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The paradox of the modernisation of urban water systems in Europe: Intrinsic institutional limits for sustainability

Thomas Bolognesi

Abstract

This article assesses the sustainability potential of the urban water systems in Europe (UWSE) following their modernisation. A decade after implementation and close to the first deadlines, modernisation efforts seem to have not been (totally) successful. This article examines the ability of governance to achieve sustainability and poses the question of how modernisation develops a particular “terrain” more or less favourable to sustainability. We use the Institutional resource regimes framework which has been dedicated to determining the potential for sustainability of natural resources regulation. Conclusions show that the modernisation of UWSEs offers a path for progress which though necessary is insufficient due to a lack of coherence between policy design and the regulatory system. Globally, the development of regulation goes hand in hand with increasing inconsistencies that reduce the efficiency of the reform.

Keywords: Water management; cities; Europe; governance; sustainability; institutional economics.

1. Introduction

The modernisation of the urban water sectors in Europe (UWSE) provides an example of a regulation/re-regulation process implemented within an institutional framework. Because of a strong environmental constraint on the governance process, it lies at the intersection of governance and sustainability.

At the beginning of the 1990s, policymakers assessed the malfunctions of UWSE: they are a strong budgetary burden for municipalities, the quality of the resource is low, the service provision is not efficient enough, etc. So, policymakers agreed to modernise UWSEs in order to attain more sustainable outcomes (European Commission, 2003; Gee, 2004). The European Water Framework Directive (WFD) states that, “The purpose of this Directive is to establish a framework for the protection of inland surface waters, transitional waters, coastal waters and groundwater which: promotes sustainable water use based on a long-term protection of available water resources” (art. 1.b) and “the provision of the sufficient supply of good quality surface water and groundwater as needed for

sustainable, balanced and equitable water use” (art.1.e). The modernisation of UWSEs is based on three pillars: streamline public command; resort to market mechanisms; and take account of environmental constraints so as to take sustainable paths (Kallis and Butler, 2001; Barraqué, 2003, 2012; Wright and Fritsch, 2011).

Thus for two decades, the institutional framework of UWSEs has been evolving, but a gap between expected and observed results has appeared. Objectives in terms of good ecological status will not be attained. In France, 45% of surface waters are in good ecological status whereas the target is 64.3% (European Union, 2013). In Germany, the level of exemption ups to 79.3% (European Environment Agency, 2012). These data highlight the difficulties to attain good ecological status; similar problems are observed with the quality of infrastructure: underinvestment, leakages, etc. (Ofwat, 2009; BDEW, 2011; Bolognesi, 2014). As H. Benn, the Secretary of State for Environment, Food & Rural Affairs, says “We still have environmental water quality problems, an ageing infrastructure, and an unsustainable supply-demand balance in certain parts of the country” (Water UK, 2008:4).

A decade after implementation and close to the first deadlines, modernisation efforts seem to have not been (totally) successful. The question is why and leads us to examine the effectiveness of these changes. This article focuses on the ability of governance to achieve sustainability in a particular sector which represents an

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increasing interest in institutional economics (Vatn, 2005; Jordan, 2008). For the most part, the starting point of the literature is the limits of the modernisation; however understanding why modernisation stumbles on sustainability concerns is relevant to policy formation and reformation, with a view to further improving UWSEs governance (Ostrom *et al.*, 2007, Pahl-Wostl *et al.*, 2010; Ferguson *et al.*, 2013).

Because each country's water system is a complex socio-ecological system oriented by polycentric governance, its modernisation is analysed in term of "potential for sustainability". This article deals with policy at the European level only, and this level contributes to building the context of each of the UWSE, after the rules are locally interpreted and implemented (Ostrom, 1990). Consequently, it seems salient to consider that the process of modernisation develops a particular "terrain" which is more or less favourable to sustainability. Hence the modernisation of UWSEs at the European level allows for sustainable practices to be implemented by local actors.

The institutional resource regime (IRR) framework has been developed with a view to determining the potential for the sustainability of the regulation of natural resources (Kissling-Näf and Kuks, 2004; Knoepfel, 2007; Gerber *et al.*, 2009; Garin and Barraqué, 2012). IRR questions the sustainability of the management practices used for a resource and its related goods and services. This interpretive framework provides us with a typology of natural resource governance systems based on their coherence and their extent. Then, we use the framework to determine the capacity of a regime to develop its sustainability potential. The IRR framework appears very relevant because it combines public policy analysis and institutional economics specific to the study of natural resources management. This combination allowed the holistic approach that is needed to deal with the modernisation of UWSE.

UWSEs cover the interactions between stakeholders in the urban water cycle (drinking water and sewerage) and the institutions that coordinate them (Bolognesi, 2014). By dealing with property rights and public policies, this approach puts the institutional dimension of governance at the heart of the system. The IRR approach favours the determination of what degree of UWSEs modernisation leads to a form of governance conducive to producing a sustainable path. Results of the analysis show that the norms in place for the modernisation of UWSEs do not lead to the necessary changes in urban water management that would achieve a sustainable process. This pessimistic assessment is based mainly on the observation of a lack of coherence in UWSEs. Therefore, we support that this contradiction between the development of regulation and the inability to achieve a sustainable path reveal a paradox in the UWSEs modernisation.

The present article is divided into four parts. The first section presents the IRR framework. Then, the

modernisation of UWSEs is characterised. In the third section we show how the modernisation limits the sustainability potential of UWSE, demonstrating the working paradox.

2. IRR research programme: Combining public policy analysis and economic institutionalism

2.1. Objective of IRRs from the perspective of positive economics: Identification of ways of regulating a natural resource

An IRR is primarily dedicated to identifying the governance mechanisms at work in regulating a natural resource. The framework addresses the formal rules, focusing on public policies and the structure of property rights (Kissling-Näf and Kuks, 2004; Knoepfel and Nahrath, 2005; Gerber *et al.*, 2009). The work of the French Development Agency, using data on national institutional profiles, confirms the relevance of restricting the analysis to the formal rules by showing the high degree of formalisation of the OECD countries' regulation systems (Meisel and Ould-Aoudia, 2007).

An IRR is a means of governance of natural resource use in a defined territory. Public policies and property rights are brought together in the two components of an IRR, the policy design and the regulatory system. The weight of the two components in the regulation structure varies from one IRR to another, making it possible to distinguish between regimes that are organised essentially through the structure of property rights and those for which public policies are the main means of coordination.

