Governing Integrated Water Resources Management

Mutual Learning and Policy Transfer

Edited by

Oliver Fritsch and David Benson

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Cover image courtesy of Oliver Fritch and David Benson.

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Preface to "Governing Integrated Water Resources Management"

Integrated Water Resources Management (IWRM) has become a global paradigm for the governance of surface, coastal and groundwaters. International bodies such as the European Union, the Global Water Partnership, and the United Nations have taken the lead in promoting IWRM principles, while countries worldwide, both in the Global South and the Global North, underwent reforms to implement these principles and to restructure their domestic or regional water governance arrangements.

Although academic, political and professional communities have put forward a wide range of different forms that IWRM could take, a basin- or catchment-based management approach, the participation of stakeholders and the wider public, an equitable allocation of water resources, full-cost pricing and an integrated approach to the management of water are typically considered key elements.

The term "integration" lies at the heart of IWRM. It describes the consideration of functional, societal and institutional integration, i.e., attempts to bring each other together and think together. This first includes watershed functions—for instance, the supply of water for domestic, industrial, and agricultural use, the protection of water resources for recreational purposes and their role as an ecosystem for numerous species, the management of floods and droughts, etc.; second, a variety of views held by water users, stakeholders, indigenous communities and other members of the public; and third, the cooperation and coordination of decision makers who operate at all political levels and govern a diversity of economic sectors and policy fields. In doing so, IWRM aims to overcome patterns of fragmentation in terms of function, societal interest and political institutions, which have previously resulted in water governance arrangements that were often described as ineffective, inefficient and illegitimate. In other words, IWRM is supposed to respond to a wicked problem.

However, the international transfer of IWRM principles raises a number of theoretical, empirical and normative questions. These relate to the causes, processes and outcomes of policy transfer. This Special Issue explores these questions. Regarding the causes, the contributions apply, criticise, extend or revise existing approaches to policy transfer in a water governance context, asking why countries adopt IWRM principles and what mechanisms are in place to understand the adoption of these principles in regional or national contexts. Looking at processes, articles in this Special Issue unpack the process of policy transfer and implementation and explore how IWRM principles travel across borders, levels and scales, between international organisations and the domestic sphere, between globally and domestically operating non-state actors and regional and national governments, and between countries and national governments. Finally, this set of papers looks into the outcomes of IWRM policy transfer and asks what impact of IWRM principles, once implemented, have on domestic water governance, water quality and water supply, and how effective IWRM is at addressing critical water issues in specific countries.

This Special Issue contains twelve articles related to the transfer of IWRM policy principles. The articles explore all three dimensions of transfer—causes, processes, outcomes—and offer a theoretically inspiring, methodologically rich and geographically diverse engagement with IWRM policy transfer around the globe. As such, they can also productively inform a future research agenda on the 'dimensional' aspects of IWRM governance. We would like to thank all authors for their contributions to this exciting Special Issue.

Oliver Fritsch, David Benson
Special Issue Editors

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Editorial

Mutual Learning and Policy Transfer in Integrated Water Resources Management: A Research Agenda

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Abstract: Integrated water resources management (IWRM) has become a global paradigm for the governance of surface, coastal and groundwater. International bodies such as the European Union, the Global Water Partnership, and the United Nations have taken the lead to promote IWRM principles, while countries worldwide have undertaken reforms to implement these principles and to restructure their domestic or regional water governance arrangements. However, the international transfer of IWRM principles raises a number of theoretical, empirical and normative questions related to its causes, processes and outcomes. These questions will be explored in our Special Issue 'Governing IWRM: Mutual Learning and Policy Transfer'. This editorial briefly introduces IWRM and links this governance paradigm to theoretical and empirical scholarship on policy transfer. We then summarise the aims and objectives of this Special Issue, provide an overview of the articles brought together here and offer avenues for future research.

Keywords: integrated water resources management; IWRM; policy transfer; water governance; Water Framework Directive; learning

1. Introduction

Integrated water resources management (IWRM) has become a global paradigm for the governance of surface, coastal and groundwaters. International bodies such as the European Union (EU), the Global Water Partnership and the United Nations (UN) have taken the lead to promote IWRM principles, while countries worldwide, both in the Global South and the Global North, have undertaken reforms to implement these principles and to restructure their domestic or regional water governance arrangements [1–3].

Although academic, political and professional communities have put forward a wide range of understandings of what IWRM could entail [4,5], a basin- or catchment-based management approach, the participation of stakeholders and the wider public, an equitable allocation of water resources, full-cost pricing as well as an integrated approach to the management of water are typically considered key elements [6,7].

The term integration lies at the heart of IWRM. It describes the consideration of functional, societal and institutional integration, i.e., attempts to bring and think together: first, watershed functions, for instance, the supply of water for domestic, industrial, and agricultural use, the protection of water resources for recreational purposes and for their role as an ecosystem for numerous species, the management of floods and droughts and many others; second, a variety of views held by water users, stakeholders, indigenous communities and other members of the public; and third, the cooperation and coordination of decision makers who operate at all political levels and govern a diversity of economic sectors and policy fields. In doing so, IWRM aims to overcome patterns of fragmentation in terms

of functions, societal interests and political institutions, which have resulted in water governance arrangements that were often described as ineffective, inefficient and illegitimate [7,8]. In other words, IWRM is supposed to respond to a wicked problem [9].

However, the international transfer of IWRM principles raises a number of theoretical, empirical and normative questions. These relate to the causes, processes and outcomes of policy transfer. This Special Issue explores these questions. With regard to *causes*, the contributions apply, criticise, extend or revise existing approaches to policy transfer in a water governance context, thereby asking why countries adopt IWRM principles and what mechanisms are in place to understand the adoption of these principles in regional or national contexts. When it comes to processes, articles in this Special Issue unpack the process of policy transfer and implementation and explore how IWRM principles travel across borders, levels and scales, between international organisations and the domestic sphere, between globally and domestically operating non-state actors and regional and national governments, but also between countries and national governments. Finally, this set of papers looks into the outcomes of IWRM policy transfer and asks what the impacts are of IWRM principles, once implemented, on domestic water governance, water quality and water supply and how effective IWRM is in addressing critical water issues in specific countries.

This article is organised as follows: Section 2 provides an up-to-date overview of IWRM, its origins, consolidation, and developments. We move on to discuss, in Section 3, the concept of policy transfer, together with adjacent schools of thought such as policy diffusion and policy translation, and their relevance for the IWRM literature. Section 4 then introduces this Special Issue; the final section concludes and explores avenues for future research.

2. Integrated Water Resources Management: Origins, Consolidation, and Developments

Soon after IWRM began to influence the global discourse about water governance and management, countries have shifted the emphasis of their approaches to managing water resources away from what has variously been called the 'hydraulic' or 'engineering management' paradigm, characterized by single-use water management agendas and major infrastructure projects, towards more integrated, plan-led, river basin scale, participatory forms that often eschew large-scale technical solutions to water management problems [10,11]

However, IWRM is far from a united approach, with different conceptualisations evident on a global scale: its popularity with policymakers no doubt stemming from its conceptual flexibility and hence the capacity to fit different water management contexts [4,7,12]. In this respect, IWRM can be understood as a management philosophy, a set of guiding principles, a process, but also as an almost certified benchmark of how good water management institutions and practices are supposed to look like [8]. These differing and often divergent understandings reflect the evolution of IWRM over many decades, so that now it is prioritised by the UN Sustainable Development Goals (under SDG 6 for access to clean water and sanitation) as the primary approach for meeting sustainability targets for global water security [13,14].

To an extent, water management practice has exhibited elements of an integrated river basin based approach for centuries [10,12]. In the 20th century, a landmark event in the development of modern IWRM was the establishment of the Tennessee Valley Authority in the United States (US) in 1933 [15]. Created by the US federal government as a means of stimulating economic development, the Authority adopted a technocratic mode of river basin management incorporating an "engineering ethos" linked to "scientific knowledge and systematic rational planning" [10] (p. 487). A series of dams on the Tennessee River were employed in an integrated way to provide electricity generation, irrigation for agriculture and other benefits such as flood control, thereby contributing to increased economic activity in the basin [15]. This model was copied extensively by other US states and also served as a blueprint for supporting US overseas development policy in the post war period [16]. During the 1950s and 1960s, the model proved attractive for developing nations as it constituted a fast track approach to modernising economies, with river basin authorities established in many countries in the Global

South [17]. Expansion of the model globally was also supported by international development agencies, including the World Bank [18]. By the 1970s, concerns over the 'engineering' paradigm started to emerge, due to its technocratic nature and its basis in rational, scientific modes of management that took little account of environmental impacts or even social need [17]. Limited transparency and public accountability in project decision making was also highlighted, with World Bank projects coming under particular scrutiny [19]. As environmental issues became more significant amongst policy makers globally in the 1970s and 1980s, new thinking emerged around integrated water management.

While the precise origins of IWRM are diffuse, one of the first attempts to develop its core principles can be traced back to the UN's Mar del Plata conference in 1977 [20]. Here, the conference recognised the importance of considering environmental and social concerns in river basin planning plus incorporating public participation into decision-making. This paradigm shift was given added impetus by the growing sustainable development agenda in the 1980s and early 1990s, particularly the publication of the influential UN-sponsored Brundtland Commission report [21]. In parallel to preparations for the UN Conference on Environment and Development in Rio de Janeiro 1992, the International Conference on Water and the Environment in Dublin established the principled basis of IWRM [22]. While the river basin was still identified as the critical scale of management, other aspects such as public participation were prioritised. In the intervening period, IWRM principles have spread globally, supported by international transfer agents [23] such as the Global Water Partnership, the Organisation for Economic Co-operation and Development, and the UN Educational, Scientific and Cultural Organization [7,24]. The EU has become a key actor as well, promoting IWRM principles amongst its member states via the Water Framework Directive (WFD) [25] as well as, through the EU Water Initiative, in other countries worldwide [26]. According to the UN [27] almost all countries now implement some form of IWRM.

The global transfer of IWRM has increasingly led to differences in how IWRM is conceptualised [5], with interpretations encompassing key principles, management processes and implementing institutions. Such a transfer of practice has led to the emergence of multiple models and examples of IWRM [1]. In contrast to the technocratic, engineering-based paradigm of the post-war era, the Dublin Principles maintain that freshwater is an essential resource which is "finite and vulnerable", that water management decisions should be participatory and engage multiple actors including women while stressing the economic value of water resources [22]. IWRM principles have been expanded to encompass pre-existing river basin planning, through the development of guidance by the Global Water Partnership and other international actors. Such guidance also provides indicative advice on establishing IWRM planning processes [28], which typically involve sequential but also adaptive stages from initial characterisation of water resources to plan development and implementation, and monitoring as a basis for iterative revision of plan objectives. IWRM also informs the establishment of specific institutions, primarily river basin or catchment authorities, to steer such planning processes. The WFD, for example, legally requires the establishment of dedicated river basin districts and participatory mechanisms, plus coordinating institutions for transnational rivers, to support planning processes [29,30].

Despite its popularity, IWRM is not without criticism: primarily that it is still argued to be a top-down, technocratic approach that is often unsuited to the social needs, economic capabilities and technical capacities of countries in the Global South [12,31]. One recent response from the academic and policy communities has been to champion other, less technocratic, management modes such as the water-energy-food nexus that specifically seek to move beyond IWRM in offering more flexibility in policy responses [1]. That said, there is a need to develop the water-energy-food nexus as a genuine form of governance before it can replace IWRM. In addition, the prioritisation of IWRM as the main implementing approach for achieving SDG 6 up to 2030 will ensure that it remains paradigmatically significant in the coming decade.

3. Policy Transfer and the Governance of Water Resources

Policymakers have always drawn lessons from other political contexts as a basis for comparison, learning and potential transfer of ideas. Given that national policy makers tend to face similar challenges in designing public policy, it therefore becomes attractive to examine policy approaches in other countries [32]. Despite a long history of transnational lesson drawing, such processes have accelerated under globalisation thereby "creating new opportunities for learning from the policy experiences of others" [33] (p. 78). This, however, raises several questions about the nature of lesson drawing; most notably, why does it occur, what are the underlying processes, and what are the outcomes? Public policy and international relations scholars have given much attention to these questions, resulting in a broad body of literature around the concepts of diffusion, lesson drawing and policy transfer and, more recently, notions of policy translation, mobilities and mutations. Questions of causation, process and outcomes also have specific implications for studying the global transfer of IWRM-but are as yet not well developed.

In explaining government policy innovations, scholars have long since examined the origins of such innovations. Originally, debates emerged in the United States in the 1960s arguing that two main features are evident: internal determinants such as political or economic factors within a jurisdiction, but also diffusion or spread of innovations operating inter-governmentally between political contexts [34] (p. 308). Subsequent studies focused more on the rationales of individual policy makers for what Rose [32,35] called lesson drawing. Political dissatisfaction is argued to be the primary motivation to learn: when pressured for responses to issues policy makers can either look to their own experiences or, when such options are exhausted, look for new ideas elsewhere [32] (p. 2). Lesson drawing is then understood as the process by which policy makers deliberately examine policy lessons elsewhere in order to understand how learning can occur: "Lessons can be sought by searching across time and/or across space; the choice depends upon a subjective definition of proximity, epistemic communities linking experts together, functional interdependence between governments, and the authority of intergovernmental institutions. The process of lesson-drawing starts with scanning programmes in effect elsewhere, and ends with the prospective evaluation of what would happen if a programme already in effect elsewhere were transferred here in future." [35] (p. 3).

The notion of such learning as a rational act by policy makers was carried forward by authors such as Dolowitz and Marsh [36–38] through their notion of policy transfer. Ostensibly, this is a neutral term to describe the transposition and implementation of policies in new political contexts, whereby various transfer mechanisms are conceivable. However, it can well be linked to Rose's concept of lesson drawing and its underlying notion of learning. Dolowitz and Marsh identified three types of policy transfer: voluntary, directly coercive, and indirectly coercive. The above-mentioned process of updating one's beliefs in the face of pressing issues and taking solutions off the shelf from somewhere else is then best described by the notion of voluntary policy transfer [36,37]. Most commonly, voluntary transfer was argued to occur where policy makers become dissatisfied with existing policy performance (i.e., Rose's notion of 'political dissatisfaction'). However, the authors were well aware of the fact that the result of lesson drawing, the transfer of policy, may also occur in settings where attempts to search proactively for solutions to policy problems are largely absent. This is when coercive policy transfer kicks in, which is imposed upon directly by external actors or indirectly through external processes. Practically, the lines between coercive and voluntary transfer are often blurred.

