
POLITICAL-ECONOMIC FACTORS INFLUENCING THE QUALITY OF WATER RESOURCES: REVIEW OF STUDIES INCLUDING EX-POST ANALYSIS

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Abstract

The following work corresponds to a summary of 20 publications from authors from different countries, and which are focused on the ex-post analysis of the influence of institutional, political and economic factors on changes in water quality and quantity. The analysis of each publication comprises a description of the problem and an identification of the methods used by the authors. The findings of the work show that institutional factors (understood here as such administrative measures as treaties, laws, directives, etc.) are identified as the main cause of changes in the quality of water. The methods used for ex-post analysis were mainly focused on the analysis of cost-effectiveness, cost-benefit and “peoples’ perception”. It is important to point out that just a few of these works actually explain the method used for the evaluation of environmental performance in terms of the quality of water.

Prefacio en Español

El presente trabajo corresponde a un sumario que comprende 20 publicaciones de autores de distintos países. Los trabajos incluidos se refieren a análisis ex-post que estudian la influencia de cambios en factores de índole económica, política e institucional sobre la calidad y cantidad del recurso natural “agua”. Esta recopilación presenta un resumen de cada publicación. Al final se incluyen las conclusiones y un apéndice conteniendo una tabla que reúne todas las publicaciones y datos sobre los resultados correspondientes a los cambios en el recurso agua, a los factores de influencia y los métodos utilizados para realizar el análisis ex-post. Entre las principales conclusiones cabe destacar la identificación de las instituciones (entendidas como medidas administrativas reflejadas por tratados, leyes y acuerdos) como la

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razón principal de cambios en niveles de calidad del agua. Entre los métodos de evaluación ex-post mas mencionados por los estudios se encuentran el análisis de costo-beneficio, análisis de costo-efectividad y análisis de percepción pública. Es importante destacar que solo pocos estudios mencionan de manera explícita el metodo usado para evaluar las mejoras ambientales en términos de la calidad del recurso agua.

Introduction

This work corresponds to one part of the preliminary results for the research project “*GA 402/06/0806 -Development of the Ex-post Analysis of the Relationship between Political-Economic changes and the Quality of the Environment*”, undertaken by the Department of Environmental Economics, University of Economics in Prague; and financed by the Czech Grant Agency [GACR]. The objective of the project is to study and evaluate the methods used in the ex-post analysis of changes in the quality of the environment. The project is focused mainly on the causality between the institutional, economic and political changes; and changes in the quality of the natural environment. It also aims at explaining, in a more detailed way, the methodology used in studying environmental economics and policies, and their related branches.

In the preliminary stages of our work we realized that the amount of literature available for ex-ante analysis in this area is very rich, however there are less works focused on the ex-post analysis of the economic, political, and institutional factors influencing the quality of the environment, which also interested us for the purposes of formulating our conclusions.

The main objective of this paper has been, chiefly, to answer the following questions:

- Which institutional, political and economic factors have influenced the quality and/or quantity of water sources in different countries?
- Which methods have been used in order to assess these changes?

This work can be taken to be a summary of studies carried out on one particular environmental subject–water-. The studies are presented in alphabetical order, by author, and followed by the conclusions. The appendix shows an overview of the studies included in this work, the subject of study, the methodologies and the results.

Summary of Publications

ARCY, TODD, WITHERS. Industrial Effluent Control and Waste Minimisation: Case Studies by UK Regulations

[1] presents a series of case studies from the United Kingdom. The six cases observed examine how the application of „simple“ techniques were able to provide significant environmental benefits at minimum net cost to the discharger.

According to the authors, environmental legislation doesn't have enough power to reduce the levels of effluents released into water if there aren't any techniques which can ensure the protection of the environment at a reasonable cost. The authors argue that the „simple approach“ of waste reduction has been proven, in the UK, to be one of the most cost-effective ways of achieving the desired environmental goals. The authors conclude that the waste reduction approach should operate as the major incentive to those industries that wish to achieve a more sustainable business operation.

The authors do not recommend considering the costs of environmental protection just as a result of investing in more treatment and cleaning facilities. They urge research into new methods for avoiding, or, at least, greatly reducing the creation of pollutants in the first place.