In the context of IRRs, public law is considered to be the formal manifestation of public policies. Policy design helps define use rights for the resource. The first design is the least sustainable and "confines itself to reasoning in terms of limiting the emission of pollutants" [*Trans.*] (Knoepfel and Nahrath, 2005:207). The second design attributes the objective of sustainable development to environmental policies: this involves reconciling the economic, ecological and social requirements relating to a resource and is limited to the qualitative dimension. A third design was proposed in order to genuinely coordinate resource uses in a sustainable manner. Gerber *et al.* (2009) maintain that the effectiveness of environmental policies hinges on the distinction between resource sustainability and resource use. We refer to this third design as "distinctive sustainable policies".

The second component of an IRR, the regulatory system, groups together the formal property rights over the resource as well as the resulting use and disposal. Roman law distinguishes between right of disposal and right of use (*usus*, *abusus*, *fructus*). The right of disposal, (right to sell, *abusus*) applies to the transfer of the resource, while *usus* refers to the right of use and the prerogatives relating to the modification of the resource contained in the *abusus*.

Private law is a formal manifestation of the rights of the regulatory system. Thus, property rights come from the regulatory system while use rights are jointly defined by the regulatory system and policy design (in general, public policies limit or refine the use rights allocated).

IRR governance is a combination of these two components. By distinguishing between possible combinations, four different ways of regulating resources can be identified (Knoepfel and Nahrath, 2005; Gerber *et al.*, 2009) based on the impact of the policy design and the regulatory system on property and usage rights. Type 1 regulation has no impact on the system of rights and essentially involves the creation of incentive mechanisms. Type 2 has a limited impact on the structure of rights through the use of *ex post* specifications or restrictions on the allocation of rights. Type 3 modifies the breadth and content of rights through a redefinition of the institution of formal property, for example, via an amendment to the civil code. Type 4 procedures redefine the allocation structure of property titles, for example through privatisation.

2.2. Objective in terms of normative economics: Definition of an integrated IRR for sustainable governance

IRRs stand on the realistic assumption that the sustainability potential of a system depends on its policy design and its regulatory system. Hence, the procedures for explaining the effectiveness of governance are logically structured around three analytical steps: identification of the scope of an IRR; its classification; and the formulation of hypotheses linking the characteristics of an IRR to its sustainability potential.

The notions of “extent” and “coherence” define the scope of an IRR. The extent refers to the number of goods and services regulated by an IRR at any given time. To evaluate it, these goods and services have been listed for different natural resources, including water (Knoepfel *et al.*, 2001). The ratio between the extent observed and all the goods and services used gives the relative extent of the IRR. When the ratio is less than 1, it indicates the possibility of non-regulated rivalries, whereas a ratio greater than 1 suggests over-regulation. The coherence of an IRR relates to the content of the different sources of regulation of an IRR and the coordination between them (Gerber *et al.*, 2009). Three forms of coherence may be distinguished: coherence within the policy design ensures compatibility between its elements, on the one hand, and between the different public policies on the other; coherence within the regulatory system means that property rights are clearly defined and non-contradictory; and external coherence reflects a satisfactory link between the two components of the IRR, for example, correspondence between target groups and holders of rights under the regulatory system.

Based on an IRR’s extent and level of coherence, we can distinguish four possible IRR forms: non-existent; simple;

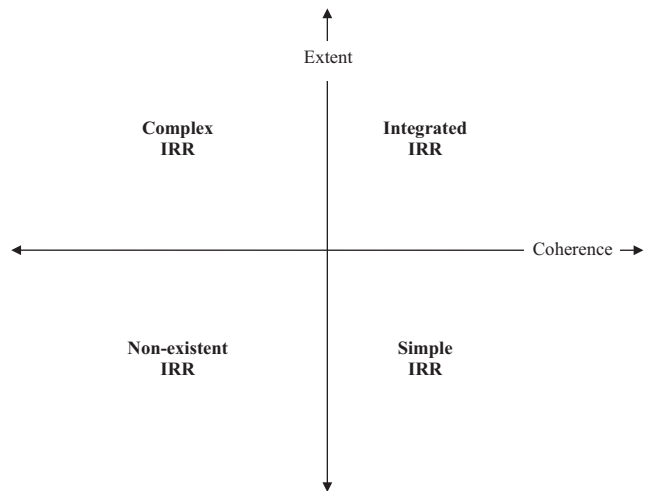


Figure 1. Typology of IRRs according to extent and coherence.
Source: Gerber *et al.* (2009:806).

complex; and integrated (Gerber *et al.*, 2009) (Figure 1). A non-existent IRR indicates the absence of any form of usage regulation for the resource. A simple IRR reflects emerging regulation for a resource, where only a limited number of goods and services (among those actually used) have so far been regulated but in a coherent manner (reducing the sources of incoherence). An IRR becomes complex when most of the goods and services used are regulated but in a way that is not very coherent. Finally, an integrated IRR indicates the coherent regulation of all the goods and services used. Empirical evidence shows this form occurs most often when regulation is public or is administered by a powerful stakeholder representing collective interests (Knoepfel and Nahrath, 2005). Each IRR studied is classified according to this typology.

Assumptions may be made as to the causality between the extent and coherence of an IRR and the potential for sustainability (Gerber *et al.*, 2009).¹ The first inference suggests that the move towards an integrated form increases the potential for sustainability and leads to two sub-inferences, each specific to the extent and coherence of the IRR. The second assumption relates to the evolution of an IRR. It establishes a positive causality between the level of threat to a resource, its perception as an issue of collective

¹ In our opinion, and based on the epistemology of Lakatos (1978), these inferences constitute both a cornerstone and a stumbling block of the research programme, a cornerstone because they establish the originality and the major contribution of the corpus, and a stumbling block because, given that these deductions are not explained, the normative and predictive objective of the IRRs appear unstable. However, experience has neither refuted the conclusions nor falsified the research programme. This therefore enables us to use IRRs with caution. The apparent shortcomings of the research programme are a reflection of its relatively recent beginnings and indicate that it is still maturing, whereas the development of it as a positive heuristic constitutes a major element in its future progression.