Subsequent scholarship expanded the range of transfer mechanisms beyond degrees of coerciveness as suggested by Dolowitz and Marsh, studying in more detail what transfer processes operate between jurisdictions. In particular, diffusion studies displayed an interest in the processes by which governments adopt policy innovations from each other [34,39]. Critical diffusion mechanisms identified in the spread of policy innovations between jurisdictions are "learning, imitation, normative pressure, competition, and coercion" [34] (p. 310). Diffusion studies expanded rapidly in the 1970s and 1980s encompassing inter-state processes of innovation spread [40], but primarily intra-state research within the USA [41]. Diffusion also became a popular research agenda amongst international relations

scholars seeking to understand how ideas, norms and policies spread through transnational state interdependency, influencing a now expansive literature [42].

Richard Rose consequently developed an influential analytical framework for policymakers to follow when appraising such policy and its transfer [32]. Dolowitz and Marsh [36] (p. 344) built upon these arguments to conceptualise policy transfer as "a process in which knowledge about policies, administrative arrangements, and institutions in one time and/or place is used in the development of policies, administrative arrangements, and institutions in another time and/or place". Policy transfer research then expanded throughout the early 2000s to encompass processes at multiple scales and the involvement of multiple actors [43]. For example, EU policy transfer has been studied as a mechanism for national policy convergence via a Europeanisation lens [44]. Such studies have subsequently diverged to include related concepts such as policy assemblages, mobilities and mutations, whereby scholars are interested in how policies are modified or reconstructed under these transfer processes [45]. While more ontologically critical in nature, these arguments connect into broader debates amongst geographers around how globalisation has shaped and increasingly shapes the transfer of ideas extra-territorially [43]. Meanwhile, other scholars have become interested in how such learning processes determine specific outcomes through the translation of policy ideas as they travel between contexts [46].

Studies have also considered the outcomes of such learning determinants and processes. For diffusion scholars the outcome is policy innovation, although different forms are evident [34]. While lesson-drawing research is more focused on the rationales for policy learning and the process by which it occurs, Rose does also provide insight into its outcomes, primarily in the form of policy evaluation and decision making, either in a negative or positive sense, around adoption [32,35]. His analysis also provides five categories of positive lesson drawing: copying, emulation, hybridization, synthesis, and inspiration [35] (pp. 132–134). As Dolowitz and Marsh [36,37] describe, copying equates to complete transfer without adjustment whereas emulation, hybridisation and synthesis entail different degrees of combining existing policy with imported innovations. Inspiration is considered the weakest form of transfer since it involves policymakers merely drawing ideas from elsewhere as a stimulus for action. Policy assemblages, meanwhile, understand the outcomes of transfer processes in terms of the constitution of diverse policy objects in specific political contexts [47]. Translation is, in contrast, concerned with how ideas 'travel' and modify in the process of transfer [46].

To an extent, these policy learning concepts and theoretical perspectives have been applied to water policy, although their use for explaining the growth of IWRM globally is limited mainly to the question of how. Primarily, studies have employed a policy transfer perspective to examine specific examples of trans-jurisdictional learning around water policy [48]. In one example, Michaels and de Loë [49] show how water management institutions were transferred into Canadian states from Australia and the USA, citing bio-physical factors as critical to lesson drawing. These arguments are extended by Swainson and de Loë [50] in demonstrating how bio-physical, socio-economic, political and cultural factors influence policy transfer in Australian water governance. In specifically addressing IWRM, Benson et al. [51] take a more normative stance when comparatively examining how cross-national learning and policy transfer could potentially enhance public participation processes within EU river basin management planning, by exploring contextual constraints in both importing and importer jurisdictions. Adding another perspective, Mukhtarov [46] utilises policy translation to provide insight into how IWRM ideas were initially adopted by Turkey. More recently, Fritsch et al. [26] explain how the EU has transferred its water policy to different regions globally, via transnational partnership networks in the form of the EU Water Initiative.

That said, our understanding of why IWRM policy norms are transferring between countries, how transfer is occurring and the types of transfer outcomes consequently is still evolving, thereby providing many research gaps. This Special Issue therefore significantly adds to this body of literature in addressing such questions, while creating new opportunities for future scholarly debate and research activities, which are discussed in the next two sections.

4. Contributions to This Special Issue

This Special Issue contains twelve articles related to the transfer of IWRM principles. The articles explore all three dimensions of transfer—causes, processes, outcomes—and offer a theoretically grounded, methodologically inspiring and geographically diverse engagement with IWRM policy transfer around the globe.

Six contributions to this Special Issue—by Demirbilek and Benson [52], Fritsch [53], Glavan et al. [54], Pellegrini et al. [55], Schröder [56], and Waylen et al. [57]—study the implementation of EU water policies; another one by Fidelis et al. [58] examines a setting directly and indirectly shaped by Brussels although no direct reference to the EU is being made. All six EU-centred contributions focus on the WFD whereby Glavan et al. [54] and Waylen et al. [57] analyse the Directive in conjunction with other EU water policies. A brief introduction into the WFD is therefore in order.

The WFD was adopted in 2000. Its overarching goal is to achieve a good water quality status for all coastal waters, surface waters and groundwater in Europe by 2027; this metric includes biological, chemical and geomorphological components for coastal and surface waters as well as chemical and quantitative components for groundwater. The Directive responds to the rather ineffective attempts to tackle water quality problems in the previous three decades via more than 20 water-related EU directives. This period was characterised by four major challenges: first, a vast majority of these policy initiatives took a sectoral (for instance, Nitrates Directive), user-focused (e.g., Bathing Water Directive) or otherwise exclusive (say, Dangerous Substances Directive) approach to the protection of water resources, resulting in a fragmented regulatory framework that ignored the cyclic nature of our aquatic environment. Second, these policies differed in ambition, resulting in contradictory water quality targets. Third, many European countries delegated environmental policy competencies to subnational jurisdictions the borders of which were often not in line with the ecological boundaries of water basins, implying a spatially fragmented approach to water planning and management. Finally, previous legislation had a technocratic, top-down tone that largely ignored the knowledge and views held by important stakeholders and the wider public; in other words, these policies ignored the social side of EU policy implementation [59]. The WFD, in contrast, promotes an integrated approach to water management that aims to bring together, in the sense of Lubell and Edelenbos [7], the diverse functions, societal interests, and institutional arrangements in the field of water. As a result, the WFD absorbed some earlier EU water directives entirely while others remained in place, but took subordinate, and auxiliary, roles in WFD management processes. Key elements of the Directive are, apart from the achievement of good water status, a six-year planning and management cycle for all water resources, the consultation of stakeholders and the wider public in water planning, the active involvement of selected key stakeholders in planning and management activities, as well as water management within ecological, rather than politico-legal, boundaries (but not beyond nation state borders). The Directive therefore represents the best embodiment of IWRM principles that Europe currently has on offer [60].

EU member states and associated countries, including candidate states, implement the WFD. However, the individual components of the Directive come with different degrees of legal obligation which is why the term implementation may have a variety of meanings here. To illustrate, the consultation of the wider public is a legal requirement whereas the active involvement of key stakeholders is more likely to have the status of a recommendation and falls short of being a legally binding and enforceable provision [61]. Likewise, there is no doubt that water managers are obliged to manage Europe's aquatic environment at ecological scales, i.e., introduce river basin management if not already present, whereas many economic instruments mentioned in the Directive have a much weaker legal status [62]. This has implications for the role of policy transfer in WFD research.

When it comes to causes and processes in WFD policy transfer, the transposition and application of legally binding IWRM principles in the Directive could easily be explained with reference to coercion, given that non-compliance may result in infringement procedures and hefty fines imposed by the European Court of Justice. For the sake of simplification, we hereby ignore the possibility that such principles were already in place in some member states when the WFD was adopted or that member

states were otherwise keen to introduce such principles anyway. After all, this is the line of reasoning implicit in almost all EU policy implementation studies: legal obligation coerces member states into compliance. In such cases, the completed transfer of EU policies is a rather uninspiring research topic: not the successful transfer deserves our attention, but its unexpected absence is a concern. Four schools of thought offer explanations here. Some argue, with reference to rational choice theory, that the benefits associated with non-implementation are greater than the costs related to an infringement procedure. Others detect a political will to implement, but observe a lack of resources to do so; this again is an argument compatible with rational choice theorising. Social constructivist thinkers, in contrast, refer to incompatibilities between EU policies and domestic practices, related either to policy ambitions or policy styles, and invoke fundamental normative and ideational differences to understand non-compliance. Finally, authors explore general patterns of behaviour when it comes to the degree to which countries fulfil international obligations [63–65]. Significantly, none of our Special Issue contributions explores this side of the coin. Instead, authors have examined the transfer of WFD principles when coercion is largely absent.

Established approaches to EU policy implementation are relatively toothless when it comes to understanding policy transfer in contexts with no or ambiguous legal-political pressure. The policy transfer literature—with competition, emulation, imitation, learning and so on—offers a much richer arsenal of mechanisms to assist here. However, it should be clear that the voluntary or quasi-voluntary character of these mechanisms suggests a much greater degree of diversity when it comes to transfer outcomes. After all, the causal chain between cause (coercion), process (transposition) and outcomes (harmonisation) is relatively straight-forward, despite the above-mentioned cases of non-compliance that are the exception rather than the rule, and the degree of diversity of outcomes tends to be small. Voluntary transfer instead, whatever the precise cause, is likely to be more unpredictable; an insight somewhat hidden in earlier works on policy transfer, yet which comes across much more prominently in studies utilising policy translations and similar frameworks [46].

The articles in this Special Issue explore these questions from different angles. Pellegrini et al. [55] analyse seven EU member states and their track record when it comes to implementing three IWRM principles: public participation, river basin management, and coordination and integration. The findings display a chequered pattern where different transfer mechanisms interact with ecological, political and societal contexts. Although the WFD triggered domestic reforms in line with IWRM principles, these reforms did not follow a common template and resulted in a variety of institutional arrangements and practices. This is not entirely surprising in light of the fact that the WFD is a framework directive which therefore provides considerable leeway to implementers, as the authors explain. On the other hand, attempts to inspire intra-European dialogue about best practices and mutual learning in the context of the Common Implementation Strategy could have suggested greater degrees of harmonisation than evidenced by Pellegrini et al. [55].

This then raises the question of knowledge exchange in IWRM, and the role that scientific inputs play in institution building, river basin planning, and implementation of measures. Looking into a range of water-related EU policy initiatives, including the WFD, Glavan et al. [54] investigate this topic. The authors identify areas of improvement, but also opportunities for a better integration of scientific findings in water management. Likewise, Nilsson et al. [66] stress the importance of better integrating scientific knowledge into environmental management decisions, here on basis of an ambitious quantitative analysis of sustainable fisheries in 34 nations. The analysis covers countries from all continents and is unrelated to the EU, which dominates the set of Special Issue papers so far. However, the findings chime well with Glavan et al. and others.

The contributions by Schröder [56] and Waylen et al. [57] look at the degree of integration and coordination achieved through recent EU water legislation. Waylen et al. compare several European countries while Schröder presents an in-depth case study of five German states. Interestingly, the regulatory provisions of the WFD themselves did not appear to be a major factor to enhance coordination and integration, Schröder's study finds. Germany is a country

defined by high degrees of land use, with few areas characterised by a pristine natural environment. WFD implementation interacts, and sometimes potentially conflicts, with a range of other land use activities and policy goals. Hence, the achievement of the Directive's water quality goals calls for integrated and coordinated approaches to water management. Water officials in Germany recognise this necessity but to various degrees, resulting in a vast diversity of local-level attempts to achieve integration that have occurred relatively independently from the regulatory provisions found in the WFD [56].

This line of reasoning mirrors arguments presented by Fritsch [53]. The author analyses the adoption of more participatory forms of water management in England and Wales during the implementation of the WFD. Coercion was an unlikely explanation here because the respective provision in the legal text has no binding force. Carefully tracing the decision-making process that led to enhanced participation, Fritsch provides evidence for intra-organisational learning within the implementing agency that occurred in response to the ambitious and visionary water quality agenda set by the Directive. True, we observe IWRM policy transfer here, but the source of inspiration were not the WFD's public participation provisions, as one would have expected, but a wide range of domestic and international discourses, both academic and political, that were utilised in order to respond effectively to a perceived policy problem. Exploring two case studies in Canada and the US, Watson et al. [67] too stress the importance of problem perception as a key condition for the adoption of IWRM principles. However, here water managers responded directly to suboptimal conditions out there, not—as in Fritsch's case—to ecological goals in legal frameworks adopted by higher-order authorities.

Demirbilek and Benson focus primarily on transfer outcomes in their analysis of WFD implementation in Turkey [52]. Drawing upon pre-existing transfer outcome concepts, they analyse the extent to which legal requirements of the Directive have been implemented within the context of a declining EU accession process in this country. The authors conclude that, while the 'conditionality' of Turkey's accession has led to implementation of the main features of the Directive, a unique hybrid or 'assemblage' form of IWRM, that combines the EU approach with pre-existing water institutions, is now emerging. The analysis of hybridity in IWRM, along with de-Europeanisation in water governance, are therefore developed as research agendas.

Fidelis et al. [58] analyse the case of Ria de Aveiro in Portugal to discuss the potential of four more or less IWRM-compatible governance models, using the requirement of institutional reforms, the requirement of new practices, comprehensiveness, adaptability, focus and degree of collaboration as benchmarks.

