

The Critical Review of the Performance of the EU Water Framework Directive in Improving the Rivers' Water Quality and the Impediments in its Implementation

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Abstract

Water is essential in the disposition and growth of living species, especially in the maintenance and survival of human life. History divulges that all the civilisations, countries and big cities were established along the main river courses/ water channels merely because of the importance of water in human life. The increased world population has increased the depletion of this natural resource. Anthropogenic activities pollute water resources by throwing physical, chemical, biological and industrial waste in these streams. The division of regions into states and countries and different ruling bodies in different areas of the world have purported the issues of maintaining control of water bodies and their rights of use within the river basins based on the trans-border's flow/catchment areas and multinational utilisation. European Union, since its inception, has been issuing different directives regarding the environment, pollution, water usage, ecology and hydrology. In 2000, a detailed directive named "Water Framework Directive (EU WFD 2000)" was formulated by the European Union encompassing significant aspects of all previous directives with the direct responsibility of each member state to arrange implementation of this directive by incorporating this directive in legislation and establishment of independent bodies/ agencies for its implementation in true letter and spirit. Three years were given to incorporate the water framework directive as law. Then further specified periods were given to implement it in a phased manner from 2003 to 2015. Though a tremendous change in attitude towards maintaining the water quality, partial implementation of EU WFD in member states has been achieved, unfortunately; still, the target is too far away, especially in tackling the heavily modified water bodies despite multi-billion investments by public and private sectors. An endeavour has been made to critically review/evaluate the challenges in implementing the water framework directive and the efforts of member states to overcome these challenges. The scope of this paper is to review some of the available literature on the subject in the form of books, European Union directives, conventions/conference minutes/proceedings/documents, assessment reports, documents of environmental agencies of member states and different presentations followed by a suitable conclusion as per own understanding from literature and assessment by different sources.

Keywords: EU WFD Implementation; Efficacy; Performance; Impediments

Introduction

Water and the environment have been the focus of the European Union since its inception after World War II. Numerous directives have been issued on water, considering it a natural heritage for present/future generations and all living species, which all have equal rights to use cleanly and clearly. EU directs its member states to maintain/preserve the surface/groundwater resources by employing stringent river basin management plans in the river catchments considering the ecology/biodiversity/morphology of water bodies across administrative/territorial regions [1]. The EU wants water to be usable by human beings in its healthiest form with no mixing of dangerous chemical or biological waste substances, including banned or restricted chemicals [2]. and no emission-based pollution to water and environment by

industry in the public or private sector or limits of waste materials which are discharged to water streams or air have been imposed/banned [3]. EU has imposed directives for using clean water for drinking, bathing, surface water quality, subsurface water quality, fish water quality and many other aspects to safeguard the aqua life and microorganism in water streams [4,5]. The member states are not supposed to dispose of even domestic waste/ sewage in coastal waters, and sewage treatment and disposal must be adequately treated to avoid polluting the water streams [6]. Kallis & Butler et al. [7-10] have termed the WFD issue in 2000 as an ice-breaking step which was taken by the collaboration of all previous directives and setting up of future goals for clean and healthy water for human, animals, forests, agriculture, water creatures and microorganism including economic aspects, ecological goals, environmental protection, good water management, river basin management, pollution-free water streams including rivers, lakes, groundwater and coastal water as shown in Figure 1, [7-13]. The main objectives are to maintain/preserve fresh water, reduce pollution, manage rivers at basins/catchment levels, protect all kinds of water sources and mitigation of floods and scarcity of water with cohesive/cooperative efforts of all stakeholders [11,12].