Table 1. Main laws and regulations concerning water standards enacted at European level

Text	Year	Subject
Generation 1		
European Water Charter	1968	1st European instrument dealing with water
Directive 75/440/EEC	1975	Surface water
Directive 76/464/EEC	1976	Dangerous substances
Directive 80/68/EEC	1980	Groundwater
Directive 80/778/EEC	1980	Quality of water intended for human consumption (revised by 98/83/EC)
Generation 2		
Directive 91/271/EEC	1991	Urban waste water
Directive 91/462/EEC	1991	Guidelines for a pan-European water resources management policy (supply and quality)
Directive 91/676/EEC	1991	Nitrates from agricultural sources
Recommendation 1224	1993	Protection and management of fresh water resources (this originated in the Freshwater Europe action programme)
Recommendation 1232	1994	Water resources and agriculture
Generation 3		
Directive 96/61/EC	1996	Integrated pollution prevention and control
Directive 98/38/EC	1998	Quality of water intended for human consumption
Resolution 1222	2000	Water resources and agriculture
Recommendation 1471	2000	Link between science and technology to balance supply and demand, especially in the Mediterranean basin.
Directive 2000/60/EC	2000	Water Framework Directive (amended by decision 2455/2001/EC and directives 2008/32/EC; 2008/105/EC; 2009/31/EC)
European Water Charter	2001	European water resources charter (replacing charter of 1968)
Directive 2004/17/EC	2004	Public procurement in the water, energy, transport and postal services sectors
Directive 2006/7/EC	2006	Quality of bathing water
Directive 2006/11/EC	2006	Pollution caused by certain dangerous substances
Directive 2006/118/EC	2006	Protection of groundwater
Directive 2007/60/EC	2007	Assessment and management of flood risks
Directive 2008/105/EC	2008	Environmental quality standards
Directive 2010/75/EU	2010	Industrial emissions: Integrated pollution prevention and control

Source: Author's elaboration.

action and, consequently, the expansion and greater coherence of the IRR.

Accordingly, UWSEs are not integrated and their modernisation is not able to assure their integration. To demonstrate this hypothesis, we carry out a comparative analysis (synchronic and diachronic) of UWSEs. The diachronic analysis shows the structural evolution of the governance of UWSEs further to their modernisation. Complementary to this, the synchronic analysis relies on the studies defining a European model of water management and identifying its constituent parts in terms of national variations (Correia, 1998; Kissling-Näf and Kuks, 2004; Finger *et al.*, 2007; Grossi *et al.*, 2010; Ménard and Peeroo, 2011). Variations of the European model are diverse. From the less modernised to the more modernised, models of national variations rank: German, French and English.

The existing literature characterises the impacts of modernisation reform that are common to all UWSEs. We focus on the modernisation characterisation (excluding very normative papers) taking a two-pronged approach. First, European literature is examined for the content of the reform. Green and white papers, communications and directives are analysed. Second, academic literature which deals with the evolution of water regulation is considered. Articles come from different disciplines, but mainly economics and politics (Kallis and Butler, 2001; Kaika,

2003; Kissling-Näf and Kuks, 2004; Lorrain, 2005; Finger *et al.*, 2007; Allouche *et al.*, 2008; Grossi *et al.*, 2010; Ménard and Peeroo, 2011). The principal limit of this literature review is that local implementations are not taken into account, even where national reports are considered. Whereas it does not interfere with our main purpose, it would motivate further research.

3. UWSEs modernisation: Technical standardisation and liberal governance

European regulation is becoming an increasingly significant factor in national water rights in EU countries and is thus one of the main components of UWSEs management. This regulation was formally introduced on 6 May 1968 with the first European Water Charter and has undergone several phases in its development (Table 1).² It is necessary to go back to the first European acts of UWSEs regulation, since comparing current regulation with previous generations of regulation and analysing its development enables us to

² All normative and preparatory acts and those relating to water management and protection in Europe can be accessed via <http://eur-lex.europa.eu/search.html?qid=1406279648969&text=water%20management&scope=EURLEX&type=quick&lang=en> (Last accessed 25 July 2014).

Table 2. Comparison between the three different chronologies of European water regulation

	Kallis and Butler (2001)		Kaika (2003)		Allouche <i>et al.</i> (2008)	
	Date	Content	Date	Content	Date	Content
Phase 1 Emergence	1973-1986	- Harmonisation - Environmental protection	1975-1990	- Water quality	1973-1988	- Protection of water for use
Phase 2 Development	1987-1992	- Environmental protection - Control of pollution	1991-1996	- Emissions limitation	1988-1995	- Specific measures - <i>Command and control</i>
Phase 3 Modernisation	1993	- Environmental protection - Deregulation - Subsidiarity	February 1996	- IWRM	1995	- IWRM

Source: Author's elaboration.

characterise the modernisation process so we may then explain its limitations. The literature refers to three generations of European regulation of water resources and associated activities (Kallis and Butler, 2001; Kaika, 2003; Allouche *et al.*, 2008). Depending on the authors, the delimitation of each of these generations varies. In each case, the modernisation of UWSEs corresponds to the third generation, the first being the emergence and the second the development (Table 2). Kallis and Butler (2001) adopt a politico-administrative perspective, and the periods match the history of European planning as well as at the evolution of the different collective objectives and targets of the policy design. Kaika focuses on the legislative rhythm; the three generations are determined by the rules which indicate a turning point in the legislation. The study by Allouche *et al.* (2008) is based on the European research programme Euromarket (2003-2005) and extends the research to the present day. It considers both the planning rhythm and paradigmatic evolution of the regulation. In this approach, European regulation can be divided like as: [1973-1988]; [1988-1995]; [1995-present day]. The third generation represents the modernisation period discussed in this article.

During the first generation, the European Union introduced rules aimed at controlling the quality of the resource and limiting the impact on uses, mainly through drinking water standards and pollution thresholds. This type of regulation controls the immission of polluting substances,³ and aligns with two of the European political objectives of that time: harmonisation of environmental rules, with a view to facilitating trade in particular, and protection of public health (Kallis and Nijkamp, 2000). The rules resulting from the second generation continued this effort and completed it by dealing directly with the sources of pollution and targeting specific sectors (urban water, etc.). Regulation took the form of a command and control system focusing then on the sources of emissions that

degrade the resource. This pollution control was aimed at meeting environmental protection objectives and not simply with protecting uses. It should be noted that these two generations of regulations are anthropocentric, even though the second leaves a little more room for environmental concerns (Euromarket, 2003).

The third and current generation of regulation represents a paradigm shift with respect to the preceding periods. Rather than continuing to manage the resource and its uses in a selective and sector-based manner, the EU began to promote integrated water resources management (IWRM). The objectives remain environmental but achieving them must remain compatible with the development of human activities (Kaika, 2003; Allouche *et al.*, 2008; Petersen *et al.*, 2009). As an illustration, the European Water Framework Directive (WFD) states that “The purpose of this Directive is to establish a framework for the protection of inland surface waters, transitional waters, coastal waters and groundwater” (art. 1). The implementation of means to achieve sustainable development is at the heart of this generation of regulations, and the WFD spells out the fundamental principles. It appears that economic incentives are increasingly used whereas the observation of operators’ performance is more systematic. Information plays a central role in this generation, and this system becomes more transparent.

