must be protected, defended and treated as such.

Related to the Framework Directive are also the Council and European Parliament Directives adopted in 2006 and 2008 respectively on the protection of groundwater against pollution and deterioration and on the environmental quality standard in the water policy field⁴⁹.

More recently, was adopted the Directive 2014/23/EU of the European Parliament and of the Council on the awarding of concession contracts: it explicitly excludes concessions in the water sector from its scope⁵⁰.

In the preamble, in §40, we find an important reference to water as a good, “the importance of water as a public good of fundamental value for all citizens of the Union”⁵¹.

Not even the interpretation of the aforementioned directives provided by the Court of Justice of the European Union has contributed to the affirmation of the human right to water. And indeed, there were a lot of infringement proceedings issued by the European Commission against one of the EU member states for

⁴⁶ E. MORGERA, *Environment*, in S. PEERS, C. BARNARD (eds), *European Union Law*, OUP, 2014.

⁴⁷ Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy, available on https://ec.europa.eu/environment/water/water-framework/index_en.html.

⁴⁸ Cf. S. HENDRY, *Frameworks for Water Law Reform*, CUP, 2015; cf. S. DE VIDO, “Il diritto all’acqua nella prospettiva europea”, in *Il diritto all’acqua*, atti del seminario di studio svoltosi a Milano il 26 novembre 2015 (by L. VIOLINI E B. RANDAZZO), Giuffrè Editore, 2017.

⁴⁹ Directive 2008/105/CE of the EU Parliament and the Council of 16 december 2008, GU L 348, 24.12.2008; also, Directive 2007/60/EC of the European Parliament and of the Council of 23 October 2007 on the assessment and management of flood risks, in O L 288/28, 6.11.2007.

⁵⁰ Cf. S. HENDRY, *Frameworks for Water Law Reform*, CUP, 2015; also S. De VIDO, “Il diritto all’acqua nella prospettiva europea”, in *Il diritto all’acqua*, atti del seminario di studio svoltosi a Milano il 26 novembre 2015 (by L. VIOLINI E B. RANDAZZO), Giuffrè Editore, 2017.

⁵¹ Directive 2014/23/CE of the EU Parliament and the Council, 2014.

failure or incorrect transposition of one of the aforementioned directives⁵².

2) The Role of the European Parliament

As is known, the “Right2Water” European citizens' initiative, of its kind, urged the EU institutions and Member States to ensure that all citizens enjoy the right to water and sanitation, which is the supply and the management of water resources are not subject to internal market rules and water services are excluded from liberalization measures.

In response to this citizens' initiative, the Parliament, by a large majority, asked the Commission to propose legislation that enshrines the universal human right to drinking water and sanitation, as recognized by the United Nations and, where appropriate, a revision of the water framework directive to recognize universal access and the human right to water.

Recently, in the resolution on the international governance of the oceans, the Parliament emphasises that creating a sustainable maritime economy and reducing pressures on the marine environment, require action on climate change, land-based pollution reaching the seas and the oceans, on the restoration of marine ecosystems and biodiversity, and on the sustainable use of marine resources⁵³.

In this context, the Parliament urges the Commission to support international efforts to protect marine biodiversity, in particular in the framework of the ongoing negotiations for a new legally binding instrument for the conservation and sustainable use of marine biodiversity in areas beyond national jurisdiction⁵⁴. The Parliament also calls on the Commission to propose more stringent legislation in order to preserve and ensure sustainable uses of marine biodiversity in areas under the jurisdiction of the Member States⁵⁵.

§ 3 – SMART CITIES AND THE MANAGEMENT OF WATER RESOURCES

A) Smart cities and smart water

The concept of smart city has progressively changed its meaning and the related interconnections with the different dimensions of life, essentially designating since the beginning of this century the value of a digital city that over the years has also incorporated

⁵² Economic Social Cultural rights Committee, General Comment No. 15: The Right to Water (Arts. 11 and 12 of the Covenant) Adopted at the Twenty-ninth Session of the Committee on Economic, Social and Cultural Rights, 20 gennaio 2003. E/C12/2002/11; cf. M. A. SALMAN and S. MCINERNEY-LANKFORD, *The Human Right To Water*, Washington 2004.