Turning now to the remaining Special issue contributions set in a context outside Europe, the work presented by van der Voorn and Quist [68] links well to our previous discussion of IWRM policy transfer processes and their causes. This paper is original in two ways: it explores water management reforms in the Lower Mississippi River in the 19th century, showcasing the value of historical analysis for contemporary debates. On the other hand, the authors use the literature on socio-technical transitions to understand their case, a highly cited theoretical framework in transition management and the like, but somewhat neglected by the water policy transfer community. Likewise, the contribution of Leong and Mukhtarov [69] has a strong theoretical focus. The authors link more recent conceptual work on policy translation and policy analysis to understand IWRM in a Cambodian context. The authors find that, in particular, myths and stories can be important drivers with regards to mobilisation and policy making. Finally, Jensen and Nair [70] compare the cases of Singapore and Hong Kong with regards to the capacity of their integrated urban water management regimes to achieve water security in their jurisdictions.

5. Outlook and Avenues for Future Research

The contributions to this Special Issue have analysed the causes, processes and outcomes of IWRM policy transfer, and in doing so they have used a range of approaches, methodologies and perspectives. This final section will conclude by reflecting upon a few of the themes raised by these contributions

with the aim of proving suggestions for a research agenda to guide future scholarship. Our discussion is organised around four major themes: concepts, theory, causality, and methodology.

First, we encourage further conceptual work on IWRM and, more specifically, IWRM ideal types. Let us explain: the articles here have, in line with previous scholarship on the topic (see Fritsch and Benson [60] and other works in that special issue of the International Journal of Water Governance), stressed the diversity of IWRM implementation patterns. Pellegrini et al. [55], for example, examine the various embodiments of public participation and river basin management in seven European countries; for Leong and Mukhtarov [69], the juxtaposition of top-down, technocratic approaches and bottom-up, society-centred perspectives constitutes the point of departure of their research. We suggest systematising this line of thinking. IWRM is typically presented as consisting of principles such as participation, science-policy interfaces, management at hydrological scales, and the like. These principles are not uniform; they can come in various guises. One could say that these principles are variables that may take on different values. However, there is little research exploring whether some combinations of values are more likely to occur than others, i.e., whether the empirical reality out there is characterised by the presence of, say, three, five or seven ideal types of IWRM. We believe that such conceptual work will assist in going beyond plausible, but in their ambition somewhat limited, insights according to which IWRM implementation patterns are colourful and diverse. Instead, it may inspire empirical work examining under which ecological, political or societal conditions IWRM is likely to take on a specific shape.

Second, we suggest broadening our theoretical lenses when studying IWRM policy transfer. Contributions to this Special Issue provided exciting examples: van der Voorn and Quist [68] brought the widely cited, but within the IWRM community somewhat underutilised, scholarship on socio-technical transitions into play. Leong and Mukhtarov [69] link the literature on policy translation to narrative analysis. Fritsch [53] employs organisational theories to study the transfer of IWRM principles. In our mind, the IWRM literature is, at times, either under-theorised or operates within theoretical and disciplinary silos. Enhanced dialogue with related scholarly communities will be beneficial. This includes the literature on policy implementation (in Europe: Europeanisation), international relations scholarship including concepts such as norm transfer (in Europe: EU conditionality studies), social-constructivist and discursive-institutionalist work, and many others.

Third, research published in this Special Issue confirms that several mechanisms may simultaneously be at work during the transfer of IWRM principles [53,56]. In the hope to improve our understanding of causality here, we propose further studies into the interplay of mechanisms. Specifically, the question arises how mechanisms interact, whether they compete or reinforce each other, and what the implications are for transfer outcomes. Globally, a number of organisations engage in promoting IWRM principles, including the EU, the Global Water Partnership, the Organisation for Economic Co-operation and Development, the UN, and the World Bank. However, they utilise different mechanisms to do so, and studies exploring the interplay of these mechanisms in an IWRM context are still in great demand.

Finally, this Special Issue points to challenging methodological questions. Many studies of IWRM policy transfer take a methodological top-down approach: IWRM, or one of its components, is the idea, and authors then trace the pathway that this idea has taken from sender to recipient in order to establish causality. However, some works in this volume suggest that such a research design may result in premature conclusions. Fritsch [53] and Schröder [56], for example, observe the application of IWRM principles in their case study countries, but deny a major causal role of the WFD, the piece of legislation promoting such principles in the EU. Instead, they observe an internal learning process leading to the adoption and institutionalisation of IWRM principles. Plausibly, there is not necessarily a causal link between actor A demanding X and actor B doing X. It may well be that actor B had intrinsic reasons to do X anyway or that actor C demanded X as well—and that it was actor C rather than A who influenced B. In order to detect such a pattern, one would need to study the whole range of potential influences, and this calls for a research design following a bottom-up perspective [71] (p. 37).

In order to avoid conceptualising IWRM transfer agents as 'a cause in search of an effect' [72], students of IWRM policy transfer are therefore well advised to start and finish the analysis at the domestic level and treat specific globally operating actors as one of many potential sources. Decision makers are, after all, subject to a number of potential domestic, European, and international influences.

Whichever direction future studies will take, there are good reason to look forward to another wave of exciting scholarship on the international transfer of IWRM principles, particularly as this governance 'paradigm' assumes greater global significance for policy makers due to the UN's SDG agenda.

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Article

Coordination and Participation Boards under the European Water Framework Directive: Different Approaches Used in Some EU Countries

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Abstract: River basin planning under the European Water Framework Directive (2000/60/CE, WFD) poses two major challenges to EU countries: coordination among administrative units for large-scale river basin planning and the inclusion of interested parties in decision-making processes. To face both challenges, many Member States have established Coordination and Participation Boards at the River Basin District or river basin level. These boards can be defined as multi-agency and multi-actor groups that support the development of inclusive and coordinated river basin planning to comply with the WFD requirements. The aim of this paper is to understand the functioning and effectiveness of the coordination and participation boards in promoting participatory river basin planning in seven EU countries. We built a conceptual framework, based on spatial fit, coordination capacity and participatory governance theories, to assess the scale at which these boards are established as well as the type of coordination and participation they support. The results indicate the relevance of the sub-River Basin District level to promote participatory decision-making. However, a clear linkage between participatory processes conducted at the sub-district level and decision-making processes at River Basin District should be established. Only if this link is well established are the outcomes achieved through the coordination and participation boards included in river basin plans. Moreover, we identified a lack of knowledge on how planning and implementation activities carried out at sub-River Basin District are aggregated and coordinated for the entire District. Research could contribute to this issue, by focusing on coordination mechanisms and problems that occur at the River Basin District level.

Keywords: Water Framework Directive; policy implementation; integrated water resources management; river basin planning; public participation; water governance; scale; top-down and bottom-up

1. Introduction

European water resources are definitely under pressure: more than half of surface water bodies have a less than good ecological status, and approximately 25% of the groundwater is reported to have a poor chemical status [1]. Moreover, European waters are endangered by over-abstractions and increasing climate change effects, such as droughts and short periods of rainfall [2]. In 2000, the Water Framework Directive (2000/60/CE, WFD) established the European strategy to address these increasing concerns about water resources. The reference to the principles of Integrated Water Resources Management (IWRM) is evident for some aspects of the WFD, such as river basin management,

participatory approach and the acknowledgement of the economic value of water. However, the WFD reflects a narrower and more technical vision of IWRM with a primary focus on water sector [3] and its overall aim is to establish a framework for the protection of water resources that applies to all available water bodies in Europe. For this purpose, two targets were set in 2000: first, preventing further deterioration of water bodies, and second, improving their state with the aim of achieving 'good water status' by 2015 (Article 4, WFD). As a 'framework' directive, the WFD does not prescribe EU countries what to do to improve water quality and management but rather tell them how to do it [4–6]. In particular, the WFD establishes the river basin planning process as the 'central tool' to achieve water quality objectives [7]. Outputs of this process are the River Basin Management Plans (RBMPs) that are manifold documents that go from the evaluation of the state of water bodies within a specific hydrological scale, the River Basin District (RBD), to the identification of a set of measures to improve and restore qualitative and quantitative aspects of water resources [7]. The identification of RBD as the management unit of water bodies, and the development of RBMPs, can be observed as the institutionalization of the principle of spatial fit at the European level [8]. This large-scale configuration for river basin planning poses a great challenge to EU countries in terms of coordination among the government tiers at different geographical scales of the RBD. Moreover, the WFD mandates the involvement of civil society at each stage of the planning process [9]. Kaika [10] argues that the new decision-making procedures and institutions that the WFD implementation mandates can be seen as 'a top-down effort to create social capital' and that the interaction between this WFD-generated social capital and the pre-existing social capital determines the final implementation. Newig and Koontz [11] synthetized this new approach for policy implementation established at the EU level with the expression Mandated Participatory Planning (MPP). The latter tries to grasp the main aspects of this implementation style that are: the creation of new governance levels and the need to improve horizontal and vertical coordination for effective policy implementation, the participation of private actors in decision making, 'the creation of plans that are in themselves political programmes' [11]. After the first implementation cycle (2009–2015) it was evident that implementation of the WFD has been cumbersome for many Member States [12,13]. By studying the adaptation to the requirements of river basin management and participation in thirteen EU countries, Jager et al. [14] concluded that 'established routines of environmental decision-making' were kept in most of the countries. Nevertheless, the authors found that implementation of the WFD encouraged the creation of organized boards that bring together authorities and stakeholders for the development of RBMPs [14]. These boards promote coordination and participation for river basin planning and can be seen, we argue, as the new social capital generated by the WFD under Kaika's definition [10].

Even though the WFD does not formally require the institution of these boards, in the guidance document on public participation the European Commission suggests the creation of steering and advisory boards as methods to promote coordination and participation in many steps of the planning process [9].

We believe that the governance changes that occurred in EU countries as a consequence of the WFD implementation deserve a specific attention from research. Consequently, the aim of this paper is to understand what type of coordination and participation these boards support for the development of RBMPs. To this end, we performed a qualitative meta-analysis of the implementation strategies in 7 EU countries, focusing on the role of coordination and participation boards in the development of RBMPs. In this paper we refer to Coordination and Participation Boards (CPBs) to identify multi-agency and multi-actor groups supporting the development of river basin planning.

In doing so, this paper aims to contribute to the growing branch of the literature that addresses the governance implications of the WFD [15] and to provide useful suggestions for the future implementation cycle.

The rest of the paper is organized as follows: the second section provides more information about the procedural obligations established by the Directive for the development of RBMPs and public participation; the third section provides the theoretical framework that guides our analysis. We referred to the theories of spatial fit, coordination in public management and participatory governance and we identified three research questions: (1) At what scale are CPBs established? (2) How is coordination among administrations within the same RBD achieved? (3) How are civil society's interests included in RBMPs? The fourth part describes the method adopted to select the EU countries for whom CPBs are analysed; in the Results section, we analysed the formal institutional changes occurred in selected EU countries to comply with the WFD's requirements; in the sixth section, we discuss the results in view of the conceptual framework, focusing on what implications institutional changes have in promoting effective coordination and participation strategies; finally the Conclusion outlines the main results of our analysis, limitations and future avenues of research.

2. River Basin Planning under the EU Water Framework Directive

To achieve both objectives of good water status and not deterioration, the WFD establishes two main procedural obligations that EU countries should undertake. The first requires Member States to base the planning and management of water bodies on hydrological boundaries rather than on administrative ones. This requires setting up a new unit for the management and protection of river basins, the RBD, which is 'the area of land and sea, made up of one or more neighbouring river basins together with their associated groundwaters and coastal waters' (Article 2, WFD). For each RBD, an RBMP must be developed (Article 13, WFD), which includes the analyses of the RBD characteristics and of the main physical and societal pressures on the water resources; the designation of specific objectives for each water body according to the pressure and the state identified; monitoring programmes to trace improvement in the state of the water resources; the economic analysis of water uses and services; and the Programme of Measures (PoMs). The latter is a key document of RBMPs as it establishes all the activities that have to be carried out on water bodies to achieve the good status objective.

The second obligation asks Member States to engage in participatory processes by including all interested parties into the development of RBMPs. To operationalize this bottom-up approach, information supply, stakeholder consultation and the active engagement with civil society in the development of RBMPs are required by the WFD (Article 14). Both information supply and consultation are mandatory for WFD implementation but do imply a direct engagement of the public in the decision-making process, while active involvement is encouraged by the European Commission and implies collaboration among authorities and interested parties in the development and implementation of RBMPs and PoMs [9].

Due to the heterogeneity of water governance systems across EU countries, river basin planning and public participation can be achieved in many ways, and the Directive recognizes a high degree of flexibility in addressing both procedural obligations. For instance, the WFD does not require that specific competent authorities accountable for the WFD are created, nor does it state that one specific implementation approach (such as centralized, regional, or local) is superior to the others. In addition, the Directive recognizes that the planning process may occur at different geographical scales (i.e., sub-basin) or per water themes [7]. In the same vein, public participation may be carried out at the scale deemed most appropriate by countries as long as a clear reference to the RBD is made and information flows across the different scales are guaranteed [9].

Despite this flexibility, the WFD is unequivocal on the effects that both requirements should produce. For instance, Article 3 states that 'Member States shall ensure that [...] all programmes of measures are coordinated for the whole of the river basin district' (WFD). This requirement has implications both in terms of coordination across administrative levels at different geographical scales of the RBD and for cross-sectoral coordination among different water-use sectors that must align their interests and objectives to improve the state of the water bodies [3,16]. In the same vein, the WFD

links the achievement of effective policy implementation to public participation [4,17,18]. For instance, participatory planning is supposed to improve the quality of river basin planning, as expert-based and local knowledge are included in the decision-making processes, as well as to increase social acceptance towards decisions that should, in turn, facilitate implementation. Moreover, public participation should increase public awareness and the ownership of environmental problems [19] and facilitate a process of mutual understanding among parties as well as social learning [3,20,21].

In summary, the adoption of both procedural requirements by Member States is expected to produce results in terms of administrative and sectorial coordination, as well as of inclusive decision-making. Whether these outcomes are achieved depends on the actions and activities that the actors involved in water management and protection establish [22]. In this paper, we focus on a specific activity that Member States usually engage in to promote inclusive and coordinated river basin planning and management: the creation of CPBs. These boards, established at the RBD or sub-RBD scale, address the challenge of coordination through the creation of multi-agency and multi-actor groups that develop or support the development of RBMPs and PoMs.