BRESSERS,H. Th.A. The Impact of Effluent Charges: A Dutch Success Story

[2] presents the results of three independent statistical analyses. The analyses have shown that effluent charges have been an effective instrument in Dutch water-quality policy during the period 1975-1980.

The author compared the statistical results with the qualitative approach, from the assessment of experts from the water boards regarding the relative effectiveness of these instruments.

In the assessment by the “Regional Water-Quality Administrators of the Relative Effectiveness of Policy Instruments”, the results showed that effluent charges have the greatest influence. Inspections, the courts, informal negotiations, permits and the promotion of technological innovations are also listed as causes of higher standards of quality.

The author mentions some reasons as to why this kind of instrument was so successful in the Netherlands. One of the reasons is the existence of the system of information about the pollutants (called “coefficient tables”), which facilitates the classification of polluters and therefore saves costs while charging the emissions. The effluent charges system works in the Netherlands as a revenue-generating system, which is attractive for local authorities. The

author concludes that the general condition of the economy and the expectations in the Netherlands at the time of the policy formulation, might also have contributed to the general acceptance of the charge system.

The methods used in this work in order to assess the changes in water quality as a result of effluent charges, are the comparison of statistical results, qualitative analysis (interviews), research of historical data and the travel cost method.

DENTE, B., FARERI, P. The End of Chemical Industrial Waste Dumping in the Adriatic Sea

This paper focuses on the decision-making process leading to the complete halt of the legally sanctioned chemical waste dumping in the Adriatic Sea in the vicinity of the Venice Lagoon. The authors describe the 4-year conflict resolution case in which many stakeholders were involved.

[3] describes in detail the whole decision-making process of the public authorities and its success as a result of “interactive knowledge” and as a part of the cognitive process.

[3] states that the availability of time and the resource of the power of the veto, together with the high level of conflict, facilitated the redefinition of objectives leading to improvements in the levels of water quality (eutrophication, phosphorus).

ECOTEC in Association with CESAM, CLM, University of Gothenburg, UCD and IEEP. Study on Environmental Taxes and Charges in the EU

[4] describes the systems of taxation on water abstraction in Europe. At the date of publication there were water abstraction taxes in two European countries: Denmark (water supply tax) and the Netherlands (groundwater tax).

The work includes a brief description of the effects of the taxes on the environment. There are also mentioned the effects on consumers, employment and the state budget.

The Dutch tax applies to the abstraction of groundwater by water works, or other entities (industry, agriculture), and aims at protecting the scarce groundwater sources in the Netherlands, which represents 70 per cent of the total water supply.

According to the authors, the exemptions included in the Dutch groundwater tax have considerably reduced the potential environmental effectiveness of the tax by creating room for environmentally-adverse practices. As an example [4] mentions the case of the pumping capacity exemption, which created the incentive for farmers to use several smaller pumps,

thereby reducing their capacity and not paying the tax. In terms of environmental effects, this resulted in an overexploitation of groundwater.

The study also mentions the results of the first evaluation of the groundwater tax undertaken in 1997 by [23]. According to this evaluation, water savings by the industrial sector were found to develop in line with expectations, e.g. a decline in consumption between 2% and 12% of the 1995 consumption levels.

The precise effect of the tax on demand from households (which accounts for 52 per cent of the total revenue from the tax) was unclear at the time of publication.

The main environmental aim of the water supply tax in Denmark is to reduce household water consumption. According to the study, it increased through the 1980's, but reached a peak in 1989. From 1989 to 1998 consumption decreased from 360 million m³ to 266 million m³, i.e. by about 26 per cent. Around half of the reduction took place prior to the introduction of the water tax, the remaining half since its inception. The authors contend that there were no studies which explore the precise effect of the tax, but it is likely to represent less than a 13 per cent reduction from 1994 to the date of publication.

FREEMAN, M. Air and Water Pollution Control. A Benefit-Cost Assessment

[5] presents the results of a survey on the benefits of air and water pollution control in the U.S.

As part of the book, the author presents the estimates of the benefits of the U.S. Water Pollution Control Act done by the Environmental Protection Agency and the National Commission for Water Quality.

Total estimates of national benefits from water pollution abatement costs were calculated to be 6.6 billion dollars for 1977. The types of benefits that were included in the study were: recreational, aesthetic and ecological, health, material damage and production.