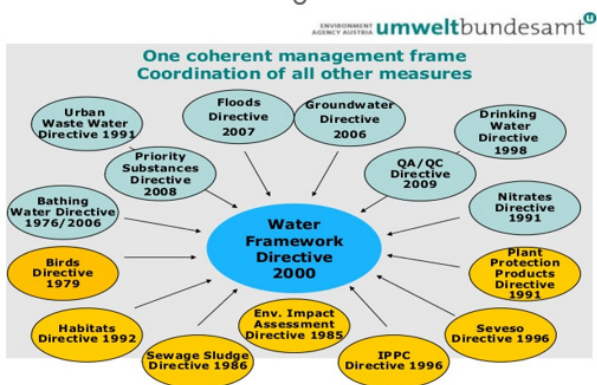


Figure 1: Integration of WFD [13].

Implementation Schedule for WFD

WFD is a long-term policy document having spelled out yearly milestones based on planning and arranging clean water resources at the river basin level. It gives a long-term base for the protection of freshwater sources, and ecosystems, reduction of pollution/emissions and prevention of flood havoc [1,5,14,15]. The EU gave a logical and coherent schedule to incorporate, establish, monitor and implement WFD in year wise scheme, as shown in Figure 2. A goal of 2015 was set to achieve clean water through river basin management planning and public and people partnership/collaboration in the management of water basin districts among the states of the EU by employing economic analysis to achieve growth targets and overall policy integration through common integration strategy forum [5,12,16]. However, the target could not be achieved, and an extension to 2021-2027 has been seeking to achieve the overall target by 2027, when all environmental objectives will be achieved [17].

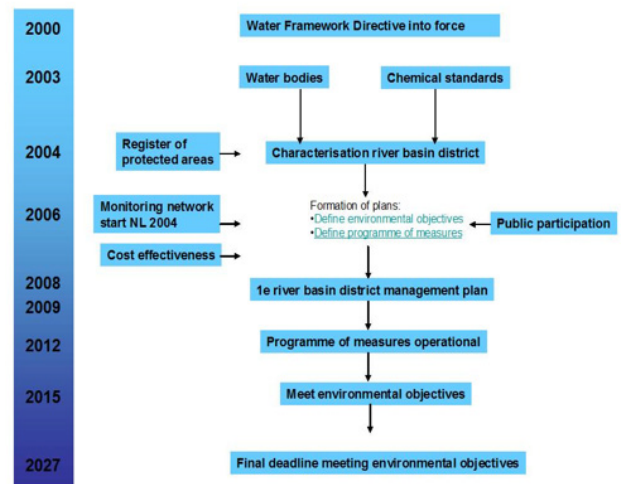


Figure 2: Schedule for implementation of WFD [17].

Water Flow Mechanism in River Catchment Area and Source of Pollution

UK groundwater forum on WFD explains the elements of water input/ output along with water pollutants/toxins sources in a 3-D layout, as shown in Figure 3. Water input is the precipitation to a river basin, the portions of which converts into groundwater, surface runoff to the rivers, some is evaporated back into the environment, and some is recycled through evapotranspiration. The primary pollutants and toxins are coming from landfills mixed with precipitation water, urban runoff, petrochemical residuals, leakage in sewerage systems, oil refineries and storage depots, industrial waste/emissions from industries/manufacturing units, vehicle tyres particles and residuals from direct drainage from the road surface, pesticides, fertilisers, insecticides and manure being used by agriculture. This is the holistic picture of basin management elements for clean water sustenance from river catchment to rivers and sub-surface water, which EU WFD desires member states to eliminate [18-20].



Figure 3: Water flow mechanism in river catchment area and source of pollution [20].