3. Conceptual Framework to Analyse CPBs

Cross-administrative coordination and civil society engagement in decision-making procedures are surely issues widely discussed in public management literature.

New Public Management (NPM) reforms that occurred in many Western democracies during the 1980s and 1990s challenged the notion of the State as the only provider of public services [23]. Central government lost its capacity to give direction to society, while the space of decision-making became wider including decentralized state actors, societal actors and supra-national actors [24]. This modern setting is referred to with the overarching definition of governance. As Hufty observes, governance is a social fact that has to do with the way in which each society develops its own ways of making decisions and resolving conflicts [25]. This definition explains why this term is widely used in governance literature. Kjær [23] provides a basic definition of governance saying that it entails 'something broader than government, and it is about steering and rules of the game'. For our research's objectives, three specific aspects of this social phenomenon are relevant. The first relates to how multiple actors that are engaged in decision-making processes coordinate their activities to find solutions for collective problems (Coordination in public management and administration). The second addresses the issue of how decision-making processes include the interests of civil society in policy development (Participatory governance). The last one regards the capacity of social institutions to match themselves with the natural and social domains they influence (Spatial fit).

Coordination in public management and administration. Many governance studies agree that the dispersion of authority across jurisdictions and societal actors is normatively superior because it allows decisions to be taken closer to the places where problems arise [26] and it facilitates the achievement of benefits at multiple scales as well as experimentation and learning [27]. However, this broader space of decision-making, together with the hollowing-out of the State, makes coordination a huge challenge.

MLG research, for instance, raises 'the difficulty of having to coordinate governmental and non-governmental actors at different territorial levels in ways that do not conform with the hierarchical relations or the mechanisms of consultation currently in place in member states' (Piattoni, 2008 as cited by [28], p. 12). Rhodes stresses the meaning of governance as self-organizing networks that risk creating problems to governability when not properly managed by central government [29]. Dang et al. [30], indeed, define governance capacity as the 'actors' ability to cooperate to solve collective problems' while institutional capacity is intended as the institutional settings that allow actors' cooperation. Strategies to improve coordination often find a compromising solution between the increase of central control and the promotion of more collaborative types of decision-making [31]. Rhodes argues that for managing networks of interdependent actors that characterize any governance system, government should search for new tools different from traditional authoritative power, such as 'game-playing, joint action, mutual adjustment and networking' [29]. Elinor Ostrom stresses the need for institutions that

enable trust among participants engaged in a 'dilemma situation' of resources management to promote social cooperation [32].

The implementation of the WFD engages first and foremost public administrations concerned with water management and protection. For this reason, research addressing the issue of coordination in public administration is particularly relevant for our study. Wegrich and Štimac describe three main types of coordination that have been observed for public administration and executive government: hierarchical coordination, negative horizontal coordination and positive horizontal coordination [31]. In the first type of coordination, decisions are made at high levels (by executives, leaders, etc.) and affect lower levels regardless of the individual distribution of the costs and benefits [31]. In negative horizontal self-coordination, instead, the policy is developed by the group with the main responsibility for the issue and then is analysed by the other units involved in the decision-making to ensure that the draft does not violate or contradict other policy domains [31]. Finally, positive horizontal self-coordination occurs when proposals from different units are combined to elaborate a joint plan. This type usually involves the creation of task forces or specific working groups [31].

Participatory governance. We borrow definitions from both collaborative governance and participatory governance theories. Collaborative governance is defined as 'A governing arrangement where one or more public agencies directly engage non-state stakeholders in a collective decision-making process that is formal, consensus-oriented, and deliberative and that aims to make or implement public policy or manage public programs or assets' [33]. Participatory governance, instead, can be defined as 'the regular and guaranteed presence when making binding decisions of representatives of those collectivities that will be affected by the policy adopted' (Schmitter, 2002 as cited by [34], p. 595). Engagement of non-state actors is certainly the common trait of both definitions; however, collaborative governance implies a two-way communication and influence between public agency and stakeholders and its aim is a multilateral consensus-based deliberation [33]. Partnerships, collaborative management, interactive decision-making can provide examples of this bottom-up approach of decision-making [33,35]. Participatory governance, instead, implies decision-making processes initiated from the top and that include stakeholders before the policy is created [34]. Newig and Koontz [11] place WFD's requirement for public participation under the umbrella of participatory governance and underline that the rationale for having stakeholder involved in the development of RBMPs is to enhance the effectiveness of policy delivery. The guidance document of public participation, in fact, clarifies that 'Public participation is not an end in itself but a tool to achieve the environmental objectives of the Directive' [9]. Newig and Koontz [11] identify three dimensions of participatory governance: representation, information flow and influence. The first relates to the extent to which participatory processes reflect the variety of interests of society. The second, at least in the terms of the WFD, can range from information supply to the public (one directional flow), consultation of interested parties (bi-directional flow with advisory function), active engagement (bi-directional flow with deliberative function). Finally, influence is related to the capacity of participatory processes to actually determine decision-making [11]. This last dimension is particularly relevant for our study, because it provides information on whether, and under what conditions, the outcomes of participatory processes are included in RBMPs.

Spatial fit. Spatial fit, and its related problem of fit, refers to the attempt to improve the capacity of social institutions to match themselves with the natural and social domains they influence [8,36,37]. In terms of water resources management, the answer to the problem of fit has come from the river basin approach or watershed approach [38]. Although river basin management was a practice since ancient time, it is only in the last century that this approach was deemed at the base of sustainable water resources management [39]. Empirical research on the topic highlights the difficulties of matching institutional boundaries with natural ones [40] and stresses the need to take into account also other dimensions of fit, for instance, with political, socioeconomic and cultural features, to support sustainable water management [8,41–43]. CPBs established at the river basin level, can be regarded as an endeavour to make institutions more consistent with natural and societal processes.

The theoretical background described in this section allowed us to identify the three relevant factors that we analysed in the selected case studies: the scale, the type of coordination and the type of participation. For each factor, a specific research question has been identified and possible options outlined. Table 1 summarizes the theoretical background, the factors, the research questions and options that guided the analysis of CPBs in the selected EU countries.

Table 1. Conceptual framework used to analyse the CPBs.

Theoretical Background	Factors	Research Question	Options
Spatial fit	Scale	At what scale are CPBs established?	Administrative RBD Sub-RBD
Coordination in public management and administration	Type of coordination	How is coordination among administrations within the same RBD achieved?	Hierarchical coordination Negative horizontal self-coordination Positive horizontal self-coordination
Participatory governance	Type of participation	How are civil society's interests included in RBMPs?	Representation Information flow Influence on decision-making

Source: author's own elaboration.

4. Materials and Methods

This article analyses empirical studies, European Commission implementation reports and consultants' reports that address the topic of water governance adaptation to WFD requirements in EU countries. Using the Scopus and Web of Science databases, papers were first screened by title and abstract to exclude non-English written papers; papers on physical or natural science; mathematical, technology and software-based research; studies on the exportability of the WFD to non-EU countries and meta-analyses. This first screening led us to consider 70 studies. This analysis allowed us to understand the overall implementation pattern for the following countries (not for all EU states as none or very few studies were found for some countries): Denmark, Latvia, Lithuania, Poland, The United Kingdom, Greece, Finland, Germany, Italy, Spain, Portugal, France, Sweden, The Republic of Ireland and The Netherlands. These countries represent a good sample of different approaches used for WFD implementation: the centralized approach (Denmark, Latvia, Lithuania, Poland, The United Kingdom, and Greece), the federal/regional approach (Finland and Germany), the river basin approach (Italy, Portugal, France, Sweden, and Spain), the local approach, (The Republic of Ireland), and the multi-level approach (The Netherlands). However, as the aim of the study is to understand the structure and functioning of CPBs, we restricted our analysis to 64 studies referring only to those countries for which detailed information on the topic was available. Thus, the focus was placed on the following countries: Denmark, England and Wales, Germany, Italy, France, Spain and Sweden. This selection certainly constitutes a limitation to a more comprehensive analysis of coordination and participation across EU countries. Nevertheless, this study allows for an analysis of some of the different approaches used in Europe to comply with the WFD requirements.

5. Results

Implementation of the procedural obligations described in the Section 2 varied considerably across EU countries depending on the different domestic water policies already in place. In this section, we analyse formal implementation of both requirements of river basin planning and participatory decision-making in the seven selected countries with a focus on CPBs. In particular, we looked at how countries have adapted their water governance structures and what role, composition, functioning and resources 'availability CPBs had in the development of RBMPs. We overall identify two main

approaches for the implementation of the WFD: the centralized and the decentralized. Specifically, we identified the centralized approach in Denmark, England and Wales, and the decentralized in Germany, Italy, France, Spain and Sweden although these countries differ considerably within the group.

5.1. Centralized Approach for WFD Implementation

5.1.1. Denmark

The first phase of WFD implementation in Denmark was characterized by a rigid top-down approach. According to Liefferink et al. [44], the main reason for this centralized planning approach was related to the fear that a more participatory approach would have increased the costs of the decision-making process. The Nature Agency (NA) under the Ministry of Environment (MoE) and its seven local agencies were given the responsibility for the development of RBMPs for the four RBDs [45]. Additionally, PoMs were designed in a highly centralized process with a limited inclusion of municipalities despite their role of recipients and implementers of the measures [46]. In 2013, however, the Ministry of Environment reformed water governance for WFD implementation and established 23 new water councils (WCs) at the sub-RBD level composed of a maximum of 20 members each, representing a variety of stakeholders of water resources protection, use and management [47]. The new structure for the WFD implementation is organized as follows: the NA is still responsible for RBMP development, and it establishes a fixed regulatory framework within which WCs can work (e.g., the NA establishes the minimum environmental improvements that PoMs must make). Then, the municipalities organize and facilitate the WCs' work, which basically consists of providing advice to the municipalities for the drafting of PoMs. [47]. Concerning funding sources, for the implementation cycle 2015–2021, the Danish government allocated DKK 695,700,000 (€93 million) to the 23 water councils and municipalities, and the money was distributed across WCs according to the NA's criteria [47]. Hence, WCs have a twofold function as they allow for stakeholders' participation in the planning process, and they provide advice to local authorities even if they do not have veto power over municipalities' decisions.

5.1.2. England and Wales

WFD implementation in England and Wales shares many common features with the Danish experience. During the first planning cycle (2009–2015), in fact, water planning was centralized at the Environment Agency (EA), with poor consideration of local authorities and stakeholders' organizations, which were treated merely as 'co-delivers' of PoMs rather than 'co-deciders' [48]. To ensure a degree of coordination and stakeholder consultation, the EA established RBD Liaison Panels composed of representatives of key sectors of the district who were responsible for PoMs implementation [19]. However, these panels were mainly used by the EA to transmit information to other administrations and stakeholders, rather than being real participatory bodies [48,49]. Similar to Denmark, for the second cycle (2015–2021), the government launched the so-called 'Catchment-based approach' (CaBA), re-focusing the scale of water planning from 10 RBDs to 93 individual catchments [50]. At the catchment scale, the national government encouraged the creation of multi-actor groups, called 'Catchment Partnerships' (CPs). The structure, composition and organization of the CPs are not established by the national government, but these partnerships can organize their activities based on local needs. However, the aim of these collaborative groups is to facilitate collaborative works between local communities and the EA's planning process through the identification and implementation of measures. For its part, the EA encourages such initiatives by providing data, the framework of analysis and funding support. During the start-up of the process, the government allocated £1.6 M to be distributed across the CPs according to criteria delineated by the EA. After the initial funding cycle, the CPs are expected to establish their own funding sources to support their activities [51]. Moreover, in each CP, an EA Catchment coordinator is responsible for ensuring that there are information flows

and collaboration between the experts of the EA and the CPs [51]. Although the EA should show 'due regard to the advice from those partnerships in relation to the priorities set out in the River Basin Management Plan' [51], the leading role in the development of RBMPs and PoMs is kept in the hands of the Environment Agency.

5.2. (Decentralized) Federal Approach for WFD Implementation

Germany

Water management in Germany is traditionally organized around administrative-political boundaries rather than hydrological ones [41]. Following the WFD, 10 RBDs were identified, and the Länder Ministries for the Environment were appointed as competent authorities for WFD implementation for all water categories [52–54]. As many RBDs include more than one Federal State (Länder), they are required to coordinate their activities for RBMP development [52]. A joint working group of Federal States, called LAWA, insures cross-state cooperation, but the development of joint RBMPs among Länder belonging to the same RBD is not general practice [14]. The governance for WFD implementation varies depending on the Federal State but is generally organized as follows: at the Länder level, the federal ministry for the environment provides general instructions on the planning process and approves RBMPs. At this level, coordination boards are established, composed of groups of technical experts to support the implementation of the WFD. However, real stakeholder engagement and participation occur at the catchment level, where long-term participatory institutions, called working groups (WGs) or area cooperation (AC), were established [14,20,42,55,56]. These CPBs are established by the Länder Ministries for the Environment and are usually led in cooperation with the Federal State environmental agency, which sets the agenda for meetings and selects participants among existing networks of organizations [34]. These boards are composed of local authorities, water-user associations, and NGOs, and their task is to discuss and identify feasible and cost-effective measures [57]. The measures selected by the CPBs are then returned to the Länder Ministries for the Environment to elaborate the final versions of the RBMPs and PoMs. In terms of funding, we did not find information for the whole country, but both Newig et al. [42] and Koontz and Newig [34] report that the Lower Saxony Ministry for the Environment allocated €15,000 to each AC to support their work.

5.3. (Decentralized) Traditional River Basin Approach for WFD Implementation

5.3.1. Italy

In Italy, the institutionalization of river basin management occurred before WFD implementation.