The author criticizes the way the methodology (mainly travel cost method) was applied for the assessment. There are no further details about the calculations.

HARTJE, V. Ocean Pollution by Tankers

[6] describes the nature of operational discharge of oil into oceans and the pertinent environmental regulation linked with its reduction over 20 years.

According to the paper, the primary source of oil discharges into oceans are the discharges of operational oil due to ballast tank washing, and land based sources. Oil is considered an important source of water pollution after oxygen-consuming compounds, pesticides and heavy metals, among others.

International regulations concerning operational discharges were agreed in the 1970's, resulting in two legal documents:

-International Convention for the Prevention of Pollution from Ships, 1973 and

-The Protocol of 1978 related to the International Convention for the Prevention of Pollution from Ships. The documents contain the design and equipment requirements for tankers. These requirements were based on cost effective technologies.

[6] considers the existing set of regulations as successful. It contributed to an 80% reduction in operational tanker oil discharge until 1990. However, the success was just partial due to ineffective control and enforcement at some harbours, and the non-adoption by some states (e.g. in the Middle East loading zone).

The author also assesses the international regulations for accidental discharge as less efficient and not successful. The only factor which is recognized to have had a positive effect on the reduction of accidental discharges is the tanker owner's liability for environmental damage following an accident. The author argues that the essential reasons for success in the case of operational discharge might be the narrow margin of freedom provided by structural control technology combined with the positive economic incentive to minimize costs.

KEMP, R. Implementation of the Urban Waste Water Treatment Directive (91/271/EEC) in Germany, the Netherlands, Spain, England And Wales. The Tangible Results

The article analyses the implementation of the Urban Waste Water Treatment Directive 91/271/EEC in four member states (Germany, the Netherlands, Spain and the United Kingdom). This was an environmental directive adopted under Article 130[S] and was stimulated by concerns about eutrophication of surface waters and health hazards to the affected life forms.

The article describes the implementation process of the Directive in the states mentioned, and focuses on explaining the interaction between policy and technology which [7] calls „the circular relationship“; thus, the main part of the paper explores how environmental technology choices are embedded in the policy process.

In the analyses of each country, there is a brief description of the environmental effects of the directive. In Germany phosphorus levels have been reduced in all rivers since the Urban Wastewater Directive was adopted, but ammonia and nitrate level changes could not be identified as a result of the directive. Most of the improvements occurred in the new „Laender“ (former East Germany). In England it helped to achieve improvements regarding eutrophication and discharges of bacteria and enteroviruses. The Netherlands also reported improvements in phosphorus and nitrate effluents.

The author concludes that the directive contributed to the improvement of water quality in Europe, but the costs of achieving it were very high (130.3 billion EUR for the 1993-2005 period).

KISSER, M., KIRSCHTEN, U. Reduction of Waste Water Emissions in the Austrian Pulp and Paper Industry

The article presented by [8][8] deals with the water protection steps taken by the Austrian paper industry, whose processes used to severely pollute water. The improvement in Austrian waste water was observed in the period of 1980 -1992 by its quantity (56 to 27 m³/tonne) and quality (4% to 80% of biologically purified water). The author affirms that the implementation of this protection steps are due essentially, to a Greenpeace campaign.

Besides the description of evolution of quantity and quality of wastewater, and the technological advances in pulp production, the author presents a detailed analysis of the campaign started in Austria in 1986 against water pollution caused by the production of paper.

The author, who was also actively involved in the campaign, mentions the existence of some technical reasons for the reduction in waste water in the Austrian pulp and paper industry (technological advances such as digestion and cooking; low chlorine , non chlorine bleaching, expansion of purification facilities), but states in different parts of the paper, that the better levels of qualitative and quantitative characteristics of wastewater are essentially the result of the Austrian Greenpeace campaign and the pressure it brought to bear on the government, as well as on different sectors of the economy.

KNOEPFEL, P. The Clean-up of Lake Sempach (Switzerland)

[9] presents the political-administrative decision-making process involved in the 15-year saga of the clean-up of a lake in the Swiss interior situated in the northern, mainly agricultural, hinterland of the canton of Lucerne „Sempach“.

Although the clean-up of the lake has still not been completed at the time of publication, the author classes the case a success.