This generation reveals a change in European regulations in both substance and form. European regulations on water first developed in response to specific problems as they arose (agriculture, quality, technology, urban water, etc.) and then procedural rules were proposed to address them (Table 3). Following this stage, an effort was made to link the different problems so that a holistic approach to water management could gradually be put in place. The policy design of the first and the second generation of regulation are mainly constituted by classical policies, whereas the third generation is based on distinctive sustainable policies. As an illustration, in 1991, Directive 462 drew up guidelines for pan-European water management which were followed by sectoral recommendations, such as recommendations 1224 and 1232 in 1993 and 1994, dealing respectively with resource protection and water and

³ “Immission” refers to the concentration of pollutants in the water, whereas “emission” refers to the action of diffusing pollutants in the water. In the first case, emphasis is on the host environment of pollutants; in the second, it is their source.

Table 3. Evolution of UWSEs regulation

	Phase 1	Phase 2	Phase 3
Aims	<ul style="list-style-type: none"> - Control on quality - Limitations of uses' impacts - Harmonisation of environmental policy in EU - Protection of public health 	<ul style="list-style-type: none"> - Pursue and strengthen Phase 1 - Environmental protection 	<ul style="list-style-type: none"> - Sustainable development - Rationalisation
Tools	Immission rules : <ul style="list-style-type: none"> - Drinking water standards - Pollution thresholds 	<ul style="list-style-type: none"> - Immission rules - Emission rules - Specific targets: sources, sectors, etc. - Command & control 	<ul style="list-style-type: none"> - Immission rules - Emissions rules - IWRM - Market mechanisms
Policy design	Classical policies	Classical policies	<ul style="list-style-type: none"> - Sustainability policies - Distinctive sustainable policies - Privatisation - Liberalisation
Regulatory system			
Type of IRR	Simple	Complex	Complex

Source: Author's elaboration.

agriculture. Again in 1991, the Urban Waste Water Treatment Directive (UWWTD) imposed obligations regarding the collection and treatment of wastewater and acted directly on the management of UWSEs. In 2000, the WFD introduced new water management principles in Europe and became the main element in the third phase of the development of European regulations. Its novelty lies in the assumption of a positive correlation between methods of governance, in particular those recommended by new public management (Ventriss, 2000), and protection of the environment. However, the directive evolved as a function of the constraints observed during implementation and was amended in 2001, 2008 and 2009.

In this article, we examine how the paradigm shift brought about by the third generation of regulations is providing impetus to the modernisation of UWSEs. In this respect, among all the rules promulgated, the WFD is of a paramount importance and is in line with an anthropocentric approach to sustainable development; it protects the resource both qualitatively and quantitatively, without neglecting economic efficiency. This ambition to integrate the three pillars of sustainable development is reflected in the essential principles of the directive, such as integrated management based on river basins, attainment of good ecological status, and incentives to set up public-private partnerships (PPP). In addition, the WFD also breaks with the old European standards concerning methods of regulation. As illustrated by the objective of attaining good ecological status for the resource, management results remain important, but now management procedures are also imposed and recommended, such as implementation of the "polluter pays" principle (Moss, 2004). The modernisation of water management practices promotes a form of water governance that is no longer concerned only with protection of the resource and its uses.

The WFD supports a certain form of governance which is not in accord with the classical organisation of natural

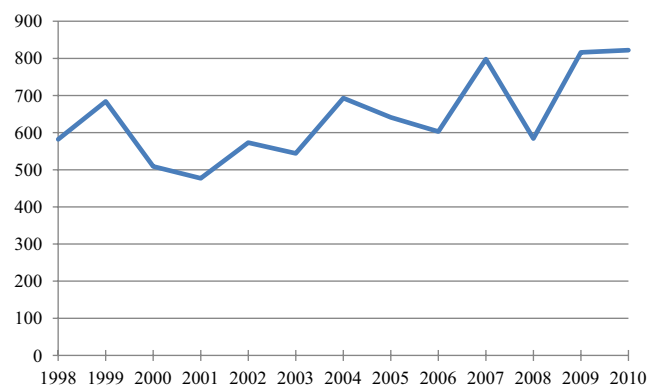


Figure 2. Evolution of competitive bidding in France.

Source: Canneva *et al.* (2013).

monopolies (mainly public). Economic incentives and market mechanisms are more often used to organise management of the sector. As an example, article 9.1 of the WFD states that "water-pricing policies provide adequate incentives for users to use water resources efficiently, and thereby contribute to the environmental objectives of this Directive". Moreover, in different communications (1999, 2003, 2010), the European Commission highlights that modernisation of the water sector is a continuation of the movement that began in the 1900s to liberalise all network infrastructures. Thus, this third generation of regulation is characterised by liberalisation, privatisation and rationalisation of governance process (Finger *et al.*, 2007; Ménard and Peeroo, 2011). For example, in France, competitive bidding (Sapin procedure) increased by more than 30% between 1998 and 2010 (Figure 2). As a result, the modernisation of UWSE, and the WFD, limits the possibility for a solely public management and supply of UWSEs and contributes to the division of property rights and the de-integration of the supply chain of UWSE.

UWSEs modernisation is based on both a multitude of technical standards that ensure the preservation of the

Table 4. The two dynamics of expansion contained in the modernisation of UWSEs

	Expansion through regulatory measures	Self-organisation expansion
Definition	Increase of binding rules issued by public authorities	Increase of rules related to the implementation of governance principles
Sources	<ul style="list-style-type: none"> - Public intervention (welfare state) - Control on UWSEs economic activity 	<ul style="list-style-type: none"> - Implementation of coordination conditions different from authority
Operating mechanisms	<ul style="list-style-type: none"> - Formulation of technical standards, etc. 	<ul style="list-style-type: none"> - Property rights formalisation - Contractual coordination
Types of regulation concern	Type 2	<ul style="list-style-type: none"> - Type 4 (for the most part) - Type 1
Source in the institutional polycentrism	<ul style="list-style-type: none"> - Institutional environment - Legal structure 	<ul style="list-style-type: none"> - Organisational structure - Water markets
Impact on extent	Absolute extent	Relative extent: uses require existence of specific rules
Examples	<ul style="list-style-type: none"> - Prescriptions relative to the evacuation of wastewater by sewage works (UWWTD 1991/271EEC, Appendix II) - Procurement procedures of entities operating in the water sector (Directive 2004/17/EC) 	<ul style="list-style-type: none"> - Sharing of responsibilities and property in contracts - Specific modalities of contractual renegotiations

Source: Author's elaboration.

resource and protection of its uses, and on a set of rules favouring the privatisation and liberalisation of the sector so as to improve the efficiency of governance. This modernisation may be seen as the combination of the pursuit of environmental objectives (protection and preservation) and rationalisation of the governance process (privatisation and liberalisation). The process gives impetus to two dynamics of urban water management in Europe: an increase in standardisation and a liberal approach. By reconciling these two dynamics, the European authorities hope to organise the sustainable management of urban water resources.