In 1989, Law 183/1989 was the first attempt to establish a systemic management of land and water resources based on river basin boundaries with specific river basin authorities. In addition, Law 36/1994 identified 'optimal territorial units', where intermunicipal agencies identified by regional administrations were in charge of managing all the water services, from water capture to sewerage and depuration systems, in an integrated way to overcome administrative fragmentation. However, both laws were implemented to a limited extent. The main governance innovations established by the laws—namely, the creation of functional jurisdictions for water management and protections—were basically overlooked [58]. In 2006, for WFD implementation, specific competent RBD authorities (RBDAs) were designed and appointed to develop RBMPs and PoMs and ensure public participation [52]. According to the law, these RBDAs should have replaced the pre-existing river basin authorities and become the coordinating and decision bodies for WFD implementation. However, this replacement occurred only in 2016, so that the first and second rounds of RBMPs were approved under the supervision of the weak pre-existing river basin authorities and large-scale river basin planning was very limited [58–61]. Moreover, in the first implementation cycle, no additional funding sources were allocated by the Ministry of the Environment to the RBDAs. Regardless, the governance for WFD

implementation is organized as follows: regional administrations (R in Figure 1) develop their own water protection plans, which are similar to RBMPs and contain PoMs. RBDAs should ensure that the regional plans are consistent with the objectives set at the RBD level. RBDAs are composed of two decisional bodies, namely, the institutional and the technical committees. The first is the deliberative body of the RBD authorities and is composed of the head of the RBD authority, all the regional administrations in the district, representatives from the main national ministries and representatives from the agricultural sector, which have only an advisory function. The second is a technical body that provides technical support for the development of RBMPs (Article 63 Legislative Decree 152/2006). However, in addition to these institutional bodies, coordination is mostly achieved through more informal meetings at the district or sub-district level. RBD authorities also organize road shows in different places and at different levels of the RBD to provide information on WFD implementation to citizens and stakeholders. In summary, although RBDAs are competent authorities for WFD, the main actors for river basin planning are still the regional administrations (see in Figure 1, where the transparent triangle of RBDA is compared to that of regional administrations).

5.3.2. France

In France, river basin management was established long before the WFD, in 1964, when Water Agencies (WAs) at the river basin level were created [62]. Moreover, in 1992, the French Water Development Master Plan established planning at the watershed level, and citizens were allowed to give input to these plans by means of Basin Committees and Local Water Commissions [63]. Following the WFD, the French water governance is organized around two main governance levels: the RBD where the WA, and in particular its legislative body called the Basin Committee (BC), adopt a river basin management plan (SDAGE) that is equivalent to the RBMP under the WFD [44]. In addition, there is the local level, where local authorities develop their own water management plans (SAGE) and implement measures [64]. At the RBD level, the BC is composed of elected representatives from ministries (20%), regional and local governments (40%), water users and associations (40%) (such as farmers, industries and NGOs). The river basin plans adopted by the BC are then approved by the *prefèt*, which is a national government representative designed as the official competent authority for the WFD in each RBD, so that central control over the plans is insured [44]. The WAs are also composed of executive bodies, called, again, water agencies, which are 'state-owned, financially autonomous bodies responsible for levying abstraction and pollution charges on water users' [64]. At the sub-basin and local levels, local authorities can elaborate the cross-municipality plans called SAGE. The latter is developed through a local water commission (CLE) composed of representatives of the state (25%), local authorities (50%) and users (25%) [65]. Upon WFD implementation, water governance in France has become increasingly less centralized [64]; however, at the RBD level, through the *prefèt*, and at the sub-RBD level, because of CLE composition, central control is ensured.

5.3.3. Spain

River basin management in Spain was established in 1926 when the '*Confederaciones Sindicales Hidrologicas*' were created. Moreover, in 1985 river basin plans became compulsory and approved as Royal Decrees by the government [66]. Upon the WFD implementation, the country has been split in 25 RBDs, of which 9 are inter-regional RBDs made up of several *Comunidades Autonomas* (regions hereafter), while 16 are intra-regional RBDs. Competent authorities for inter-regional RBDs are the *Confederaciónes Hidrográficas* (CHs) that are river basin authorities belonging to the Ministry of the Environment and Rural and Maritime Affairs (MMARM). CHs have a high degree of financial autonomy because they receive fees from users; however, the MMARM also contributes to their functioning by providing them with financial resources and appointing their presidents and water management boards [67]. In the intra-regional RBDs, instead, regional hydraulic administrations are the main competent authorities for the WFD implementation [52]. In this organization, CPBs are established both at national and RBD levels. At the national level, the National Water Council

(NWC) is composed of the national government, regional and local administrations, CHs and regional hydraulic administrations that together are called *Organismos de Cuenca*. NWC provides information and coordination for the development of RBMPs and for the drafting of National Water Plan. At RBD, the CHs are composed by four different bodies: the executive body, the management board, the Water Council and the Committee of Competent Authorities. These bodies have a similar composition, including representatives from state, regional and local administrations belonging to the same RBD and the main water users. Although with different functions for water planning and management, all these bodies support coordination and participation for the planning process. In particular, the Water Council is the organism in charge of planning process and participation, while the Committee of Competent Authorities ensures administrative cooperation for the execution of water protection standards [52]. Concerning public participation, very inclusive forms of participation have been established following the WFD implementation. However, participatory processes are usually organized at regional level where specific sub-groups of public and private stakeholders are established; moreover, specific offices have been created within regional administrations to foster participation [18,20].

5.4. (Decentralized) Adaptive River Basin Approach for WFD Implementation

Sweden

Sweden has undergone formal institutional changes to comply with the river basin management requirement established by the WFD [14]. Before the WFD, competences for water protection and management were shared between two actors: the central state was responsible for water regulation, and the municipalities were responsible for water and land-use planning [14,68,69]. For the WFD, 5 RBDs and new regional water authorities (RBDAs) were created [70]. These new authorities are responsible for coordinating water management among the regional county administrations of the RBD, while in each RBD, formal decision-making is carried out by a Water Board (WB), which is made up of government-appointed experts [14]. Coordination among the RBDAs is also foreseen; for instance, the measures listed in the PoMs are the same for all RBDs [70]. While the RBDAs are responsible for formal decision-making for WFD implementation, participatory processes are mainly conducted at the sub-RBD level through Water Councils (WCs), which are composed of regional and local authorities, companies and interest groups [70]. At the local level, stakeholder engagement was already in practice, and WCs inherited this tradition. The function of the WCs is twofold: they have an advisory role and should be consulted by RBDAs before making decisions, even those regarding technical issues (e.g., the classification of water bodies or EQS). They should also serve as arenas for knowledge sharing, the identification of water problems and the development of solutions [70,71]. WCs receive economic support from water authorities depending on some requirements, such as the broad representation of stakeholders, the size of the catchment, and the number of municipalities and inhabitants [71]. However, the advice and comments provided by WCs on the RBMPs and PoMs are not binding for the RBDAs [71].

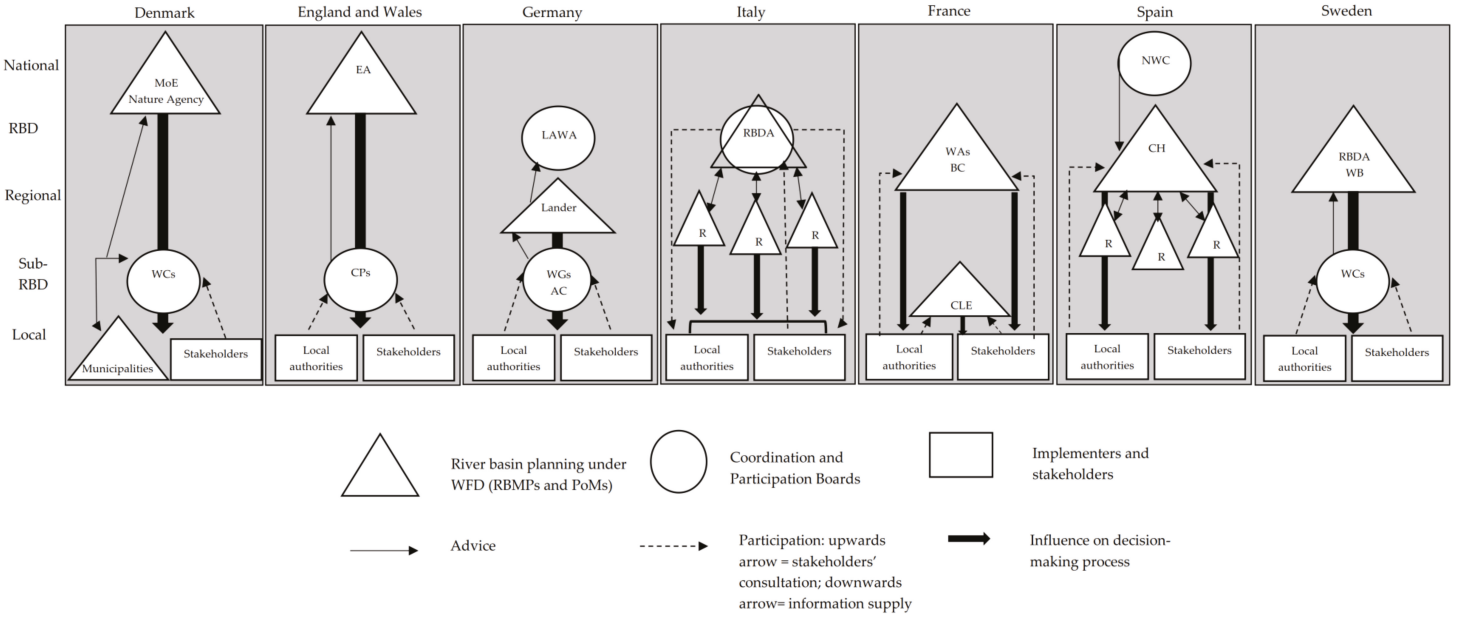

Figure 1. Governance structure for WFD implementation in the selected countries. Source: author's own elaboration.

6. Discussion

After the analysis of the implementation structures, in this section we discuss the implications that institutional changes undertaken in the 7 EU countries have in promoting effective coordination and participation strategies. Table 2 summarizes the main results of our analysis based on the conceptual framework provided in Table 1. In doing so, we are left with four questions that summarize what emerges from the countries' analysis and may suggest future research needs.

Table 2. Summary of the main results based on the conceptual framework provided in Table 1.

Country	CPB	Scale	Type of Coordination	Type of Participation
Denmark	Water Council	Sub-RBD	Hierarchical + positive horizontal coordination	Representation: Medium Information flow: Stakeholders consultation Influence: High
England and Wales	Catchment Partnership	Sub-RBD	Hierarchical coordination	Representation: Low Information flow: Stakeholders consultation and active engagement Influence: Low
Germany	Area Cooperation Working Group	Sub-RBD	Information not available for the RBD, While positive horizontal coordination within AC	Representation: Medium Information flow: Stakeholders consultation Influence: Low
Italy	RBD Authority	RBD	Negative horizontal coordination	Representation: Low Information flow: Stakeholders consultation (mostly regional and state representatives) Influence: Low
France	Basin Committee Water authority	RBD and Sub-RBD	Positive horizontal coordination	Representation: Medium Information flow: Stakeholders consultation Influence: High
Spain	National Water Council *Confederaciónes Hidrográficas*	National and RBD	n.a. (not available)	Representation: High Information flow: Stakeholders consultation and active engagement Influence: mixed results
Sweden	RBD Authority Water Council	RBD and Sub-RBD	Positive horizontal coordination at municipal and RBD level. No clear coordination between the two levels	Representation: Medium Information flow: Stakeholders consultation Influence: Low

Source: author's own elaboration.

6.1. Denmark and England: Softening the Top-down Approach (Apparently?)

- Scale. Denmark and England have both reformed their water governance structures moving from the first to the second implementation cycle. Interestingly, both countries opted for the sub-RBD scale as the optimal level for enhancing coordination and participation rather than the RBD scale. In England, the appropriateness of the sub-basin scale was endorsed both by the government and the involved organizations [50]. In Denmark, the large-scale river basin approach is perceived as

a limiting factor since the size of the RBD is considered to be too broad to facilitate access to local knowledge [47].

- Type of coordination. As Figure 1 shows, in either case, the structure for WFD implementation is top-down, with the NA and EA leading the planning process. The presence of WCs and CPs certainly softens the hierarchical approach to coordination; in Denmark, as it will be discussed in the next point, collaborative planning has occurred in some cases. In alignment with Wegrich and Stimac [31], we could argue that in Denmark, a mix of hierarchical coordination and of positive horizontal coordination achieved through CPBs, is in place. In England, the hierarchical approach seems to still dominate in the implementation process as it is discussed in the next point.
- Type of participation. The three dimensions of participation identified by Newig and Koontz, display quite differently in the two countries. Concerning representation and information flow, in Denmark, decisions on who can have access to the process are defined within the fixed regulatory framework given by the NA. Participation was limited to stakeholder organizations, with an uneven representation of interest groups, generally in favor of agricultural water users [72]. The strict framework provided by the NA, defining timing, funding allocations, competences and influence of WCs on PoMs elaboration, allowed WCs and municipalities to work effectively [47] but limits these participatory processes to 'expanded stakeholder consultation' and does not provide any possibilities for active public involvement [72]. Concerning the influence, in Denmark the measures concerning stream management proposed through the collaboration of the municipalities and WCs were adopted by the NA for the development of RBMPs [47]. In this case, CPBs were given a deliberative power to identify the most cost-effective measures and the clear regulatory framework provided by the NA, together with funding allocation, allowed an effective co-production of PoMs [47]. However, a second factor explains this successful collaborative planning and relates to the role of municipalities in the planning process. Municipalities, in fact, by acting as facilitators and intermediaries between the central level and lower level of decision-making, established a link between the *loci* of knowledge production and those of policy formulation. Scholars highlight the need for institutions that act as 'interface' to ensure that the results of collaborative planning are integrated into the decision-making processes [73] and for the active participation of decision-makers in continuous learning processes [74]. In the Danish case, municipalities fulfill both needs and this may explain the elaboration of collaborative planning.