⁵³ European Parliament resolution of 16 January 2018 on international ocean governance: an agenda for the future of our oceans in the context of the 2030 SDG.

⁵⁴ *Ibidem*.

⁵⁵ *Ibidem*.

social inclusion, to then extend the interest towards a higher quality of life, with a view to “Smart more than digital”⁵⁶.

Smart water is one of six components that define a smart city; the others include energy, mobility, buildings, public services and integration⁵⁷.

The concept of smart water is derived from the concept of smart cities having one to one relationship in their building blocks⁵⁸.

The goal of these efforts is to make the city more sustainable and efficient and effectively improve the quality of life.

Smart water generally refers to a holistic approach to managing this priceless resource, and the infrastructure systems surrounding its sourcing, treatment and delivery.

As we update and invest in our water infrastructure with more internet-enabled tools, and a wealth of data becomes available, it is vital that these networks communicate with one another.

This will allow not only the measurement of important indexes such as reserves and groundwater supply, and triage of infrastructure updates, but will improve efficiencies across water-related disciplines⁵⁹.

As an example, Water World cites predictive capabilities of flood mapping when looking at historical flood data paired with real-time and predicted weather and precipitation data⁶⁰.

By recognizing anomalies in consumption patterns for both the utilities and end users, cities can optimize and eliminate water waste and cost in delivery. The high-energy demand of a city's water treatment and delivery networks are often underestimated, meaning that improving operational efficiency through actionable data will reduce greenhouse gas emissions and cut costs simultaneously⁶¹.

It seems as though the impact these technologies could have for problem anticipation is boundless. Automatically prioritizing repair projects will help avoid major catastrophes like what happened to the Oroville Dam in California in 2017⁶².

⁵⁶ Cf. AA.VV., *Smart Cities in Italia un'opportunità nello spirit del Rinascimento per una nuova qualità della vita*, The European House Ambrosetti, 2012.

⁵⁷ T.M. VINOD KUMAR, *Smart Environment for Smart Cities*, Springer, 2019, p. 240.

⁵⁸ T.M. VINOD KUMAR, *Smart Environment for Smart Cities*, Springer, 2019, p. 242.

⁵⁹ Cf. in this issue the study by S. KARTAKIS, S. YANG, J.A. MCCANN, *Reliability or Sustainability: Optimal Data Stream Estimation and Scheduling in Smart Water Networks*, ACM 2017.

⁶⁰ *Handbook on good practices for flood mapping in Europe*, Prepared by EXCIMAP (a European exchange circle on flood mapping), Endorsed by Water Directors, 29-30 November 2007 available on:

https://ec.europa.eu/environment/water/flood_risk/flood_atlas/pdf/handbook_good_practice.pdf; On the flood prediction an interesting study has been carried out by A. MOSAVI, P. OZTURK, Kwok-wing Chau, *Flood Prediction Using Machine Learning Models: Literature Review*, *Water* 2018, 10, 1536.

⁶¹ H. CHOURABI, T. NAM, S. WALKER, J.R. GIL-GARCIA, S. MELLOULI, K. NAHON, T.A. PARDO, H.J. SCHOLL, *Understanding smart cities: an integrative framework. The 245th Hawaii international conference on system science (HICSS)*. Maui, HI, 2012.

⁶² I. A. ALVI, P.E., *Case Study: Oroville Dam (California, 2017)*, *Damfailures.org*, available on <https://damfailures.org/case-study/oroville-dam-california-2017/>

As global water demand grows and climate change creates a question mark in the future of water's security, it's likely we won't be able to afford resource losses at this scale.

Computational digital sensors can regularly monitor the quality, quantity and water wastage in water distribution and water leakage through smart water-metering system, smart water quality-sensing devices and smart water tariff structure, based on the concept of the more water requirement, the more costly it will be⁶³.

Implementing smart solutions comes with pivotal – and sometimes costly – challenges and limitations⁶⁴. To update our aging water infrastructure with the most current technologies, tens of billions will need to be spent through both public and private investment.