The Acceptable/Unacceptable Water Quality Standards-WFD

Paola [21] conducted a study on water quality assessment incorporating the EU standards in acceptable and non-acceptable divisions, as shown in Figure 4, [21]. The EU has set five standards for achieving the status quality of water bodies, measured by high, good, moderate, poor and bad categories. EU desired all water bodies to be only in high and good status by 2021 (acceptable standards range). Moderate to bad-status water bodies were desired to be converted to acceptable regions. Generally, the first river basin management plan review till 2015 exhibited that the countries with flourishing economies and undaunting desire to improve water quality, like the UK, Germany, France, Scandinavian countries, Netherlands and Switzerland, performed well in accomplishing the acceptable status to some extent, countries with lower economic growth and lesser determination, like Italy, Greece and east European countries performed with significantly low progress/determination. The second review of river basin management plans, 2019, portrayed the same trend by showing the increasing cost of the preventive/remedial measures for implementing WFD. Several countries put in sustained efforts with more economical pledges in the implementation of EU WFD; however, the investment requirements are increasing as the member states are not expending the desired capital funds, with Italy topping the list, as shown in Figure 5. estimated capital requirements to go around 115 billion euros in fifth WFD implementation review by 2023 [22]. No member state could accomplish this gigantic target, and an extension up to 2027 has been sought, which is still expected to be non-achievable, seeking further extensions beyond 2030. This is now the challenge faced by the member state of the EU/UK of converting the water quality status to Good or High to be in acceptable zones. It can rightly be considered an ambitious target the EU sets for water and the environment [5,22-34].

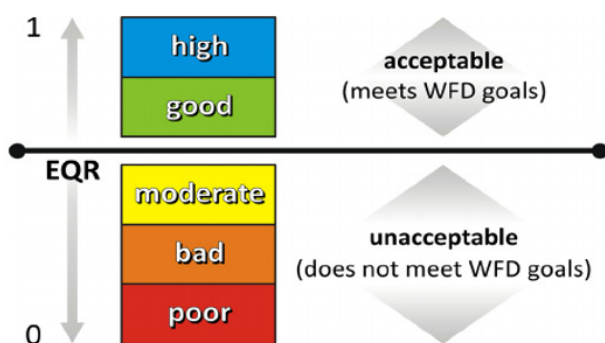


Figure 4: The five acceptable/unacceptable water quality standards-WFD [21].

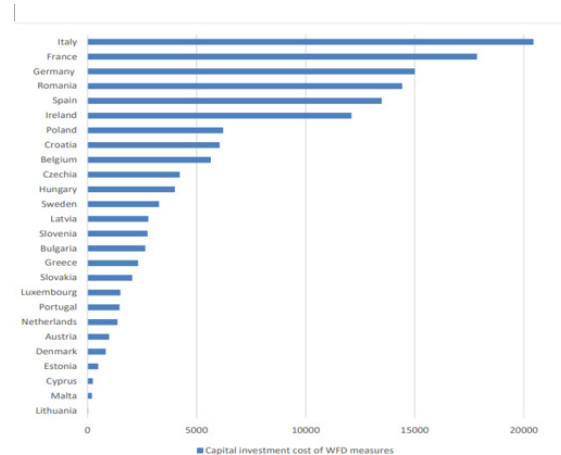


Figure 5: The requirement of capital investment to meet WFD desired standards (million euros) [22].

Performance of EU States in Implementation of WFD

The ambitious goal of good water by 2015 set by the EU to achieve by member states remained grossly unachievable. The timeframe was extended to achieve acceptable standards by 2021, with a target of all good-quality water status by 2027. However, only a few countries could get good quality status for 40% of surface water bodies and 70-90% for groundwater good quality targets. Several exemptions have been given due to the extraordinary costs involved, difficulty in reversing heavily polluted/modified structures and modification/cost involved for replacement/modification of existing built-up residential, commercial and industrial infrastructures along the rivers. Therefore, achieving good status is an uphill task even by 2027 [33]. The third implementation review of the river basin management plan showed that only Austria and Netherlands fully submitted the plan, whereas 70% of states have partially submitted the plan. A few countries, like Belgium and Spain, are still engaged in initial public participation. Greece and Bulgaria have yet to start public participation to evolve a plan, as shown in Figure 6, [23].