In England concerning representation and information flow, the EA gives considerable leeway on CPs organization and activities. Euler and Heldt [17], for instance, describe the CPs in the Thames catchment that are coordinated by the non-profit charity Thames21 'which works with the community to improve rivers and canals for people and wildlife'. The authors highlight that despite the non-profit organization is able to promote a very participative form of information sharing and consultation, representativeness in participatory processes is not guaranteed because all the activities are volunteer-based [17]. Similarly, Rollason et al. [75] found that CPs are embedded into local social structures and are found to be effective in improving the horizontal integration of management practices among the members of the partnerships. However, the same authors highlight that traditional top-down approaches still dominate planning and management activities and that 'participation is limited in either power transfer and/or representation' [75].

6.2. Germany: To Change or Not to Change?

- Scale. In Germany, long-term participatory institutions have been established at the sub-RBD scale to comply with WFD requirements. These CPBs, together with the Lander, determine how the policies are shaped and implemented in practice, despite the WFD requirement of large-scale river basin management [57].

- Type of coordination. Cross-administrative coordination in Germany occur at supra-federal state level, within the LAWA, and at sub-basin level, though AC and WGs. However, since the development of joint RBMPs among Lander belonging to the same RBD is not general practice, we consider only coordination carried out at sub-basin scale. The authors found that the AC supported the 'mutual understanding of the views and positions of stakeholders and even help to develop a shared perception of problems' [76]. This may suggest the achievement of positive horizontal self-coordination within the AC.
- Type of participation. CPBs in Germany usually include several interest groups from both public and private domains. Municipalities, local water authorities, farmers and fishery associations, environmental NGOs, water boards and state representatives usually participate in AC or WGs [20]. However, many authors highlight the uneven representation of environmental concerns compared to agricultural interests and highlight the risk for 'co-optation' of environmental actors from stronger interest groups [42]. Participation through AC has similar characteristics with the WCs in Denmark in terms of expanded stakeholder consultations and is found to be effective in promoting social outcomes such as networking, satisfaction of participants, mutual understanding and shared perceptions of environmental problems [20,76]. Concerning influence, the extent to which the decisions made by the CPBs are actually considered by the federal ministries of environment for the development of RBMPs and PoMs is questionable. Scholars found a limited impact of the measures identified by the WGs or AC on the final draft elaborated by the federal ministry for the environment [20,34,42,57]. There may be strategic reasons behind the decision of using measures identified by the CPBs only as a general reference [34]; in addition, water planning in larger and aggregated management units cannot be, by nature, as specific as local water planning [42]. However, authors identify other reasons that may explain the low capacity of the CPBs to influence decision-making. The first relates to the unclear framework provided by the federal state environmental agency to define CPBs' functioning. Koontz and Newig [34] indicated that the guidelines given by the federal state environmental agency to AC in Lower Saxony were vague and unclear about how the CPBs could structure their work. This caused performance to vary across working groups of AC even for substantial aspects, such as how to propose measures and how to decide which ones to include in the final draft [34]. The second aspect is intrinsic of the complex shift from administrative-based to hydrological-based water planning. Germany, like almost all EU countries, should consider who decides 'in this complex balance between local basin bodies and federal national administrations' [3]; otherwise, it runs the risk of creating two disconnected governance levels, which will end up in confusion, conflicts and overlaps [73].

6.3. Italy, France and Spain: Keeping the Status Quo?

- Scale. Italy, France and Spain established planning and the management of water bodies along hydrological boundaries before the WFD. Moreover, all these countries set up competent authorities and CPBs at the RBD scale to comply with the Directive's requirements.
- Type of coordination. Despite these commonalities, the results in terms of coordination for river basin planning are rather different. After the first implementation cycle in Italy, RBMPs were a simple collection of regional water protection plans without clear coordination mechanisms at RBD in place [13]. Regional administrations in Italy have had competences in water protection and management since the 1970s; consequently, it would be illogical, even risky, to completely change the water governance structure. However, as Rainaldi [60] explains, problems emerge because a number of planning tools, such as the river basin plans established by Law 183/1989 and regional water protection plans established with the Legislative Decree 152/1999, coexist and overlap with RBMPs without the law clearly defining the roles and hierarchies of these different planning instruments. These overlaps, together with the great delay in providing RBDAs with their full functions, significantly affected the capacity of coordination for RBMPs development. Using Wegrich and Stimac definitions [31], Italy shows the features of negative

horizontal coordination although improvements from the first to the second cycle are evident at least for some RBDs (see for example the second implementation cycle in Alpi Orientali RBD at http://www.alpiorientali.it/).

Compared to Italy, in France since 1964, water governance has increasingly been characterized by hydrological-based water planning and management. As Aubin et al. highlight [65], the polycentric water governance system observed in France, where functional water agencies are present at both the RBD level (WA) and at the sub-RBD level (CLE), is anchored in a long history and the influence of the WFD on that is limited. However, some authors highlight that coordination between planning at RBD and planning (SDAGE) at the municipal level (SAGE) may be an issue in terms of implementation of measures. For instance, Christophe and Tina [77] highlighted that the municipalities may be more interested in re-election than in water protection, and this may be an obstacle for the implementation of some types of measures.

In Spain, while many studies have focused on how coordination and participation are achieved at regional level, the capacity of CH to coordinate the planning at RBD level is not evident form the analysed literature.

- Type of participation. In contrast to the other countries analysed, in Italy, the implementation of the WFD has not prompted the creation of CPBs at the sub-RBD level, where participation would deliver more effective results. Certainly, a number of participatory initiatives do exist within regional administrations, but it is not evident how these are related to the development of RBMPs and PoMs. Official planning for the WFD remains structured with top-down and technocratic approaches, as proven by the inclusion of few stakeholders in the decisional bodies of RBDAs. In France, both the BC and CLE provide robust platforms for stakeholders' consultation. Although citizens are not directly engaged in the decision-making processes, both the BC and CLE are composed of elected representatives, giving an indirect voice to citizens.

Spain has been a pioneer country in promoting participatory processes for water resources management. Civil society actively engaged with participatory processes, with peaks of 644 participants in Cantabria [20] and over 1600 people in Catalonia [18]. This outstanding participation, however, is only partially the result of the WFD requirement of public participation but mostly relates to a large movement called the 'new water culture' (*nueva cultura del agua*) [78]. This movement, in opposition with the previous policy paradigm—largely based on large infrastructure building and supply management—considers water as finite resource which requires an integrated and holistic management. The influence of these large participatory processes on the development of RBMPs varies depending on the case. Kochskämper et al. [20] found that the result of participatory processes was mainly a list of generic measures and no explanation was provided in the final RBMPs on whether and how these proposals have been used. On the contrary, Parés et al. [18] found that the deliberative process conducted in Catalonia had a 'significant impact on the river basin management policy' and the innovative measures were actually included in the RBMP. Despite these remarkable results, it is interesting to note that many authors question the fact that Spanish water governance can be considered an example of democratic governance. Following Parés [78], 'Even though a deliberative mechanism could be carried out in really democratic conditions [. . .], if this deliberation does not have a real impact on politics and society and, above all, if the resources between participants are unequal, then we cannot qualify this form of steering as a form of democratic participation' and he concludes 'Formal participatory mechanisms, therefore, become just one more space of influence in a complex and net-worked governance system'. In the same vein, Cabello et al. [79] found that mainstream narratives, reflecting traditional coalitions around large infrastructure investments, dominate the process at the expense of local and rural interests. Cultural factors, such as uncertainty avoidance by the government [79,80], power distance [80] and lack of a deliberative culture [18] are discussed as possible reasons that hinder the shift to more democratic processes.

6.4. Sweden: Is full Compliance Enough?

- Scale. Sweden has established functional water jurisdictions, the RBDAs, and participatory bodies, the WCs, at hydrological scales to comply with the WFD. At least in terms of formal adaptation to EU requirements, Sweden can be considered the 'the leap-frog' [14], questioning traditional implementation theories, such as the goodness-to-fit approach, which hypothesizes that when domestic policy arrangements diverge from European requirements, implementation effectiveness is likely to be low [81].
- Type of coordination. However, in this new governance setting, the municipal level is still relevant in terms of water and land-use planning. The addition of the new governance layer for water planning, the RBD, is causing problems of coordination because competences that were exclusively under the jurisdiction of municipalities are now shared with the RBDAs [69]. Despite the WFD implementation enhanced coordination within and between municipalities, as well as positive coordination between concerned parties at different administrative levels, there is a risk of a 'disintegrative process' between water planning and land-use planning [69].
- Type of participation. Participatory process in Sweden reflects the technical/scientific approach for WFD implementation that the country has undertaken (for instance, the environmental quality standards are legally binding in the country). For this reason, public participation in Sweden is more conceived as stakeholder consultation rather than active involvement of civil society, despite that large representation of interest groups is provided by WCs [71]. WCs are based on pre-existing water associations and their effectiveness in engaging local stakeholders and undertaking measures seems to be related to the legacy of cooperation capacity that was in place under pre-existing organizations [71]. A recent study highlighted the need to refine the role of WCs as municipalities do not consult WCs to ask advice on implementation [70]. According to Dawson et al. [16], the WCs provide a good basis for improving the integration of multiple kinds of knowledge into decisions, but this collective knowledge production is still separated from decision-making procedures. Combining scientific and local knowledge to develop RBMPs and PoMs is not an easy task, as evidenced by Hammer et al. [82]. Some authors argue that the technocratic structure for the implementation of WFD, which is focused on water quality goals and data-oriented, somehow conflicts with learning and knowledge integration that WCs should enhance [16].

7. Conclusions

This paper seeks to contribute to research regarding the functioning and effectiveness of new institutions, actions and activities that have come into being as a result of WFD implementation [14]. In particular, we focused our study on the multi-agency and multi-actor groups, we called CPBs, that many EU countries have established to comply with the WFD requirements of coordination and participation for river basin planning.

Three research questions, and related theoretical arguments, guided our analysis of CPBs. The first was an exploratory question aimed to understand the scale deemed more appropriate by EU countries to establish process of coordination and participation for river basin planning. We found that in most of the countries analysed, CPBs are set up at sub-RBD level. Some scholars identify the success of integrated water resources management in a combination of top-down and bottom-up policies and approaches [65]. The requirement of the WFD to adopt RBMPs at RBD scale responds to top-down approaches of decision-making, the District being too large for meaningful stakeholder participation. In addition, some characteristics of the WFD itself, such as the focus on water quality goals, its data-oriented approach, and the strict deadlines for water quality improvements, are prone to top-down decision-making and somehow conflict with participatory processes that require time and willingness to engage with complexity. Given that, the creation of CPBs at the sub-RBD scale

can be seen as a positive signal of Member States' attempts to find a sound balance between the two decision-making approaches.

The second research question aimed to identify how coordination among administrations within the same RBD is achieved. Overall, we found that the implementation of WFD promoted different forms of horizontal and vertical coordination but, hardly, this concerns the RBD. It is fair to say that most of the studies analysed focus on a narrower scale, such as a river basin, river or regional level, while the RBD usually lies in the background of their investigations. Consequently, it was not possible to draw general conclusions on how coordination is achieved at the RBD level for the seven countries we analysed. It is logical to think that most of the studies have been carried out at the scale where most of the activities related to the implementation are conducted, that is at the regional, municipal or river basin level.

The third research question concerned how the outputs of participatory processes are included in RBMPs and, in other words, whether CPBs are able to influence decision-making procedures. We generally found that establishing linkages between spaces for knowledge production and those for policy formulation is a hard task for most of the analysed EU countries. When the linkage proved effective, some factors may provide good explanations for that: the longevity, legitimacy and robustness of river basin institutions (e.g., in France), the clear framework provided to the CPBs to work, the clear allocation of roles and responsibilities among the actors engaged in RBMPs and PoMs, the active participation of decision-makers in learning processes and the presence of an 'interface' between the *loci* of knowledge production and those of policy formulation (e.g., in Denmark).

Finally, our analysis provides some general conclusions and instrumental recommendations for a more effective implementation of the WFD:

- in water governance, there are no 'one-size-fits-all' solutions, and the analysis of the countries confirmed that CPBs have to fit existing governance structures;
- if coordinated and participatory planning is needed to safeguard and improve the quality of water bodies, then the sub-RBD level should be given a primary role by the European Commission. The rule established by Article 13 that '...decisions should be taken as close as possible to the locations where water is affected or used' (WFD) can be effectively achieved only at a level lower than the RBD;
- to avoid losing the knowledge acquired through the CPBs, a clearer linkage between the top-down and bottom-up dimensions of WFD implementation is fundamental regardless of the institutional legacy of the country. The EC should encourage, and Member States should establish, a connection between the arenas engaged in learning, networking and knowledge exchange and those where decisions are made;
- there is a lack of knowledge on how planning and implementation activities carried out at sub-RBD are aggregated and coordinated for the entire District. In our opinion, the requirement of the WFD that all PoMs are 'coordinated for the whole of the river basin district' (Article 3, WFD) cannot be achieved only by a formal aggregation of measures established at different levels of the RBD but requires a greater effort of coordination among public administrations concerned with the implementation. Research could further contribute to this issue, by focusing on coordination mechanisms and problems that occur at the RBD level.
- the conceptual framework we adopted in in this paper could provide guidance for empirical research on the topic. Quantitative methods, such as the Social Network Analysis, could support the analysis of what type of coordination strategies exist among the set of actors engaged with decision-making. Moreover, specific indicators on the type of coordination and participation among public and private stakeholders could be applied: e.g., for coordination, the number and frequency of interactions among public authorities as well as the scope and the frequency of joint activities, while, for participation the degree of stakeholders' satisfaction for participatory processes [83].

Even if the focus of the paper is limited to the EU context, these conclusions might be extended to other non-EU countries that aim to implement integrated river basin management policies, by considering, however, that implementing frameworks have to be tailored on the specific local contexts. The exportability of the WFD requirements to non-EU countries was out of the scope of the paper; however, other studies address this issue especially with regard to EU-candidate countries [84,85].

Finally, we must acknowledge some limitations of this study. The first refers to the limited number of countries analysed that cannot provide a complete overview of implementation patterns in Europe. Second, this study was based only on secondary data derived from the literature. Testing our conceptual framework on other case studies would allow us to grasp less-structured aspects of coordination and participation that, in most cases, are crucial for determining policy implementation outcomes.