Luckily, the cost of these technologies is set to rapidly decline in the coming years, making smart solutions more feasible and powerful than ever before⁶⁵. In this context, it is important to move in the direction of smarter and more efficient cities, we won't be able to handle the overload of people that is inevitably coming in the near future.

It is worth noting that three major directions of the development of such systems are as follows:

- Development of decision support systems for control, monitoring and fault diagnosis of water distribution networks,
- Development of management support systems for maintenance and reliability of components of such networks,
- Development of information systems for demand side management.

In many researches and innovation projects the special attention is paid to the application of GIS-based systems in creating useful tools⁶⁶.

As a result, these tools can be easily employed by technical and administrative staff e.g. for presentation of the analysis outcomes, for optimal selection of water routes, for analysis and optimization of operations of actuators (pumps, valves, etc.) and other devices. It should also be noted that numerical-hydraulic models of the network play the important role in management of water supply systems and they have become even more important

⁶³ F. SETA, J. SEN, A. BISWAS, A. KHARE (EDS.), *From Poverty, Inequality to Smart City: Proceedings of the National*, SPRINGER, 2015; AA.VV. "Smart city and the applications", in: *Electronics, communications and control (ICECC), 2011 international conference on IEEE*, 2011; M. TAGHAVI, K. BAKHTIYARI, H. TAGHAVI, V. OLYAEE ATTAR, A. HUSSAIN, *Planning for sustainable development in the emerging information societies*, J. Sci Technol Policy Manage, 2014.

⁶⁴ E-Book: Successful US Water Management Strategies 2020

⁶⁵ Cf. in this context, S. ELIAS BIBR, *On the sustainability of smart and smarter cities in the era of big data: an interdisciplinary and transdisciplinary literature review*, Journal of Big Data, 2019; also G. PIRO, I. CIANCI, L.A. GRIECO, G. BOGGIA, P. CAMARDA, *Information centric services in smart cities*, Syst. Softw., 2014.

⁶⁶ J. KARWOT, J. KĄŻMIERCZAK, R. WYCZÓŁKOWSKI, W. PASZKOWSKI, P. PRZYSTAŁKA, *Smart water in smart city : a case study*, June 2016, Conference: SGEM 16th International Scientific Conference on EARTH&GEOSCIENCES, Albena, 2016.

and valuable assets for such systems. Hydraulic models can be applied for solving different tasks such as the planning of short, medium and long-term investments, the analysis and optimization of the performance of the sections of water mains, and the prediction of maintenance operations and repairs that require temporal changes of the water flowpath.

As a very important element for the efficient execution of tasks concerning water and wastewater, the operation of water and sewage companies has to be considered. The functioning of it is determined by many factors, including:

- Pressure from external stakeholders on cost optimization of processes of water supply for the population and receiving, municipal sewage treatment,
- Shrinking resources of drinking water and the need to diversify sources of supply, or the search for methods of rational management of current resources in situations of shortages,
- The extent of distribution of water supply systems especially in urban areas with diverse specifics of field, building, social aspects, etc⁶⁷.

B) Smart cities and smart water

In particular, the following important aspects of task management support are assumed to be taken into consideration: 1) broad monitoring, network control and diagnostics; 2) network maintenance and operation; 3) issues related to the interaction of media supplier with end-users.

The idea found its roots in combining the Intelligent Building with the model of Smart City with a special attention paid for the problem of various networks (water and sewage, gas, electricity, heat), which are the infrastructural backbone of the urban space.

A recent research on the Water Management in Silesia (Poland) called *Smart Water In Smart City: a case study*, has produced interesting results on the application of IA and technologies on the management of water resource⁶⁸.

According to this study the value of the integration between IA and smart technologies in the context of the water management will lead to a coherent methodology for the construction of an integrated support system, consisting of methods that meet the growing needs and expectations, for example using capabilities of complex measurement systems, offering expert support in the ongoing operation (especially in crisis situations) and in medium-

⁶⁷ FAO, *Wastewater characteristics and effluent quality parameters*, available on <http://www.fao.org/3/T0551E/t0551e03.htm>.