In earlier publications, the author has collected information from more than 20 case studies related to environmental policy. The results of these studies have been a set of „patterns of success“ in environmental policy processes.

This study illustrates 5 patterns of success for the case of Lake Sempach:

- Direct democratic pressure generated by popular initiatives or referenda.

- Surmounting zero-sum scenarios through the introduction of rewards, compensation, etc.
- Parallel interests in environmental and important non-environmental policies.
- Local opposition to regional or central state public policies
- Development, expansion and diffusion of scientific knowledge.

The author concludes that even if the process studied involved the identification of the specific conditions that lead to environmental policy set-backs, it would be better for practitioners and researchers to concentrate on identifying and defining the crucial factors for the promotion of past and future environmental policies.

LAWLOR J., MC CARTHY C., SCOTT S. Investment In Water Infrastructure - Lessons From Economic Analysis of Projects

The paper summarises the outputs of an ex-post economic evaluation of the EU Cohesion-Funded water supply, water conservation and wastewater investments in Ireland.

The evaluation comprised the development of a cost-benefit analysis (CBA) and is applied to roughly 50 water investment projects in 14 Cohesion Funded schemes. The total capital investment amounted to approximately 450 million EUR.

During the study, it was found that costs from the ex-post analyses were substantially higher than the ex-ante analyses estimates. The authors divided the benefits into two categories: internal and external. Internal benefits are use values and external benefits are non-use values, which is also called „environmental values“ by [12]. As a result of the analysis, most of the benefits of water supply and water conservation projects were internal, while most of those related to wastewater projects were external. They also qualified as „worthwhile“ the water supply and conservation investments, whose benefits were valued with the aid of a CBA. However, they could not fully analyse wastewater investments due to the lack of environmental data. In order to cover this gap, the authors estimated the level of willingness to pay (WTP) for environmental improvements required to justify the investments.

In the end, the authors recommend the use of tools such as CBA for ex-ante analyses, in order to identify the projects which can deliver the highest returns in the future.

LUNDQVIST, L. J. Municipal Sewage Treatment in Sweden

The author describes the factors that influenced the improvement of the quality of sewage water in Sweden between 1968 and 1980. The author put together the information from official sources, as well as independent analyses, in order to come to his own conclusions. The work addresses questions on changes in behavior, environmental awareness, as well as

pressure due to the regulations accompanying the Environment Protection Act on standards for cleaning water. [13] concludes that the most influential factor behind the development of better sewage systems, was the programme of state grants for municipal wastewater that came into force in the period 1968-69, and ended with the fiscal year 1980-81. The grants supported municipalities creating waste water treatment plants and subsidies were given to the industrial sector in order to develop better technologies for cleaning sewage water. He assumes that, while the new regulatory instruments were necessary to provide the means for demanding improved sewage treatment, they were not sufficient to make the responsible municipalities actually supply “that” better treatment in a short period of time.

[13] qualifies the results as a “success story in many ways”. As part of the limiting of the whole environmental policy towards ensuring greater water quality, he also mentioned the remaining problem of reducing and eliminating non-point source pollution caused by effluents containing heavy metals and nitrates in wastewater.

MATETE, M., HASSAN, R. Integrated Ecological Economics Accounting Approach to Evaluation of Inter-Basin Water Transfers: An Application to the Lesotho Highlands Water Project

The authors developed and applied a study, including a multi-country ecological social accounting matrix (MC-ESAM), for Lesotho and South Africa (SA) to evaluate the ecological implications of the Lesotho Highlands Water Project (LHWP) and their consequent economic costs and benefits for the two countries.

The prime objective of the LHWP is to take water from rivers in the Highlands of Lesotho, store it in reservoirs and transfer it, through gravity, to the water deficient Vaal region in SA.

The results revealed that while the LHWP has significant direct and indirect benefits in terms of social and economic development in Lesotho and SA, the project has serious unintended consequences for the ecological resources and services, with deleterious wellbeing implications for the populations residing within the reaches of the LHWP rivers and downstream from the LHWP dams in Lesotho. So, off-stream gains from the Inter Basin Water Transfers IBWT is achieved at a high ecological cost downstream.

In order to integrate ecological values into economy-wide modelling, [14] developed the study using a conceptual framework that traces flows between water-related ecological, and socioeconomic systems.