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Governing Integration: Insights from Integrating Implementation of European Water Policies

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Abstract: Integrated water resource management (IWRM) is a well-established goal, but there is little evidence about processes of integration linked to water policies. To address this, in 2016–2018 we used a content analysis, a survey and interviews with key actors leading the creation of plans to implement Europe's Water Framework Directive and the Floods Directive. We explored whether and how implementation of these policies is being coordinated and reflect on implications for integrated water governance. We found a strong emphasis on achieving integration via coordination. Our interviews brought particular attention to the resources and capacities needed to improve collaboration across teams, including but not limited to information-sharing. Our study gives insight into practical approaches that may support coordination and hence integration of different policy goals for water management: however further theoretically-informed study to track these and other processes is required, as work to connect policy integration with IWRM is still in its infancy.

Keywords: environmental policy; policy coherence; environmental governance; integrated catchment management

1. Introduction

Integrated water resources management (IWRM) is a long-standing goal for water management [1]. IWRM and related concepts, such as integrated catchment management or integrated river basin management, can be interpreted either as a technocratic tool to connect different sectors or as an approach reflecting social and ecological concerns [2]. Integration is also important for water-resource management in relation to policy and governance [3–6].

However, little academic attention has been given to the concept and process of integration of higher-level public policies in relation to water governance. This is surprising given the dominant influence of public policies on practices of environmental management [7]. As a result of persistent challenges and dissatisfaction with IWRM [8,9]), and the need to understand it as part of multi-level governance arrangements [10,11], it is timely to consider the role of policies in enabling integrated water governance.

We address this gap in the literature by exploring the implementation of two European policies concerned with water management: The Water Framework Directive (2000/60/EC) and the Floods Directive (2007/60/EC). The Water Framework Directive (WFD) [12] aims to protect and restore clean water across Europe and ensure its long-term and sustainable use. It references the need for action to mitigate the effects of droughts and floods as one of its five purposes. More recently, the Floods Directive (FD) [13] was adopted to reduce and manage risks to society caused by flooding. The FD explicitly specifies that it should be implemented in integration with the Water Framework Directive, with the expectation that this will support integrated river basin management [14]. This is required as

measures for flood management—such as engineered flood protection works that alter river banks and change natural flows—can potentially conflict with goals to improve water ecology, and vice versa. However, some interventions, especially "natural water retention measures" linked to river restoration, may benefit both flood management and water ecology [15]. This paper focusses on the governance arrangements for integrating or coordinating these policies; how water quality and quantity issues interact bio-physically and are shaped by management interventions are discussed elsewhere (e.g., Dixon, et al. [16]).

Over the last two decades, the WFD and FD are known to have spurred many changes in the organisation of and activities for water management across Europe [17,18], and so it is appropriate to examine whether, how, and how effectively integration is being achieved between these major water policies. Furthermore, evaluations of the delivery of WFD and FD are increasingly calling for their delivery to be integrated [19]. The objective of this study is to better understand progress in joined-up implementation of WFD and FD policy goals for flooding and water quality as an exploration of the process and practicalities of integration. We ask first, how is integration being enabled and achieved; and second, what are the implications for understanding integrated water governance?

We address this by studying references to integration of the WFD and FD within ongoing planning processes in selected cases of regions and member states across Europe. In this article, we first consider likely factors shaping policy integration before describing in more detail the WFD and FD and needs for integration in their governance. We then describe how we undertook content analysis, surveys and interviews to build our understanding of the process and practice of integration. We discuss the implications of our findings in terms of the research questions to provide a clearer picture of both the concept and the practice of integrated water governance.

1.1. The Concept of Integrated Water Governance

We begin by considering what is known or expected about policy integration based on existing studies and theory. We first consider the body of work on environmental governance, and then that on policy integration, as these have developed separately. We synthesise what their collected insights offer for understanding "integrated water governance", using this term to emphasise a focus on policy that is distinct to the management focus of most IWRM.

1.1.1. Insights from Literature on Environmental Governance

Whether working at the global or local scale, water has been a rich field of governance research, policy and practice. This is due to its common pool character, the fact it flows across administrative borders, embodies downstream impacts from upstream choices and is essential to the livelihoods across economic sectors and social groups, all of which make decision-making complex and requires the input of multiple perspectives. Whereas management tends to be associated with the "how" of delivering specific actions, governance is often associated with the "who decides 'what' and 'how'". Attention to governance therefore builds understanding of the structures, procedures and processes that shape the conditions in which operational management decisions are made and actions implemented [20,21].

Definitions and interpretations of governance vary, whether in discussions specifically about water [22] or in the wider field of environmental governance [23], but always signals an interest in understanding, and potentially encouraging, the decision-making role of multiple actors beyond the state [24]. Therefore, at the heart of governance is the idea of coordination of multiple actors and creating an integrated approach to the governed object. Different authors vary in their attention to the role of the state and its policy structures, often linked to whether the empirical focus is on the supranational level, typically focusing on regulatory structures and their consequences (e.g., Young [25]), or local level, typically exploring the role of non-state actors and interests (e.g., Ostrom [26]). Adopting and achieving policy goals always involves constellations of state actors across levels organising to implement (and integrate) goals as part of networks [27]. This emphasises the challenges of coordination across multiple (high-level) actors and cross-boundary scales [28], and the

level to which integration of policy goals may be influenced by the shape, form and interactions of specific governance networks.

Meanwhile, local-level studies tend to emphasise the role of non-state actors, and when and how networks may self-organise to govern natural resources, informed by Ostrom and ideas of polycentricity [29]. Although the emphasis of local-level studies on non-directed collective action appears less relevant to settings where public policy is seen as a key driver, as is the case for many aspects of water management in Europe, they again reiterate the importance of networks, and understanding efforts for their coordination [30]. This literature additionally suggests that learning may be important, both as an enabler for and as a result of coordination across networks [31].

The governance literature demonstrates that nearly all processes are to varying extents polycentric and multi-level, working within between and amongst horizonal and hierarchical networks [32]. It is clear that fragmented systems often struggle to achieve their goals, but the extent to which centralised steering of networks is necessary or appropriate is contested. Where there is meaningful stakeholder participation polycentric systems may be favoured [33], but study of EU processes suggests that central state-led steering may be necessary for effective integration [28].

Decision-making about integration of policy goals and policy implementation is likely to involve networks of multiple actors and associated challenges of aligning objectives, sharing knowledge, managing relationships and addressing power imbalances [34]. Whilst much of the literature on IWRM stresses integration of topics, the governance literature stresses coordination between actors. This has implications for how integration might practically be achieved; for example, it might be more important that different individuals are able to liaise and meet, rather than necessarily subsuming them into an integrated organisation. These insights also highlight that even when there is a focus on policy, the interplay of formal and informal institutions can be critical to understanding how policy implementation actually plays out [33].

1.1.2. Insights from Literature on Environmental Policy Integration

A body of work on policy studies has developed separately from the literature on environmental governance but has relevance for understanding and evaluating the modes, motivation and practicalities of policy integration across various governance contexts. Particularly relevant is work on environmental policy integration (EPI). EPI focuses on the integration of environmental concerns into other more powerful non-environmental policy domains (e.g., transport), rather than disconnects or conflicts between different environmental goals or within one policy domain (e.g., water). However, many of the observed challenges and principles are likely to be applicable when understanding facilitators and barriers of integration of different water policies. Collier [35] points out that there are three potential levels of policy integration—policy formulation, policy measures or policy implementation—and suggests that it can be easier to integrate at the higher levels such as in national policy texts, rather than the more operational levels, such as the creation of RBMPs and FRMPs, where trade-offs become apparent and decision-making becomes more complex. For example, Hey [36] reported that integration of environmental concerns into transport policy was strong when setting the agenda for policy but weak in subsequent implementation activities at lower, operational levels. Thus, we may expect that even when policy goals and strategies set the ambition to integrate, as is the case for the FD and WFD, this is not necessarily or easily reflected in subsequent planning and action.

EPI is relatively well-established, both as a goal for policy-making and as an object of enquiry [37]; however, still relatively little is known about how to achieve policy integration in practice [38]. Useful insights come from those studies that focus on the conceptualisation and implementation of integration in everyday policy and political settings, the so-called "positive approach" to EPI, to understand "how contradictions are 'dissolved', redundancies reduced, synergies exploited" [39]. This focus on organisational process emphasises potential tools for connecting goals in different policies. Evidence from Sweden [40] shows that once conditions allow EPI to become an established goal, specific activities

such as quantified environmental objectives can aid its operationalisation. Some recommendations intended to facilitate environmental considerations across sectors are not directly transferrable to other contexts or the coordination of two environmental policies within the same sector, but linking policy goals could be reflected in the targets and responsibilities assigned to teams or organisations, in cross-sector representatives or working groups, integrated impact assessments and the procedures used to appraise individuals or teams. Similar to the literature on governance then, this suggests the need to understand the formal and informal processes by which individuals and teams work across and between organisations [41], potentially seeing the drive to improve integration as a form of institutional change for state organisations and the individuals within them [42].

Whilst the EPI literature focusses on integration of one policy objective into another policy, there are other policy literatures that stress coordination between policies rather than integration, such as literature on policy coherence, policy alignment or policy mixes. Therefore, from here onwards, the term integration in the context of integrated water governance encompasses a spectrum from a network of policy actors coordinating their actions to full integration of policy objectives, policy actors and policy processes into a new entity.

1.2. European Policies for Water Quality and Flooding

This section provides a brief overview of the Water Framework Directive (WFD) and Floods Directive (FD) as extensive discussion of the origins and requirements of both directives is already available elsewhere for both the WFD (e.g., Hering, et al. [43]) and the FD (e.g., Heintz, et al. [44]). European directives specify goals and certain procedural requirements but are transposed and separately implemented by different member states, or by their constituent regions where environmental policy is devolved. Therefore, whilst sharing a common framework and vision, there can be considerable heterogeneity in implementation due to the principle of subsidiarity and the need to take account of local context, history and conditions (a principle shared with IWRM).

The WFD (2000/60/EC) [12] aims to protect and restore clean water across Europe and ensure its long-term and sustainable use. The WFD is, in itself, a statement of coordination as it also incorporates pre-existing directives on bathing water, drinking water, nitrates pollution control and wastewater treatment, and takes account of further policy objectives such as Natura 2000 designations. Action to achieve the WFD objectives is organised around reaching or maintaining "good ecological status" of waterbodies within river basins; member states are required to assess the status of all waterbodies, and use this information to make management plans for each river basin. These River Basin Management Plans (RBMPs) encompass inland surface waters, transitional waters, coastal waters and groundwater, and are developed using a six-year cycle: characterising the status of water bodies; identifying needs for action; identifying measures; and reviewing the impact of implementing these measures. Member states need to ensure that all water bodies meet or exceed good ecological status by 2015, 2021 or 2027 (depending on derogations). Note, that at the time of the research (which spanned 2016–2018), the second cycle of RBMPs had been published and work was ongoing to implement measures before reporting on progress in 2019. The WFD is implemented by "competent authorities" (normally state agencies) who are responsible for implementing these planning cycles, but the WFD also stipulates a programme of information, consultation and active involvement of relevant stakeholders in line with the Aarhus Convention.

The main aim of the FD (2007/60/EC) [13] is "to reduce and manage the risks that floods pose to human health, the environment, cultural heritage and economic activity". Member states should take a long-term perspective, considering climate change, as well as sustainable land use practices. It applies to inland waters and all coastal waters, but not groundwater. Unlike the WFD, the FD does not act as an umbrella directive for other, older legislation but as mentioned above, it does have integration with the WFD as an explicit requirement. Similar to the WFD, it follows a planning cycle, with member states required to: assess and identify the river basins and associated coastal areas at risk of flooding, produce flood risk maps for these zones and flood risk management plans focused on prevention,

protection and preparedness. Consultation with stakeholders is also required [45]. Whilst there are clear objectives to reduce flooding and mitigate the impacts when flooding does occur, the FD does not set specific targets to achieve within the planning processes.

The planning cycles are aligned such that the second Flood Risk Management Plan (FRMP) and third River Basin Management Plan (RBMP) are both due in 2021; however, the FD does not have an "end date" like the WFD but stipulates an ongoing 6-year planning cycle. At the time of the research the competent authorities had finished their first FRMPs and were starting to prepare their next flood risk maps as well as implement flood risk mitigation measures. The FD is also implemented by competent authorities with responsibility for ensuring the planning cycle is implemented, but as with the WFD the process involves multiple stakeholders beyond the lead state agencies.

Expectations for Integration and Coordination of These Policies

There is a clear push towards integration of the two directives: they are explicitly designed to interact and share a common adaptive planning cycle and system of leadership by competent authorities working with a suite of stakeholders to deliver the policy objectives.

Integration or coordination of the policies is referenced in the original text of the FD. Point 17 in the Preamble to the Directive notes that planning under both the WFD and FD constitute elements of integrated river basin management, and so ought to be coordinated. Article 9 specifies that member states should "coordinate the application" of the WFD, principally by coordinating information-sharing, the production of flood risk management plans and river basin management plans, and also through coordination of the public participation procedures during preparation of those plans. Newig, Challies, Jager and Kochskämper [45] provide a detailed analysis of their respective requirements for public participation.

Integration seems to have become more important over time. At the time of the first WFD Implementation Report [46] to appraise progress, the Floods Directive did not yet exist and references to integration instead focused on linking the WFD with other policies such as the Common Agricultural Policy. In the second WFD Implementation Report [47], despite the existence of the FD since 2007, flooding was again not mentioned. However, integration between the FD and the WFD has since become a strong focus and the Implementation Reports now jointly report on progress for both directives [48]. An Europe-wide working group on Floods ("Working Group F") is part of the Common Implementation Strategy of the Water Framework Directive [49] and has integration of the FD and WFD as one of its priorities. This working group hosts biannual meetings and workshops that are attended by representatives of the organisations responsible for delivery of the Floods Directive in each member state.