This is the common basis for the European model of water management, even though intra-European diversity may also be observed (between the German, French and English models). This diversity takes the form of variations of the European model and is reflected in the different institutional forms observed in the implementation of these shared principles (Finger *et al.*, 2007; Ménard and Peeroo, 2011). Two factors explain the polymorphism of the European water management model: the different legal backgrounds of the countries concerned and the variety of definitions/perceptions of a public utility (Lorrain, 2005).

4. The limited sustainability potential of UWSEs: Complex IRRs

Identification of the scope of UWSEs helps evaluate their potential for sustainability. Extent appears large whereas coherence is insufficient.

4.1. Modernisation as a step towards sustainability: A factor in the expansion of UWSEs

By interpreting UWSEs modernisation via the analytical framework presented earlier we conclude that the extent of

the UWSEs is large and that two different processes are at the origin of this large coverage (Table 4). The first process relates to the classic development of technical standardisation, which we refer to as *expansion through regulatory measures*. The second process concerns the change in the form of urban water supply services, which we qualify as *self-organisation*. Expansion through regulatory measures is an increase of rules provision by public authorities aiming to orientate and constrain the operators' practices. These rules provide a framework for the various actors and ensure the quality of services provided and that they conform to European regulation. The self-organisation expansion is a mechanical increase of rules which results from and is necessary for the implementation of governance. It takes the form of an augmentation of formal property rights and contracts and represents the contingent specificity of an institutional arrangement.

Technical standardisation of water uses meant that the extent of UWSEs was increased as a result of the introduction of regulatory measures by state authorities (Type 2 regulation). This dynamic process stems from the multiplication of standards on processes, for both emissions and immissions, produced essentially by the public authorities with a view to regulating water uses and their impacts (Barraqué, 2003). The timeline of European regulations clearly delineates the direction taken by the regulatory process and the change in the actual purpose of the control measures. Originally, technical standards served as health objectives and, generally speaking, restricted the immission of polluting substances into the resource. Following this stage, an environmental objective to protect the actual resource, with corresponding emission standards, was introduced, leading to a further increase in extent. At the same time, the identification of particularly sensitive areas encouraged the creation of technical standards specific to targeted sectors, as illustrated in the tables of

the UWWTD in its Appendix. During the modernisation phase, the attempt to harmonise practices resulted in the emergence of procedural standards governing actual uses (obligation of water treatment techniques, for example) and no longer simply objectives in terms of results. In addition, the reason for control measures has also evolved. Increased market power and the presence of private actors in the supply of urban water services forced public authorities, in a more systematic manner, to supervise activity by means of standards in order to remedy any possible negative externalities and to maintain general interest in the resource.

The second dynamic that increases UWSEs regulation, *self-organisation expansion*, is a direct consequence of the application of the principles of governance incorporated in the modernisation process. Thus, modernisation gives impetus to two essential changes in UWSEs regulation methods: the encouragement given to PPP, and to privatisation in general, led to a redefinition of the allocation structure of property rights (type 4 regulation) the privatisation of English regional water authorities in 1989 being the most illustrative example; generalisation of the use of economic instruments with a view to “rationalisation” of management increased the importance of type 1 regulation in UWSEs governance. The modification in substance or form of these two types of regulation encouraged the liberal orientation of modernisation, as underlined in the first part. It attributes increasing importance to the market, but coordination through the market implies recourse to formal regulation.

Market trading requires first the existence and/or definition of property rights and then takes place by means of contracts drawn up between the stakeholders. Thus, we maintain that liberal regulation and market supply of urban water services essentially increases the goods and services formally regulated in UWSEs. In this sense, modernisation of UWSEs governance increases the extent of the IRR by its very nature. In particular, it results in a high relative extent since all the good and services used will be formally regulated by the market.

Knowing the vast extent of UWSEs allows us to better characterise them using the IRR typology and to provide an interim opinion for their sustainability potential. Among the four forms of IRR, only the complex and integrated types have a wide-ranging extent. UWSEs therefore belong to one of these two categories, and the forthcoming analysis of their coherence will enable us to determine which one. Inferring linkage between extent and sustainability, we may assume that modernisation exerts a beneficial effect on the sustainability of UWSEs by increasing their extent and ensuring at least a high degree of relative extent. Thus far, the coherence dimension is decisive in determining the overall sustainability potential that modernisation confers on the UWSEs.

4.2. Persistence of inconsistencies in regulation as a limit to integration of the IRR

Analysis of IRR coherence involves studying the coherence of policy design with the regulatory system, and their cross-coherence. To carry out this analysis, inconsistencies and malfunctions were identified. Ultimately, the results confirm that inconsistencies persist, despite the acknowledged attempts at harmonising European water management principles.

The regulatory system appears to be the most coherent component of UWSEs, which can be largely explained by the choice of study area. As pointed out in the opening remarks of section 2, European territories are particularly suited to an analysis in terms of IRRs thanks to the mostly formal regulation systems. This long tradition of coordination around property rights has made it possible to put in place a set of institutions and organisations capable of ensuring the coherence of the regulatory system in the IRR sense. The development of water systems goes hand in hand with the development of the rule of law and the public bureaucracy (Brousseau *et al.*, 2010). Nevertheless, it should be stressed that internal coherence of the regulatory system is not necessarily equivalent to stable and clear management at the time of interaction between stakeholders. Indeed, the multiplication of stakeholders also generates uncertainty in strategic areas and the possibility of conflict, but thanks to internal coherence such problems can be resolved. The analyses of Bakker (2000; 2010) on the privatisation of the English sector illustrate this remark, as does, in a more concrete fashion, the management of the 1995 drought in England. This drought revealed that the system of price-capping had not encouraged operators to invest sufficiently in infrastructure development so as to maintain the balance between supply and demand (Bakker, 2000). Later, the regulatory authorities and the State sent out new price signals to remedy this shortcoming.

The policy design of UWSEs modernisation suffers from more internal inconsistencies than the regulatory system. The two main indicators are the debate on how to attain good ecological status and, more generally, how to ensure the conformity of local management systems with European directives. The objective of achieving good ecological status of water by 2015, in which urban uses will play a major role, appears difficult to reach.⁴ Few countries attain a good ecological status for 50% of their surface water bodies, and more than 30% of bodies are exempt; this percentage of exemptions increases to a high of 96.1% in

⁴ All the reports of member countries of the European Commission are available at: <http://www.eea.europa.eu/themes/water/reporting-obligations>, last consulted 21 July 2014. For France, in particular, the reader may consult: <http://www.rapportage.caufrance.fr/>; for England: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/297275/LIT_8869_f916ba.pdf; for Germany: <http://www.umweltbundesamt.de/sites/default/files/medien/publikation/long/3771.pdf>.