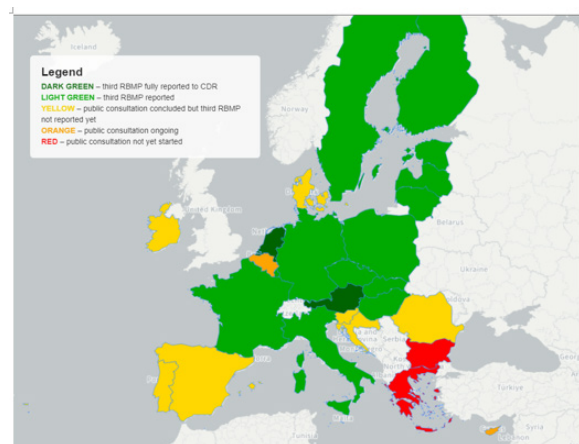


Figure 6: EU WFD Progress review of the third “River Basin Management Plan 2021” [23].

Challenge and Performance of EU Member States in the Implementation of WFD

The EU conducted a water conference in Viana, Austria, from 20-21 September 2018 to assess member states' performance, challenges faced, and how to tackle these issues. Minutes of the presentations by scholars, representatives and auditors are available on the EU Commission website [13]. The water and wastewater international forum have published a study showing, generally, Germany, Sweden, Netherlands and the UK are performing better, especially regarding research and river basin management plans; however, countries of East Europe like Romania, Hungary, Baltic states and countries joined EU after 2004-2007 are performing the least in implementation of WFD [5].

Prohibition of Chemical Substances

The prohibition of industrial chemical substances in water is a WFD clause and a challenge to be implemented by member states to achieve a good quality standard. However, out of 250 chemical substances, only 18% have been regulated 20% are under scrutiny, as shown in Figure 7, [13]. The categorisation/earmarking of hazardous chemical substances is the first step to achieving chemically good quality water status by preventing their mixing/disposal into water bodies. It seems an uphill task presently with an unfinalised list. Completing a list of banned items is complex, and identifying their impact, status, and reaction is an even more significant challenge. The first deadline for good status for chemical substances has elapsed, and emission status to be achieved in 2021 has also been delayed. However, 63% of emissions' good status in 2021 has been achieved versus 48 % from 2010 to 2016. The number of water regulation bodies on identification/advisory of chemical substances has increased from 9 to 31 with objectives to identify the chemicals and analyse industrial emissions, which are easy to eradicate by 2021-23; removal of all prohibited chemicals-based equipment and products and banning the use/manufacturing of all the chemicals pesticides are being targeted by 2023-2027 [13,35].

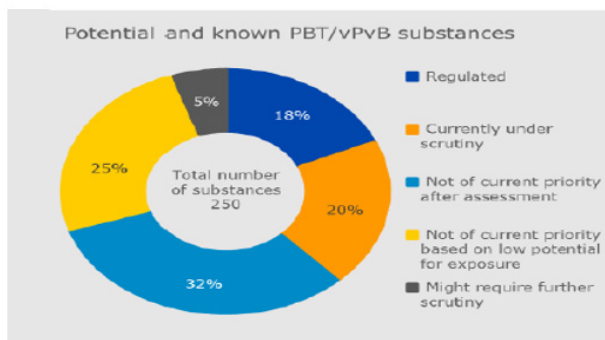


Figure 7: Progress on identification/ tackling chemical pollution in water bodies [13,35].

Quality Standards/Management for Drinking and Bathing Water and Wastewater Disposal-WFD

A critical analysis by water world Europe and the EU water commission press release 2016 shows that the quality of drinking

water, bathing water and management/treatment/disposal of sewage has improved significantly in member states of the EU. Presently 90% of urban wastewater is treated before disposal in the water bodies, with pharmaceutical industries still responsible for 92% of chemical waste, making around 10 million people vulnerable to dangerously polluted water in the EU, 80% population is enjoying good quality drinking water in their taps, and 84% beaches have achieved blue beach status (safe for bathing) as shown in Figures 8 -10, [13,36-38]. However, there is room for improvement in the treatment and disposal of sewage. Member states are working to allocate a budget for wastewater collection and disposal improvement in a befitting manner. However, the mixing of untreated sewage in water bodies, mainly due to overflowing/flooding, is still happening's e.g., the UK reported around 3000 untreated sewage mixing occurrences in 2022. However, the main challenge is shifting this cost to consumers so that end users are not burdened much with paying reasonable water tax/ bill for the provision of essential services [13,36-39].