MATSUO, T. Japanese Experiences in Water Pollution Control and Wastewater Treatment Technologies

The author describes in this paper the history of water pollution control and environmental management in Japan.

The main part of the work is concentrated on the analysis of Minamata Disease² and its impact on industrial pollution. The author describes the development of Japanese environmental legislation and the application of the concept of life cycle assessment (LCA).

According to [15], the dramatic progress of the measures to protect the environment, is due to the experience of suffering disastrous damage caused by pollution, including Minamata Disease, which in 1965 was officially attributed to methyl mercury in industrial wastewater and reported 136 billion yen for compensation payments from companies responsables for the pollution (2952 inhabitants have been certified as Minamata patients).

The second part of the paper presents the experience in Japan with LCA methodologies in order to evaluate the environmental impact of water management projects.

The paper shows comparisons between compensation and prevention costs for damages and the recovery of environmental conditions, particularly regarding water pollution.

The author concludes that it is less expensive to prevent than to compensate. Another of its conclusions is that improvements in environmental protection issues are basically due to the legislative framework which appeared after the clearly proven link between pollution and its negative impact on human health, as well as the economic disadvantages for the polluters who must pay out compensation for the damage they cause.

MUGOVA, A., MAVUNGA, J. Wei Integrated Development Project: A Success Story In Desertification Control

The report presents the evaluation of the „Wei Wei Integrated Development Project“ (WWIDP) whose main aim was to build an intake weir on the WEI WEI river (Kenya).

The results shown in the report are focused more on socioeconomic issues. Impact on the environment due to the existence of the project is identified as the positive changes in the ecosystem (rejuvenation of the vegetation), and agro-forestry initiatives. The authors mention that there is no clear evidence of improvements in the quality of soil. The only activity that can be considered to be remotely related to natural soil improvement is the distribution of some *Leucaena* trees, used for soil fertility and improvement in agro-forestry systems. The project encourages farmers to rotate their crops, but the benefits of rotation have

² Minamata is a neurological syndrome caused by severe mercury poisoning. Minamata Disease was first discovered in Minamata city in Kumamoto prefecture, Japan in 1956 [15].

been not yet realised. The most evident benefit is the supply of higher quality water for the production for food.

Some project beneficiaries interviewed during fieldwork alluded to positive climatic changes in the area due to biodiversity regeneration.

The project consists of a gravity-fed irrigation system, which does not require energy to operate.

[16] names the whole project a „success“. They qualify it as sustainable and cost efficient. At the end, the authors argue that environmental conservation came as a „secondary“ benefit for the stakeholders, and has been easily accepted.

They conclude that if conservation of the environment had been emphasized right from the beginning, the project results could have been completely different at the date of publication.

NISIPEANU, P. Kosten der Abwasserbeseitigung. Wege zur kostengünstigen Abwasserbeseitigung durch unternehmerisches Denken und Kostenmanagement

This publication is a collection of papers related to the costs of wastewater treatment in Germany. It describes the situation in different communities (7 different case studies). The description of each case study is focused on the problems associated with covering the costs of financing such projects.

[17] recognizes the reason and existence of instruments tending to the achievement of better levels of water quality, but put strong emphasis on the way the costs should be managed. It is recommended to pursue market oriented instruments for the management of costs.

NORK-STAEHLE, M. Phosphate Substitution in Detergents

The case study concentrates on eutrophication of waters. The paper includes historical data and theoretical issues on the ways in which decision-making processes could proceed. To explain the theoretical background of the particular case, the author uses the terms „stakeholder approach“, systems´ theory, and coalition theory.

The case study is based on comprehensive literature and data research, as well as on interviews with stakeholders.

The results of the study revealed that the cause of eutrophication was phosphate inflow into water, which could be solved in two ways, which are identified by the author as the „substitution approach“ and the „elimination approach“. Those supporting the substitution

approach were, therefore in favor of finding substitutes for phosphates. While the elimination approach argues that waste water treatment facilities are the best solution.

[18] concludes that it was not the ecologically optimum solution that was chosen, but a practicable, politically feasible one. According to the author the decision making process was determined not only by technical, but also by political factors.