Table 5. Classifying UWSEs as a complex IRR

	Low coherence	High coherence
High extent	<p>Complex IRR</p> <p>Impact of modernisation on UWSE:</p> <ul style="list-style-type: none"> - multiplication of formal rules (standards, contracts, etc.) - technical complexity - decentralisation and self-reliance of behaviors 	<p>Integrated IRR</p> <p>Inconsistent with the low coherence of UWSE:</p> <ul style="list-style-type: none"> - difficulties to implement multi-level governance - organisational frictions - mild and variable efficiency of incentives
Low extent	<p>Non-existent IRR</p> <p>Inconsistent with the high extent of UWSE:</p> <ul style="list-style-type: none"> - strong technical standardisation - property right formulation - multiplication of contractual relations 	<p>Simple IRR</p> <p>Inconsistent with the low coherence of UWSE:</p> <ul style="list-style-type: none"> - difficulties to implement multi-level governance - organisational frictions - mild and variable efficiency of incentives <p>Inconsistent with the high extent of UWSE:</p> <ul style="list-style-type: none"> - strong technical standardisation - property right formulation - multiplication of contractual relations

Source: Author's elaboration.

Belgium (European Union, 2013). In addition, scientists are voicing reservations on the methods of measuring efforts and the results achieved with respect to their rigour, diversity and comparability, with the classification of certain water bodies being re-examined (Hering *et al.*, 2010; Beniston *et al.*, 2012). And ensuring conformity with management methods recommended by the WFD is not always an easy matter (Wright and Fritsch, 2011), as we saw for example with a reticence towards privatisation in Germany. Thus, coordination between the different levels of UWSEs governance is characterised by malfunctions that reduce the coherence of the policy design for modernisation. Nevertheless, mention should be made of the European readjustments: the WFD has been amended three times, going so far as to bring more flexibility to external funding possibilities in the water sector.

The main sources of inconsistency in UWSEs lie at the interface of policy design and the regulatory system.⁵ All the differences between the States and the European Commission testify to these external inconsistencies. Representing about 20% of disputes, water is the subject of some of the most breached European environmental legislation (Keller, 2011). The United Kingdom (56) and Germany (57) have fewer infractions than does France (74), whereas Belgium has the worst record in the case study area with no less than 109 infractions reported in December 2010. To have an idea of the risks incurred, the penalties relating to French case C-280/02 concerning urban wastewater were estimated at several hundred million euros (Keller, 2007).

The development of standards complicates the provision of urban water services so much that it creates malfunctions

⁵ This is also because these inconsistencies are the most visible and identifiable.

in UWSEs. For example, between the 19th century and today, in France the number of drinking water standards has expanded from six to more than 60. This kind of increase is a major source of rising costs in UWSEs. The degree of coherence of UWSEs is not high, mainly because of the difficulty of organising a harmonious and multi-level policy. Members are therefore making a concerted effort to increase coordination among the different elements of UWSEs regulation, service quality vs. economic efficiency for example.

5. The paradox of modernisation: An intrinsic inability to integrate UWSEs

The scope of UWSEs, i.e., large extent and poor coherence, determines the type of IRR. The large extent eliminates the possibility of “non-existent” or “simple” types of IRR and the low level of coherence makes an “integrated” IRR unlikely. Consequently, the modernisation of water management in Europe is helping to shape UWSEs as “complex” IRRs (Table 5). The hypotheses relating to IRR sustainability suggest that complex IRRs are regulated by a governance system that does not maximise sustainability potential. Thus, as things stand, modernisation would not ensure that UWSEs develop with maximum sustainability potential. Consequently, both the positive and negative effects of expansion through regulatory measures and self-organisation on the sustainability of UWSEs must be explored.

Modernisation involves several trade-offs: expansion through regulatory measures increases the total amount of regulated goods and services, which directly improves the sustainability potential of the systems. However, it reduces this potential by making the system more complex. This

regulation through standards increases the technical complexity of supplying the services, which results in a reduction in system coherence. In addition to this technical aspect, ensuring conformity entails a financial cost that may threaten the internal coherence of the policy design and the external coherence of UWSEs. (This cost is not negligible since it represents the majority of the increase in costs for suppliers. It comes mainly from the introduction of sanitation standards and the increasing complexity of drinking water treatment procedures in order to comply with regulations.) Faced with these additional costs relating to technical standardisation, the supervision and rationalisation of governance processes stemming from procedural regulations reduce the sources of financing. The principles of full cost recovery and “water pays for water” are examples of this problem (Barraqué, 2003). Thus, while costs increase, financing possibilities decrease, and the question of investment in infrastructure becomes a major problem in UWSEs management (Bolognesi, 2014). There is therefore an area of friction between the technical component and the economic/institutional component of expansion through regulatory measures. This friction causes regulatory incoherence and eventually diminishes the sustainability potential of UWSEs. Moreover, expansion through regulatory measures reinforces the tension between the socio-environmental and economic objectives required to achieve a sustainable management system for UWSEs.

Self-organisation expansion has a similar effect on the sustainability of UWSEs. By recourse to property rights and contracts, it increases the extent of the system, ensures a relative extent that is at least equal to 1, and improves sustainability potential. This recourse, however, decreases UWSEs’ coherence because of the characteristics of coordination through the market, and reduces sustainability potential. Thus, the theory of institutional economics states that property rights and contracts are incomplete (Barzel, 1982; Brousseau and Nicita, 2010). This incompleteness implies an inability to take into account all the possible developments and changes in transactions and does not totally eliminate uncertainty. Coordination through the market does not eradicate *ex ante* uncertainty, such that contracts require readjustments, and safeguard mechanisms must accompany contracts and property rights. This uncertainty leads to difficulties in organising the different elements of regulation and is a hindrance to the achievement of IRR coherence.

It appears that the positive impact of expansion processes is counterbalanced by the appearance of inconsistencies that weaken the sustainability potential of UWSEs. In this respect, modernisation has a paradoxical effect on the sustainability potential of UWSEs. Modernisation increases the extent of UWSEs by expanding regulations and self-organisation, yet these two mechanisms generate inconsistencies and prevent the complete integration of UWSEs. Whereas it would appear that modernisation develops the sustainability potential of water management

in European cities by producing rules that add substance to system regulation, the costs of coordination associated with these rules do not seem to be taken into account. This paradox limits the sustainability potential of management systems for UWSEs.