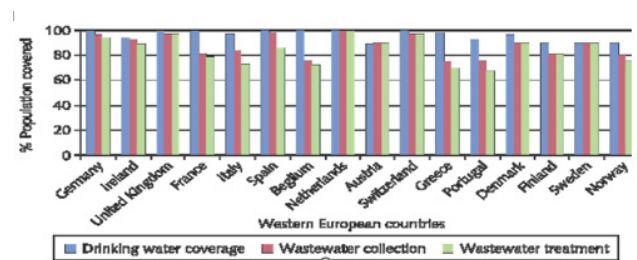


Figure 8: Drinking water supply, wastewater collection and treatment facilities in the EU [36].

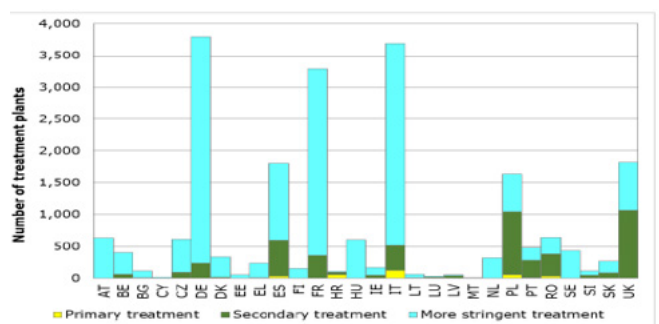


Figure 9: Number of wastewater treatment plants in the EU member states [37].



Figure 10: Percentage of bathing sites with excellent quality water [38].

Legislation and Performance Evaluation of WFD Implementation and Impediments

The EU water conference on WFD (2018) generally elucidated that member states have incorporated the WFD into their legislation and procedures. However, there is a need to integrate new systems and methods into legal processes and regulations, especially the uncertainties of post-implementation deadlines. Member states are required to establish an audit framework to check the

implementation process of WFD, which is still a neglected factor. EU has given a guideline for this fitness evaluation/ auditing mechanism to check the progress of implementing these 16 points, as shown in Figure 11. However, climate change and preparedness, paucity of financial resources, increased population and urbanisation, ageing hydraulic infrastructure and heavily modified water bodies are the primary impediments to the swift implementation of WFD, as discussed in the Succeeding sections.