POPOVICI, M. The Environmental Impact of Water Charges: Agricultural Water Management Policies in Bulgaria, Hungary, Romania and Slovakia

The aim of this paper is to analyse the impact on the environment of changes in water pricing policies in Bulgaria, Hungary, Romania and Slovakia.

The author mentions the ability of the different irrigation processes to produce both beneficial and adverse effects on the environment. Therefore, the work concentrates basically on analysing the factors which may affect the demand for irrigation systems in agriculture in these countries.

There are only few occasions in which [19] mentions a concrete ex-post effect on the environment. The first one is the fact that countries in the Danube river basin experienced a 60% reduction in the total nutrient content in water due to the „new economic mechanisms“ introduced in each country. The second, is the reduction by more than 50% of nitrogen and phosphorus as a result of the introduction of a penalty system by the respective governments, through which farms are fined 4-5 % of their revenues for polluting water resources.

The work doesn't include bibliographical references, which makes difficult to assess the validity of the results.

OECD. Evaluating Economic Instruments for Environmental Policy

This publication provides a general framework for the assessment of economic instruments for environmental policy. The main part of the book is concentrated on the description and definition of the methodology and important aspects that have to be followed while evaluating these kinds of measures.

As part of the OECD work programme, three cases summarise the operation of water charge systems -the Netherlands, Germany and France-.

According to the authors, the broad conclusion of the available evidence appears to be that the Dutch system, which had the highest charge levels, has had a substantial behavioral impact. They argue that Germany, also, has shown behavioral effects during the period of its introduction. In the case of France, changes might be likely to lead to a significant effect once the charges have been increased – at the time of publication, the authors stated that the French charge rates were too low to act as an incentive mechanism-

For the case of Germany, [20] mentions the results of other studies which associate the water charging system with the reduction of water effluents. Further beneficial ecological effects mentioned in the study arise through the incentive given by the charge for more careful management of abatement facilities, as well as various types of „soft effects“ in terms of changes in attitudes and awareness of companies, municipalities and their employees.

The main difficulty that the authors found, was the evaluation of the effects of economic instruments, where there are also command and control regulations operating at the same time.

According to the authors, the role played by the economic instruments in influencing the level of pollution is secondary to the role of regulatory policies, to a large extent. One explanation they give is the fact that each of the systems of water effluent charges was introduced initially as a revenue generating mechanism, and the incentive role of the economic instruments is a by-product of this. However, the authors mention three examples of cases in which, it could be feasible to distinguish the effects of economic instruments from regulations: cases where some group of polluters is not subject to the incentive charge system, cases where some group is not subject to the regulatory requirements, and cases where the level of the charges vary regionally, whilst the regulatory standards do not.

RANDALL. The Environmental, Economic and Societal Consequences of Inadequate Nitrogen Pollution Controls

This paper addresses the problem of nitrogen pollution control in the USA, which has been a major cause of large-scale migrations and mortality of commercial and non commercial species for fisheries.

[21] describes some of the economic and social consequences of excessive nutrient pollution (eutrophication and hypoxia) of selected estuaries and coastal areas in the USA and other countries. One example of those effects is mentioned in the paper in the case of the Northern Gulf of Mexico, where nutrient over-enrichment could lead to a sharp decline in shrimp fishing, which is a very important industry for the regional economy.

The author qualifies the problem as a “worldwide crisis” and concludes that political and social structures have permitted the existence and development of nutrient pollution, because of inadequate regulation of municipalities, developers, industries and farmers to expand and operate without paying the full cost of their activities.

Concerning the particular case of the U.S.A., the author assumes that the root problem began shortly after the passage of the Clean Water Act of 1972, especially with the wrong decision by the Environmental Protection Agency, which rejected the inclusion of a nutrient removal requirement. This decision assumed that phosphorus removal could be a requirement for treatment plants discharging into freshwater lakes which were showing signs of eutrophication. However, no consideration was given to the effects of nutrients on estuaries or coastal waters.