By qualifying the modernisation of UWSEs as paradoxical, we suggest that the inability of the modernisation to integrate UWSEs is an essential quality of the method. Some modernisation tools prove to be incompatible with each other. Thus, this paradox leads us to consider that integration is not a spontaneous phenomenon and to question the IRR integration dynamics. In the case of the UWSEs modernisation, this is illustrated by an under-consideration of governance and of the reform process. Transaction and governance costs are not taken into account (Dixit, 2009). It seems that the expansions of UWSEs produce transaction and governance costs in excess of the costs that they reduce, thanks to the cost of regulating conflicts. As an illustration, the auto-organisation expansion generalises contractual incompleteness and moral hazard. It needs more safeguard mechanisms than those which are currently proposed. North (2005:28) states that “changing only the formal rules will produce the desired results only when the informal norms that are complementary to that rule change and enforcement [are] either perfect or at least consistent with the expectations of those altering the rules”. Therefore, we may assume that the relative inefficiency of the modernisation stems from the lack of linkages between the formal rules promoted and the UWSEs institutional environment.

6. Conclusion

The modernisation of UWSEs is characterised by an increase in technical standardisation and a liberal trend in governance. This article evaluates the capacity of this modernisation process to direct the UWSEs along a sustainable development path. With this aim in mind, the IRR framework is used to assess the sustainability potential of UWSEs according to their extent and their coherence. The analysis reaches two main conclusions: the first positive, the second negative.

The first conclusion is that UWSEs are considered complex IRRs. Modernisation allows *expansion through regulatory measures and self-organisation expansion* of UWSEs, which means that the extent is high and the coherence low. UWSEs’ modernisation is subject to malfunctions and does not manage to ensure a sufficient level of coherence to reach the status of an integrated IRR. The main sources of this low level of coherence are related to the coordination between policy design and the regulatory system, the prime cause of which is the difficulty of setting up a multi-level governance system. The literature shows that the costs of coordination could undermine the efficiency of a reform, as has been shown for specific public

policies taken independently from the rest of the governance process (Marshall, 2013; McCann, 2013). Beyond these points, our results highlight that considering interactions between different institutional tools is also crucial (Saleth and Dinar, 2008). Indeed internal coherence of each component of the UWSEs modernisation appears quite good and problems take place at the connection of each measure to another. There is a problem of synchronisation of the governance components, at the local level as shown by Teisman and Edelenbos (2011) but also at larger scale.

The second conclusion is that modernisation will not provide UWSEs with a guarantee of sustainable development. The complex status of UWSEs means that, according to the conjectures relating to IRRs, sustainability potential is limited. Admittedly, since the extent dimension is high, there is less chance of any unsettled conflicts over use, but the lack of coherence reduces the effectiveness of regulation resulting from implementation of public policies and of the property rights system. This result reinforces and fuels thoughts in terms of adaptive governance or transition management (Ostrom and Janssen, 2004; Pahl-Wostl *et al.*, 2010; Ferguson *et al.*, 2013). Moreover, it raises the more general question regarding the capacity of a governance system with a liberal tendency to ensure a sustainable supply of natural resource-based services of general interest (Ostrom, 2010).

References

- Allouche, J., Finger, M., Luis-Manso, P., 2008. Water sector evolution scenarios: the case of Europe. *Water Policy*, 10(3): 221-238.
- Bakker, K., 2000. Privatising water, producing scarcity: the Yorkshire drought of 1995. *Economic Geography*, 76(1): 4-27.
- Bakker, K., 2010. *Privatizing Water: Governance Failure and the World's Urban Water Crisis*. Cornell University Press, New York.
- Barraqué, B., 2003. Past and future sustainability of water policy in Europe. *Natural Resources Forum*, 27(3): 200-211.
- Barraqué, B. (Ed.), 2012. *Urban Water Conflicts*. UNESCO, Paris.
- Barzel, Y., 1982. Measurement cost and the organization of markets. *Journal of Law and Economics*, 25(1): 27-48.
- BDEW, 2011. *Profile of the German Water Sector*. BDEW, Bonn.
- Beniston, M., Stoffel, M., Harding, R., Kernan, M., Ludwig, R., Moors, E., Samuels, P., Tockner, K., 2012. Obstacles to data access for research related to climate and water: implications for science and EU policy-making. *Environmental Science & Policy* 17: 41-48.
- Bolognesi, T., 2014. Analyse structurelle des systèmes hydriques urbains en Europe: aspects organisationnels et défis patrimoniaux. *Revue d'économie industrielle*. In press.
- Brousseau, E., Nicita, A., 2010. How to design institutional framework for markets: new institutional economics meet needs of industrial organization. *Revue d'économie industrielle*, 129(1): 87-118.
- Brousseau, E., Schemeil, Y., Sgard, J., 2010. Bargaining on law and bureaucracies: a constitutional theory of development. *Journal of Comparative Economics*, 38(3): 253-266.
- Canneva, G., Bonnet, F., Duchesne, C., 2013. Remise en concurrence des contrats de délégation de service public d'eau potable et d'assainissement. Report of the Observatory of service public delegations, Agro Paris Tech.
- Correia, F.N. (Ed.), 1998. *Eurowater, Institutional Mechanisms and Elected Issues in Water Management in Europe*. Balkema, Rotterdam.
- Dixit, A., 2009. Governance institutions and economic activity. *American Economic Review*, 99(1): 5-24.
- Euromarket, 2003. Analysis of the European Union's explicit and implicit policies and approaches in the larger water sector", Euromarket, Final report, June. The European Commission Community Research, Brussels
- European Commission, 1999. Liberalisation of network industries economic implications and main policy issues. Reports and studies 4. Directorate-General for economic and financial affairs, Brussels.
- European Commission, 2003. Communication (2003) 270 final Green paper on services of general interest. *Official Journal of the European Communities* C76, 21 May. European Commission, Brussels.
- European Commission, 2010. Communication (2010) 2020 final from the Commission EUROPE 2020: A strategy for smart, sustainable and inclusive growth. Unpublished. European Commission, Brussels.
- European Environment Agency, 2012. European waters: Assessment of status and pressures", EEA Report 8. European Environment Agency, Copenhagen.
- European Union, 2013. *A Water Blueprint for Europe*. European Union, Luxembourg.
- Ferguson, B.C., Brown, R.R., Deletic, A., 2013. Diagnosing transformative change in urban water systems: theories and frameworks. *Global Environmental Change*, 23(1): 264-280.
- Finger, M., Allouche, J., Luis-Manso, P., 2007. *Water and Liberalisation: European Water Scenarios*. IWA, London.
- Garin, P., Barraqué, B., 2012. Why are there so few cooperative agreements between Farmers and water services in France? Water policies and the problem of land use rights. *Irrigation and Drainage*, 61(S1): 95-105.
- Gee, A., 2004. "Competition and the water sector", *Antitrust* 2(1) 38-40.
- Gerber, J.-D., Knoepfel, P., Nahrath, S., Varone, F., 2009. Institutional resource regimes: towards sustainability through the combination of property-rights theory and policy analysis. *Ecological Economics*, 68(3): 798-809.
- Grossi G., Marcou G., Reichard C., 2010. Comparative aspects of institutional variants for local public services provision. In: Wollmann, H., Marcou, G. (Eds.), *The Provision of Public Services in Europe*. Edward Elgar, Cheltenham, pp. 217-239.
- Hering, D., Borja, A., Cartensen, J., Carvalho, L., Elliott, M., Feld, C., Heiskanen, A.S., Jonhson, R., Moe, J., Pont, D., Solhein, A.L., van de Bund, W., 2010. The European Water Framework Directive at the age of 10: a critical review of the achievements with recommendations for the Future. *Science of the Total Environment*, 408(19): 4007-4019.
- Jordan, A., 2008. The governance of sustainable development: taking stock and looking forwards. *Environment and Planning C: Government and Policy*, 26(1): 17-33.
- Kaika, M., 2003. The Water Framework Directive: a new directive for a changing social, political and economic European framework. *European Planning Studies*, 11(3): 299-316.
- Kallis, G., Butler, D., 2001. The EU Water Framework Directive: measures and implications. *Water Policy*, 3(2): 125-142.
- Kallis, G., Nijkamp, P., 2000. Evolution of EU water policy: a critical assessment and a hopeful perspective. *Journal of Environmental Law and Policy*, 3: 201-355.
- Keller, F., 2007. Pilotage de la politique de l'eau", Information Report to the French Senate 352, 21 June. French Senate, Paris.
- Keller, F., 2011. Application du droit communautaire de l'environnement", Information Report to the French Senate 20, 12 October. French Senate, Paris.
- Kissling-Näf, I., Kuks, S. (Eds.), 2004. *The Evolution in Water Regimes in Europe: Transition in Water Rights and Water Policies*. Kluwer Academic Publishers, Dordrecht.
- Knoepfel, P. (Ed.), 2007. *Environmental Policy Analysis. Learning from the Past for the Future – 25 years of Research*. Springer, New York.