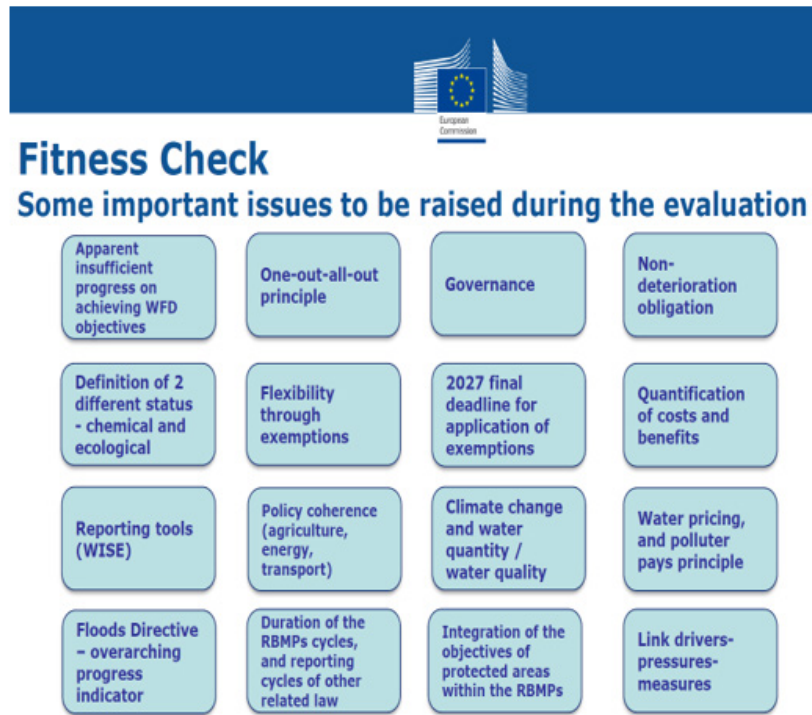


Figure 11: Fitness evaluation mechanism for legislative incorporation of WFD [13].

Climate Changes and their Effects and Preparedness on Member States

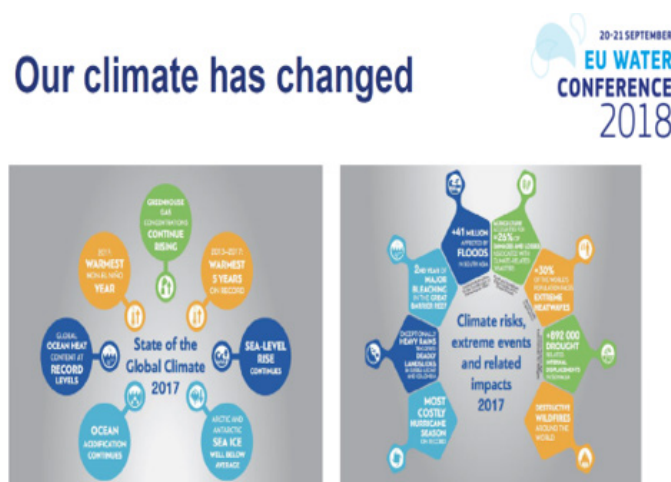


Figure 12: Climate changes and effects [13,41].

The EU member states/UK are generally aware of the climate change issue of this century. UK EA chief has stated in his Vision 2020 statement that Global warming is likely to increase sea level by 12–67 CM by the next 50 years due to the melting of glacial

ice, prolonged climatic seasons, massive snow spells, scorching summer and hurricanes are going to be the features to be faced in this century [40]. Whichers [41], in his presentation at the EU water conference 2018, enlightened that more calamities are occurring

and causing damage to men and material, as exhibited in 2017 (Figure 12). Member states are required to anticipate/ prepare to face flash floods, seasonal variations, draughts and climatic implications leading to damage to the defence shields along with a timely allocation of finances, scientific research and strengthening of infrastructure [13,41].

Financial Resources

This is the fundamental impediment to the befitting and timely implementation of WFD. An enormous amount to the tune of around 150 billion euros has already been invested to achieve the present-day goal, and still, around 115 billion euros need to be earmarked to achieve the 2023 goals. In case of non-implementation of WFD, heavy fines are levied by the EU, including the impact of the decreased index on quality of life. Therefore, the generation of huge funds and their judicious utilisation in the right direction is an essential key to the final achievement of the targets.

Population and Urbanisation

This phenomenon is increasingly superfluous in all member states, thus necessitating amplified infrastructure for residential and related activities. This costs heavily on urban development and the provision of facilities, including clean water and wastewater management. As per the vision statement of the UK EA, an overall increase of 5% in the population, with a 25-30 % increase in urbanisation, is expected in the UK [40].

Ageing Infrastructure

The EU water commission accentuated that the old-age infrastructure is unsuitable for adopting the latest trends and changes proposed by WFD. Member states must replace/modify the existing infrastructure, which involves huge investment and an impeding factor in implementing WFD. Member states are trying to prioritise the most excruciating infrastructure with the lowest possible modifications within the meagre finances.