SCHROLL, H. Reduction of Industrial Effluents into the Horsens Fjord

The author analyses the factors which might have led to the reduction of levels of eutrophication and copper in Horsens Fjord, Denmark, and therefore, to the reduction of the negative impact on the marine ecosystem. He bases his analysis on the explanation of the initiative of the Recipient Quality Plan, the Action Plan of 1987 and the Regional Council, which imposed a set of emission standards and maximum contamination levels for input to the Horsens Central Wastewater treatment plants to be implemented no later than 1992. [22] concludes that the existence of the policy is the reason why water quality has improved. As consequences of the policy he mentioned stricter regulations (closed plants), incremental costs for the transport and disposal of solid and chemical waste to other treatment utilities (no more copper to the water), the development of new technologies, and greater supervision on the part of the authorities.

Conclusions

The majority of the publications presented the influence of different factors on the changes in water quality, specifically on the levels of nitrates, phosphorus, heavy metals and bacteria. The most frequently mentioned factors causing these changes are the existence of administrative measures such as treaties, laws and directives. Economic instruments and technological progress are assumed to work in support of the legislation, but are not identified in most of the works as being the primary influencing factors in the changes in environmental performance. Almost all the publications show positive changes in the environment (in this particular case; water). The publications showing the negative impact on the environment conclude that the lack of a holistic approach on the part of the administrative and economic measures is the main cause of the “failure”. It can be implied that there is an anthropocentric

approach towards the assessment of water quality and quantity in the publications presented. In other words, the level of success of a factor is measured by its effectivity and efficiency towards the achievement of environmental goals which corresponds to people's benefits. Assessment of changes in the ecological value of water (ecocentric and biocentric approaches) are not tackled, or are identified as being difficult to evaluate. The works presented include positive as well as normative conclusions. Sometimes it was also possible to identify the existence of soft data (changes in customs and behavior, institutional arrangements, etc.) because of the introduction of particular measures such as a new tax or the occurrence of catastrophic events.

A very low number of publications define exactly the method used for the assessment of the environmental performance. It should be noted that the most frequently used methods were the ones which tackled (mostly in a combined form) the question of cost-effectiveness (quantitative analysis), cost-benefit and "people's perception of benefits" (qualitative analysis).

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Appendix. Relationship between political-economic changes and quality of water bodies

	<u>Author , Year and Title of the Publication</u>	<u>Subject of Study</u>	<u>Factors</u>	<u>Results</u>	<u>Methods</u>
			<i>What might have caused the changes in the quality of water sources?</i>	<i>How is „environmental performance“ expressed ? Which indicators show changes in water bodies?</i>	<i>Which methods are used for the ex-post analysis?</i>
[1].	ARCY, B.J. TODD, R.B.- WITHERS,A.B.(1999.). Industrial Effluent Control. and Waste Minimisation: Case Studies by UK Regulations	Water pollution in the UK.	Application of „simple“ techniques. (e.g. waste minimisation).	Less industrial effluent of pollutants.	Case studies and cost-effectiveness analysis.
[2].	BRESSERS,H. (1995). The Impact of Effluent Charges: A Dutch Success Story	Water pollution in the Netherlands.	Effluent charges.	Improvement in water quality.	Comparison of statistical results with qualitative approaches, travel cost method, and research of historical data.
[3].	DENTE, B. FARERI, P. (1995). The End of Chemical Industrial Waste Dumping in the Adriatic Sea	Water pollution in Italy.	Pertinent redefinition of objectives while implementing policy measures.	Reduction in levels of eutrophication, phosphorus.	Case study analysis, network analysis.

[4].	ECOTEC in association with CESAM, CLM, University of Gothenburg, UCD and IEEP.(2001). Study on the Economic and Environmental implications of the Use of Environmental Taxes and Charges in the EU and its Member States	Groundwater quantity in the Netherlands and Denmark.	Introduction of environmental taxes for groundwater.	Lower levels of consumption of groundwater.	Observations of historical data.
[5].	FREEMAN, M. (1982). Air and Water Pollution Control. A Benefit-Cost Assessment	Water Pollution in the USA.	National water policy (Water Act).	National benefit including recreational, aesthetical, health, and production benefits.	Analysis and observations of historical data.
[6].	HARTJE, V. (1995) Ocean Pollution by Tankers	Pollution in oceans.	Pertinent environmental regulation.	Reduction of operational discharge of oil in oceans.	Analysis and observations of historical data.
[7].	KEMP. (2001). Implementation Of The Urban Waste Water Treatment Directive (91/271/Eec)	Eutrophication and health hazards. Surface water in Europe.	„Urban Wastewater Treatment Directive“.	Lower levels of eutrophication and health hazards.	Cost-effectiveness analysis, historical data, qualitative research interviews.
[8].	KISSER, M. KIRSCHTEN, U. (1995). Reduction of Waste Water Emissions in the Austrian Pulp and Paper Industry	Wastewater in Austria.	Ecological campaign.	Qualitative and quantitative improvement in wastewater.	Analysis and observations of historical data.
[9].	KNOEPFEL, P.(1995). The Clean-up of Lake Sempach (Switzerland)	Water Pollution. Lake Sempach, Switzerland.	Political-administrative decision-making process.	Clean-up of the lake.	Case study analysis and observations of historical data. Application of „patterns