- Knoepfel, P., Kissling-Näf, I., Varone, F., 2001. *Régimes institutionnels de ressources naturelles: analyse comparée du sol, de l'eau et de la forêt*. Helbing & Lichtenhahn, Bâle.
- Knoepfel P., Nahrath S., 2005. Pour une gestion durable des ressources urbaines: des politiques de protection de l'environnement vers les régimes institutionnels de ressources naturelles (RIRN). In: A Da Cunha Antonio (Ed.), *Enjeux du Développement Urbain Durable: Transformations Urbaines, Gestion des Ressources et Gouvernance*. Presses Polytechniques et Universitaires Romandes, Lausanne. pp. 199-255.
- Lakatos, I., 1978. *The Methodology of Scientific Research Programmes*, vol. 1. Cambridge University Press, Cambridge.
- Lorrain, D., 2005. Urban capitalisms: European models in competition. *International Journal of Urban and Regional Research*, 9(2): 231-267.
- Marshall, G.R. 2013. Transaction costs, collective action and adaptation in managing complex social-ecological systems. *Ecological Economics*, 88(C): 185-194.
- McCann, L., 2013. Transaction costs and environmental policy design. *Ecological Economics* 88: 253-262.
- Meisel, N., Ould-Aoudia, J., 2007. A new institutional database: 'Institutional Profiles2006'. Working paper 46. IRD, Paris.
- Ménard, C., Peeroo, A., 2011. Liberalization in the water sector: three leading models. In: Finger, M., Kunneke, R. (Eds.), *Handbook of Network Industries*. Edward Elgar, London, pp 310-327.
- Moss, T., 2004. The governance of land use in river basins: prospects for overcoming problems of institutional interplay with the EU Water Framework Directive. *Land Use Policy*, 21(1): 85-94.
- North, D.C., 2005. Institutions and the performance over time. In: Menard, C., Shirley, M. (Eds.), *Handbook of New Institutional Economics*. Springer, Dordrecht, pp 21-30.
- OFWAT, 2009. *Service and Delivery-performance of the Water Companies in England and Wales 2008–09*. OFWAT, Birmingham.
- Ostrom, E., 1990. *Governing the Commons: The Evolution of Institutions for Collective Actions*. Cambridge University Press, Cambridge.
- Ostrom, E., 2010. Beyond markets and states: polycentric governance of complex economic systems. *American Economic Review*, 100(3): 641-672.
- Ostrom, E., Janssen, M., 2004. Multi-level governance and resilience of social-ecological systems. In: Spoor, M. (Ed.), *Globalisation, Poverty and Conflict*. Kluwer, Dordrecht, pp. 239-259.
- Ostrom, E., Janssen, M., Anderies, J., 2007. Going beyond panaceas. *PNAS*, 104(39): 15176-15178.
- Pahl-Wostl, C., Holtz, G., Kastens, B., Knieper, C., 2010. Analyzing complex water governance regimes: the management and transition framework. *Environmental Science & Policy*, 13(7): 571-581.
- Petersen, T., Klauer, B., Manstetten, R., 2009. The environment as a challenge for governmental responsibility — the case of the European Water Framework Directive. *Ecological Economics*, 68(7): 2058-2065.
- Saleth M., Dinar, A., 2008. Linkages within institutional structure: an empirical analysis of water institutions. *Journal of Institutional Economics*, 4(3): 375-401.
- Teisman, G.R., Edelenbos, J., 2011. Towards a perspective of system synchronization in water governance: a synthesis of empirical lessons and complexity theories. *International Review of Administrative Sciences*, 77(1): 101-118.
- Vatn, A., 2005. *Institutions and the Environment*. Edward Elgar, London.
- Ventriss, C., 2000. New public management: an examination of its influence on contemporary Public affairs and its impact on shaping the intellectual agenda of the field. *Administrative Theory & Praxis*, 22(3): 500-518.
- Water UK, 2008. *Sustainable Water. State of the Water Sector Report*. Water UK, London.
- Wright, S., Fritsch, O., 2011. Operationalising active involvement in the EU Water Framework Directive: Why, when and how? *Ecological Economics*, 70(12): 2268-2274.