⁶⁸ J. KARWOT, J. KAŻMIERCZAK, R. WYCZÓLKOWSKI, W. PASZKOWSKI, P. PRZYSTAŁKA, *Smart water in smart city : a case study*, op.cit..

and long-term horizon, introducing (and leveraging) business interactions with end users⁶⁹.

The study observed that creating a smart environment for the protection and management of water resource had achieved the following goals:

- Development of a comprehensive method of water distribution management,
- Support of operational decisions using expert knowledge,
- Utilization of an online platform to interact with various stakeholders⁷⁰.

The solution will be verified by cooperation and verification of its performance under quasi-real conditions in selected subnetworks of Water and Sewage Company in Silesia Region⁷¹.

The initiators planned to achieve the following results: to develop a methodology of building support systems for managing a water supply network; to develop methods for operations support systems in water distribution systems having the character of an expert systems; to develop a platform to interact with end users that provides individual customer information⁷².

At the same time, the implementation is aimed at making savings on water losses, costs of maintenance operations and more accurate planning of repairs and investments.

CONCLUSIONS

As clearly stated before, the European Commission considers urgent that EU Member States focus on eco-compatible growth and make the use of resources, including water resources, more efficient and sustainable in order to overcome the current economic and environmental crisis⁷³.

To adapt to climate change is necessary to increase the possibility of strengthening the competitiveness and growth of the European water sector⁷⁴.

The eco-compatible growth has good prospects for development and employment growth also in other sectors connected to the

⁶⁹ *Ibidem*.

⁷⁰ *Ibidem*.

⁷¹ *Ibidem*.

⁷² *Ibidem*.

⁷³ See also, Brussels, COM(2009) 147/4 - Adapting to climate change: Towards a European framework for action, available on:

https://ec.europa.eu/health/ph_threats/climate/docs/com_2009_147_en.pdf;

European Commission Decision C(2019)4575 of 2 July 2019 - Horizon 2020 Work Programme 2018-2020 12. Climate action, environment, resource efficiency and raw materials available on:

https://ec.europa.eu/research/participants/data/ref/h2020/wp/2018-2020/main/h2020-wp1820-climate_en.pdf

⁷⁴ Restoring EU competitiveness, 2016 version, available on:

https://www.eib.org/attachments/efs/restoring_eu_competitiveness_en.pdf.

For example, in Italy, the water sector includes 9.000 small and medium-sized active companies and counts.

water sector, in which innovation can increase operational efficiency⁷⁵.

Research at European level has taken up the challenge and the scientific water community is committed to rapidly developing and transferring management solutions that could make our cities more liveable and could reduce the negative pressures on the availability of good quality water for human uses.

It is important to develop a regulatory and legislative approach that does not settle for damage-repair dynamics but an approach aimed at prevention and planning directed towards two contexts: procurement and recycling-reuse.

The challenge is to create an integrated city/countryside model that does not impoverish and impoverish resources.

In this context the most emblematic cases are those of the management of the Aral Sea and the case of the rivers in China, in particular the Beijing Guanting, and the Yangtze⁷⁶.

So, we need to rethink our environment and our way of use of water resource as an opportunity to rethink the relationship between man and natural space.

In this framework it is necessary to try to carve out a living and living space for the human being that is not antithetical to nature, but that integrates it and protects it.

We need also to rethink our cities also trying to find a space that can create a green/blue belt that guarantees water supply on the one hand and pollution prevention on the other hand.

⁷⁵ A. MASSARUTTO, *La riforma della regolazione dei servizi idrici in Italia L'impatto della riforma: 1994-2011*, Research Report n. 9 January 2012, IEFE - The Center for Research on Energy and Environmental Economics and Policy at Bocconi University; also G. MURARO, *La gestione del servizio idrico integrato in Italia, tra vincoli europei e scelte nazionali*, Mercato Concorrenza Regole, fasc. n. 2/2003; AA.VV., *Infrastrutture e servizi a rete tra regolazione e concorrenza. Le infrastrutture idriche*, Astrid, 2008; also L. ARNAUDO, *Gestione giuridica delle acque e concorrenza nei servizi idrici*, in Mercato Concorrenza Regole, 2003.

⁷⁶ J. DIAMOND, *Collapse: How Societies Choose to Fail or Succeed*, Penguin Books, 2011.