					for success“.
[10].	LAWLOR,J.MC CARTHY,C.SCOTT,S.(2004). Investment In Water Infrastructure	Water quality in Ireland.	Investment in water related projects.	Internal and external benefits of water .	Cost benefit analysis – CBA-, and willingness to accept –WTA-.
[11].	LUNDQVIST, L. J. (1995). Municipal Sewage Treatment in Sweden	Water pollution in Sweden.	Better waste water treatment technologies due to subsidies and grants.	Lower levels of organic substances and phosphorus in water.	Analysis and observations of historical data.
[12].	MATETE,M.HASSAN, R.(2006). Integrated Ecological economics Accounting Approach to Evaluation of Inter-basin Water Transfers: An Application to the Lesotho Highlands Water Project	Water resources in Lesotho and South Africa.	Inter-basin water transfers project.	Impact on ecological resources.	Multi country ecological social accounting matrix. -MC ESAM-.
[13].	MATSUO,T. (2000). Japanese Experiences in Water Pollution Control and Wastewater Treatment Technologies	Water pollution in Japan.	Past pollution tragedies which lead to strict legislation.	Minimization of amount of nutrients, heavy metals, and bacteria in water .	Analysis and observations of historical data, analysis of damage and analysis of compensation vs. prevention costs.
[14].	MUGOVA ,A. MAVUNGA , J.(2000). Wei Integrated Development Project:A Success Story	Drinking Water availability, biodiversity and soil quality in the WEI WEI river region, Kenya.	Irrigation system project.	Impact on the environment as a “second” benefit.	Qualitative research – interviews-and cost- effectiveness analysis.
[15].	NISIPEANU,P. (1999). Kosten der Abwasserbeseitigung.Wege	Water Pollution in Germany.	New requirements on waste water treatment	Higher investment in sewage systems.	Analysis and observations of historical

	zur kostengünstigen Abwasserbeseitigung durch unternehmerisches Denken und Kostenmanagement		plants.		data.
[16].	NORK-STAEHLE, M. (1995). Phosphate Substitution in Detergents	Eutrophication of waters in Germany.	„Substitution approach“ and „elimination approach“.	Lower levels of eutrophication.	Case study based on comprehensive literature and data research, as well as interviews with stakeholders.
[17].	OECD. (1997). Evaluating Economic Instruments for Environmental Policy	Water pollution in Germany, France and the Netherlands.	Economic instruments for environmental policy.	Water pollution levels.	Analysis and observations of historical data, and cause-effect analysis.
[18].	POPOVICI, M. (2000). The Environmental Impact of Water Charges: Agricultural Water Management Policies in Bulgaria, Hungary, Romania and Slovakia	Environmental quality in Bulgaria, Hungary, Rumania, and Slovenia.	„New economic mechanisms“; introduction of a penalty system by the government.	60% of reduction in the total nutrient content in water; reduction by more than 50% of nitrogen and phosphorus.	Analysis and observations of historical data.
[19].	RANDALL, C. (2004). The Environmental, Economic and Societal Consequences of Inadequate Nitrogen Pollution Controls	Nitrogen pollution control in the USA.	Inadequate policy and control mechanisms.	Higher levels of nitrogen.	Analysis and observations of historical data.
[20].	SCHROLL, H. (1995). Reduction of Industrial Effluents into the Horsens Fjord	Water contamination in Denmark.	Policy on water quality.	Reduction of negative impacts on the marine ecosystem Horsens Fjord. (Reduced Eutrophication, Reduction on industrial Copper).	Analysis and observations of historical data.

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