Heavily Modified Water Bodies

Heavily modified bodies are the conspicuous problem areas in assimilating extensions and exemptions in WFD implementation. The old nature of infrastructures, dams, canals, bridges, barrages, alignment of water streams, and massive construction along rivers are such impediments that cannot be put right away due to the enormous shifting and finances involved.

Conclusion

The EU water framework directive is a resplendent document encompassing a great deal of work for clean and healthy water and the environment by reducing chemical/biological pollutants and emissions levels by all member states. It caters to the planning/management of water from rivers' headwaters to downstream by employing integrated river basin management strategies by implementing healthy mechanisms in river catchment areas for improved water quality and biodiversity [42]. Its implementation aims to preserve clean water and a healthy environment for human beings, animals, aqua life and microorganism by protecting from

natural/artificial calamities for today and the next generations. The performance of member states is capricious/heterogeneous. Some are highly committed, and others are demonstrating lukewarm and go-slow responses because of financial constraints and highly modified water bodies. However, its accurate implementation needs elaborate initiative, colossal financial resources, massive infrastructural modifications and a clear/attainable conception of the realistic targets/schedule to achieve the water framework directive's ecological, hydrological and environmental goals by 2027. Sustained efforts are required by the world, including the EU/UK, to address the water quality/quantity issues on river catchment basins level as 40% of the world population is facing water scarcity, 80% of the worldwide wastewater is disposed of in the rivers untreated, and 90% of the diseases faced by human beings/living species are water born [43]. The EU and the world need to concoct massive cooperation with tremendous capital investment in the implementation of a workable WFD-based mechanism ensuring access to safe/quality drinking water for all, pollution-free water streams for safe aquatic life/biodiversity, peaceful/ win-win resolution of transborder water disputes, practical water resource engineering across all the sectors and increased public/private participation in research/development of water management.

References

1. EU WFD (2000) European union water framework directive.
2. (1967) EU dangerous substance directive.
3. (2010) EU Industrial Emission Directive.
4. Pedersen AB, Larsen SE, Andersen DK, Jepsen N, Nielsen J, et al. (2018) Headwater streams in the EU water framework directive: Evidence-based decision support to select streams for river basin management plans. *Science of the Total Environment* 613-614: 1048-1054.
5. Boeuf B, Fritsch O (2016) Studying the implementation of the water framework directive in Europe: A meta-analysis of 89 journal articles. *Ecology and Society* 21(2): 19.
6. (1991) EU Urban Wastewater Treatment Directive.
7. Kallis G, Butler D (2001) The EU water framework directive: Measures and implications. *Water Policy* 3(2): 125-142.
8. 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.
9. Adshead J (2004) River basin management in the water framework directive: An integrated approach to water protection and management. *Water Law* 15: 5-11.
10. Grimeaud D (2004) The EC water framework directive-an instrument for integrated water policy. *Review of European Community & International Environmental Law* 13(1): 27-39.
11. Kassim H, Peterson J, Bauer MW, Connolly S, Dehousse R, et al. (2013) *The European Commission of the twenty-first century*. Oxford University Press, UK.
12. Indset M (2017) The changing organisation of multilevel water management in the European Union. *Going with the flow?* *Int J Public Adm* 41(7): 492-505.
13. (2018) EU Water Conference Viana Austria.
14. Treib O (2014) Implementing and complying with EU governance outputs. *Living Rev Eur Gov* 3(5): 1-47.
15. Egeberg M, Trondal J (2016) Why strong coordination at one level of government is incompatible with strong coordination across levels (and how to live with it): the case of the European Union. *Public Adm* 94(3): 579-592.

16. Gornitzka Å, Sverdrup U (2015) The expert-executive nexus in the European administrative system: Expert groups and the European Commission. In: Bauer MW, Trondal J (Eds.), *The palgrave handbook of the european administrative system*. Palgrave Macmillan, Basingstoke, England, pp. 401-418.
17. (2008) Background paper on Water and Health COP Workshop.
18. OECD (2023) *Implementing water economics in the EU water framework directive*, OECD Studies on Water, OECD Publishing, Paris.
19. Howarth W (2018) Going with the flow: integrated water resources management, the EU water framework directive and ecological flows. *Legal Studies* 38(2): 298-319.
20. UK Ground Water Forum on WFD-The future for Monitoring.
21. Lombardo P (2013) Indicator value of lotic water mites (Acari: Hydrachnidia) and their use in macroinvertebrate-based indices for water quality assessment purposes. *Journal of Knowledge and Management of Aquatic Science* 41: (8).
22. European Commission, Directorate-General for Environment (2021) *Economic data related to the implementation of the WFD and the FD and the financing of measures*.
23. (2021) *Water Framework Directive Review*.
24. Andersson I, Petersson M, Jarsjö B (2012) Impact of the European water framework directive on local-level water management: case study oxunda catchment, Sweden. *Land Use Policy* 29(1): 73-82.
25. Baaner L (2011) Programmes of measures under the water framework directive-A comparative case study. *Nordic Environmental Law Journal* 1: 31-52.
26. Behagel JH, Arts B (2014) Democratic governance and political rationalities in the implementation of the water framework directive in the Netherlands. *Public Administration* 92(2): 291-306.
27. Behagel J, Turnhout E (2011) Democratic legitimacy in the implementation of the water framework directive in the Netherlands: Towards participatory and deliberative norms? *Journal of Environmental Policy & Planning* 13(11): 297-316.
28. Benson D, Fritsch O, Cook H, Schmid M (2014) Evaluating participation in WFD river basin management in England and wales: processes, communities, outputs and outcomes. *Land Use Policy* 38: 213-222.
29. Beunen R, Van Der Knaap WGM, Biesbroek GR (2009) Implementation and integration of EU environmental directives: experiences from the Netherlands. *Environmental Policy and Governance* 19(1): 57-69.
30. Bithas K, Kollimenakis A, Maroulis G, Stylianidou Z (2014) The water framework directive in greece. Estimating the environmental and resource cost in the water districts of western and central macedonia: methods, results and proposals for water pricing. *Procedia Economics and Finance* 8: 73-82.
31. Blackstock KL, Waylen KA, Marshall KM, Duglinson J (2014) The hybridity of representation: insights from river basin management planning in scotland. *Environment and Planning C: Government and Policy* 32(3): 549-566.
32. Borowski I, Bourhis JPL, Pahl-Wostl C, Barraqué B (2008) Spatial misfit in participatory river basin management: effects on social learning, A comparative analysis of German and French case studies. *Ecology and Society* 13(1): 7.
33. Börzel TA (1999) Towards convergence in Europe? Institutional adaptation to Europeanization in Germany and Spain *Journal of Common Market Studies* 37(4): 573-596.
34. Bourblanc M, Crabbé A, Liefferink D, Wiering M (2013) The marathon of the hare and the tortoise: implementing the EU water framework directive. *Journal of Environmental Planning and Management* 56(10): 1449-1467.
35. (2018) ECHA SCHC Chemical substance and chemical pollution roadmap implementation report.
36. *Drinking Water Coverage, wastewater collection and Treatment in Europe*.
37. European Commission, Directorate-General for Environment (2022) In: Fribourg-Blanc B, Dhuygelaere N, Madec C (Eds.), (11th edn) *technical assessment on UWWTD implementation*. Publications Office of the European Union.
38. (2016) EU Press Release Data.
39. (2009) *Water management review under EU WFD, German NGO Perspective*.
40. Hermain J (2000) EA Environmental Vision UK 2020.
41. Whichers B (2018) *Changing climate changing risk*, Presented in EU Water Conference.
42. Nadir HM, Carrvick J (2019) Impact of adjacent land use, infrastructure and urbanization on water quality in a river from headwater to downstream. *International Journal of Advances in Science Engineering and Technology* 7(3): 16-23.
43. (2023) EU at UN water conference. EU Water Vision 2050.