Working Group F have produced two reports [14,50] that describe reasons and expectations for how to achieve integration of the WFD and FD. These have been complemented by a later report describing expected links between the FD, WFD, Marine Strategy Framework Directive, and the Natura 2000 Directives [51]. These documents first reiterate the expectation of more integration in policy delivery, and second, provide a set of recommendations of how this could be achieved. Key recommendations for linking the WFD and FD are: sharing spatial management units; sharing competent authorities; linking reporting timetables; and coordinating assessment, mapping, planning, selection of measures, and monitoring. It is expected that doing so can offer efficiency savings by identifying cost-effective "win-win" measures, often natural water retention measures (NWRM) that slow the flow of water through landscapes [15], and so ultimately supporting integrated river basin management and efficient delivery of both policies.

There are important differences in the directives that may impede linkages. First, while the European Commission classes both directives as environmental, the WFD has a clear focus on ecological health, whilst the FD focuses primarily on avoiding damage to people and property; therefore, they have different objectives that may be assigned different priorities by society. Second, the WFD has clear targets to meet and an expectation that the policy outcomes should be met by 2027. On the other

hand, the FD is more procedural, specifying the planning processes but not setting any standards or requiring continuous improvement as per the WFD. Overall, there are both similarities and differences in how the policies are formulated, how and why measures are developed, and the ethos of policy implementation, with consequences for policy integration and governance approaches. The extent and ease of WFD-FD policy integration is therefore unclear.

Two empirical studies have indicated potential issues associated with integration of the WFD and FD; a comparison of public participation in the FD and WFD in Germany [45]; and methodological approaches used to appraise and select programmes of measures reflecting both policies, also in Germany [52]. The study by Newig, et al. [45] notes that during the early stages of FD implementation, the federal states leading FD implementation were very reluctant to coordinate it with the WFD, citing different objectives, actors involved and interests. Evers [52] reports that Germany relies on a "LAWA" scheme to prioritise synergistic measures, but integration is likely to be hindered by prior "parallel procedures" operating under each policy. She recommends a set of planning steps that capture and map information for both policy goals, and to catalogue measures in such a way that links between sectors are more easily identified. The likely scope of challenges is also echoed by a study of integrating the WFD with the Natura 2000 objectives for protection of endangered species and habitats in the Netherlands [53]. Here, similar to the WFD and FD, the policy goals seem broadly complementary and there is formal support for their coordination. However, integration is impeded by actors' concern for how new policy objectives will affect their own existing goals, and by a strong focus on formal compliance with these goals, that can reduce possibilities for the discretion and flexibility needed to take account of other policy goals [53]. Taken together these studies hint at the importance of individual and organisation processes and priorities, as well as formal strategies or initiatives, but there is a need for more studies to understand how policy integration is being implemented in practice. Focusing on procedures will not account for the outputs and ultimate impacts of policy [54], but is a necessary first step to understanding integration of the WFD and FD in practice and to extend understanding of policy as part of the IWRM paradigm.

1.3. Research Gap Addressed by This Study

Integration is an important topic for both scholars and practitioners working on water management: however, there is a need for more attention to governance as part of IWRM, moving it beyond the management level. The literatures on governance and EPI together indicate the complexity of likely influences on integration (e.g., Pahl-Wostl [22]; Swartling, et al., [55]), and suggest a need to balance attention towards both formal procedures and policy requirements, as well as informal practices and an operational perspective. Such factors are likely to influence the integrated water governance context and both enable and constrain progress towards integration. However, there remains little empirical research illustrating the results of bringing water policies together, despite the focus on "integration" in the wider water literatures.

Recent work to integrate delivery of Europe's WFD and FD provide an opportunity to address this gap. We have two research questions: how is integration being enabled and achieved; and second, what are the implications for understanding integrated water governance? We seek to answer these by learning from the ongoing experiences of those charged with policy delivery, using a mixed methods approach to scope the widest possible set of insights and to balance attention to formal procedures and less formal practices by which policy goals are being implemented and integrated. The various governance and EPI literatures do not provide one clear approach or framework suitable for understanding the coordination of the WFD and FD implementation processes, so we use an exploratory methodology.

2. Materials and Methods

This study uses a mixed qualitative methodology [56] to explore integration in processes of WFD and FD implementation by selected European member states. The study focusses on the

implementation of integrating the RBMP and FRMP processes; as described above, these plans are the interface whereby the overall objectives of the policy are translated into policy measures by a range of stakeholders and as such steer the policy implementation processes in specific water bodies. It combines three main sources of data: a content analysis of nine sets of plans, a simple survey seeking written feedback on integration from those working to implement these policies across Europe, and a thematic analysis of semi-structured interviews with those charged with implementing the policies in six cases. This mixed methodology was informed by the pre-existing literature related to integration, feedback from Scottish Government and agency stakeholders [57] and existing European Commission documents on water policy integration [14,50]. In keeping with the insights from the literature above that highlight the importance of structures and practices, the content analysis and survey helped identify the formal structures and desired processes involved in integration, whereas the interviews provided richer insights focused more on practices and processes, including the informal "rules-in-use". This is reflected in the predominance of interview data in our findings section.

2.1. Content Analysis of Selected Plans

In October 2016 we carried out a search of RBMPs and FRMPs, using Nvivo (version 12, QSR International, Melbourne, Australia) [58], for terms that could indicate cross-references between RBMPs and FRMPs. In the last decade, hundreds of RBMPs and FRMPs have been created by Europe's member states. We could not review all these, so we instead selected sets of plans from nine cases: the Czech Republic, Flanders (Belgium), the Rhine, Spain, Sweden and the four devolved countries of the U.K. (England, Northern Ireland, Scotland and Wales). We treated the U.K. devolved regions as separate cases as RBMP and FD implementation is a devolved matter, and each U.K. jurisdiction has its own governmental arrangements, structures, and funding processes for water management. Table A1 in Appendix A summarizes the set of plans analysed for each case.

We searched for terms indicative of cross-references between the plans: within RBMPs, we searched for references (including stemmed words) to "flooding", "Floods Directive" and "Flood Risk Management Plan"; within FRMPs we searched for references to "water quality", "Water Framework Directive", "River Basin Management Plan" and "Natural Flood Management" or "Natural Water Retention Measures". Non-English plans were searched using translated equivalents checked by native speakers. We recorded the total portion of each plan that referred to the terms; the content of paragraphs containing the terms; and the location of the references, i.e., which section, footnotes, annexes. This process provided a strong comparative basis for the content of the plans that helped to structure the survey and interview questions, and allowed the interviews to focus on topics not accessible by document review.

2.2. Short Survey on Integration

In March 2017 we presented preliminary findings of the content analysis at the 21st meeting of the European Commission's "Working Group F" of the WFD Common Implementation Strategy, which confirmed the initial findings and identified areas of ongoing challenges. At the meeting, and also afterwards by email, we distributed a short list of questions that asked members for feedback on integration and their plans. Table A2 in Appendix B lists the questions used in the survey. We received 19 answers from member states, or regions where implementation is devolved: Austria, Bulgaria, Croatia, Czech Republic, Denmark, England (U.K.), Finland, Hungary, Ireland, Italy, Latvia, Luxembourg, Netherlands, Northern Ireland (U.K.), Scotland, U.K. (as a whole), Wales (U.K.), and Wallonia (Belgium).

2.3. Semi-Structured Interviews

We sought interviews with individuals charged with supporting the development and implementation of the plans. We expected that there may be initiatives for integration that were

not captured in the formal plans. We aimed to work in fewer cases where we could build in-depth understanding by speaking with individuals working at both the national level and the regional level.

We focused on six cases: Sweden, the four countries of the U.K. (England, Northern Ireland, Scotland, Wales), and the region of Flanders (Belgium). We selected these based on our earlier document analysis where we chose: (1) Sweden as having biogeographic similarities to Scotland (the government of which provided funding for this research); (2) Flanders as they are a devolved region whose legislative framework explicitly requires integrated planning [59]; and (3) the four devolved administrations of the U.K. (Scotland, Wales, England and Northern Ireland) since they have a similar institutional background. Table A3 in Appendix C summarises our understanding of the main organizations associated with WFD and FD implementation in each case.

We used a snowball process to ask existing contacts to suggest contacts working in other policy areas or at other levels. In total we conducted 24 interviews, with a total of 28 individuals (two interviews were with more than one person). Table A4 in Appendix C summarizes the final set of interviewees. The average length of interviews was one hour, and all interviews were carried out between January and June 2018. Our interviews were structured using a topic guide (see Table A5 in Appendix C) that reflected the key ideas identified in our review of pre-existing work on integration and questions that had arisen from our analysis of the plans. Interviews were audio-recorded and transcribed, with the exception of one where, at their request, we instead took detailed notes.

All subjects gave their informed consent for inclusion before they participated in the study. The study was conducted in accordance with the Declaration of Helsinki, and the protocol was approved by the Ethics Committee of the James Hutton Institute (Project identification code 97/2017). The data collected was processed, stored and managed in compliance with U.K. law and the EU General Data Protection Regulation.

2.4. Data Analysis

For the document analysis, for each case we summarised counts of cross-references and descriptions of content and its location within a word document, to identify integration discourses for further analysis. These integration points were then imported into Nvivo 12 [58] for qualitative analysis [60]. We "coded" the content of the document analysis, the written survey feedback and interview transcripts according to themes. A mixed inductive–deductive approach was taken: the initial set of themes were derived from the interview topic guide, but additional themes were proactively sought during review and coding of the transcripts. After the initial coding, we carried out a framework analysis to facilitate comparison and highlight main themes and patterns.

In the findings section we present the main themes and patterns. Quotes from the interviews are used as illustration, labelled using interviewee codes. Table A3 provides more information about interviewees, but to maintain confidentiality, provides only limited description of sources (e.g., we do not reveal both job role and organisation, if this would allow someone to be identified). The findings do not systematically describe every case but instead focus on highlighting common issues, the range of experiences, and the underlying connections between ideas.

3. Results

Integration was a relevant goal in all the cases we studied, though the evidence of progress was much more evident in the survey and interview data. All our interviewees confirmed that they perceived their country or region as making progress in integration, to varying extents, with Flanders rating itself the most positively. This meant that a variety of initiatives for integration were reported and discussed, even though the content analysis indicated relatively little attention to integration as there were only brief cross-references between the FRMPs and RBMPs.

Table 1 summarises the mix of initiatives for integration across our dataset. The content analysis and survey placed more focus on formal structures and procedures, whereas the interviews gave more

insights into procedural aspects and complexities. We do not further discuss the results in terms of different methods, to avoid repetition, but instead focus on the main themes.

Table 1. A summary of the formal and informal initiatives for integration reported in our data. "X" represents the presence of initiative in one or more cases analysed. The most important initiatives, and connections between these, are discussed in the main text.

Initiative to Enable Policy Integration	Content Analysis (160 Plans from 9 Cases)	Survey of Member State Representatives (19 Cases)	Interviews (28 Individuals from 6 Cases)
0\Policy Requirements and Procedures			
Altered plan structure	X	X	
Shared consultations	X	X	
Joint Impact Assessments	X	X	
Strategies for appraising measures in FRMPs/RBMPs	X	X	X
National mandate			X
Allocated resources			X
Practices to Coordinate and Collaborate			
Links during plan development		X	X
Physical co-location +/or virtual teams			X
Using shared language or concepts			X
Knowledge sharing of datasets		X	X
Knowledge sharing about individuals, teams and policies			X
Connecting across levels			
Catchment-scale trials			X
Public engagement		X	X

We focus first on the formal procedures and locations of integration envisaged to facilitate integration. We then describe initiatives to promote practices of coordination and collaboration. We acknowledge that the divide between these types of initiatives is blurred, but suggest there is a difference between policy requirements and procedures which link with publicly documented steps in the planning process, and those operational practices which are rather less accessible, potentially more flexible, and associated with the activities of individuals within teams. Finally, we turn to the challenges of integration, as exposed in the survey and interview data, which highlights interconnections between different types of initiatives, and highlights ambiguous issues cited both as an enabler and challenge.

3.1. Policy Requirements and Procedures

The content analysis indicated only one case had amended its plan structure: Flanders had decided to produce one plan encompassing both the RBMP and FRMP. Plan content and the survey data indicated two main venues where the two planning processes were expected to link in several cases: the use of shared consultation processes and joint Strategic Environmental Assessments (SEAs) or Environmental Impact Assessments. Both are mandatory parts of the planning cycle: consultations with the public must be carried out on draft plans, and SEAs are conducted to ensure that information on the environmental effects of a plan is available whilst the plan is prepared and implemented.

Several survey responses mentioned techniques or strategies to select or appraise potential measures to ensure that measures in FRMPs do not negatively impact ecology, or vice versa. Similarly, several interviewees discussed the aim of prioritising NWRM measures, which could be assisted by these strategies. By contrast, in the interview data, SEAs were not discussed, whilst consultations were often mentioned but not much dwelt on.

The interviews also noted the importance of formal mandates from the national-level. Some interviewees from Sweden and Northern Ireland felt this had been lacking, and so impeded progress.

Related to this was the need, identified by all interviews, for resources specifically allocated to integration, to enable collaboration, e.g., between parallel teams, and to trial new ways of working.

3.2. Practices to Coordinate and Collaborate

The theme of collaboration and coordination was a strong theme in all our interview data, though only four survey responses noted initiatives related to this. Often, when we asked an open question about how to encourage integration, interviewees' responses immediately focused on how different departments or organisations could better work together. Every interviewee mentioned some practical technique or approach related to coordination or collaboration, either when describing existing initiatives in their case, challenges they had experienced, or their recommendations for future improvement. Initiatives to improve collaboration include different teams attending each other's planning meetings (e.g., Hungary), cross-checks or involvement in plan development (e.g., Northern Ireland, Scotland). Individuals could also be given additional assignments or team membership: they could be physically co-located with teams working on different policies, or assigned to virtual teams that were designated for specific cross-cutting issues. Our interviewees differed as to whether and how specific terminology and concepts can assist in these links: E1 mentioned that terms such as natural capital and ecosystem services risked being seen as "technocratic gobbledegook", whereas F4 felt these concepts had been helpful for appraising the costs and benefits of artificial versus more natural interventions in some experimental trials. N4 placed more emphasis on relationships, pointing out that investing in team-building and developing trust was necessary to underpin new collaborations.

Knowledge sharing was referred to as both an outcome and a requirement for collaborative teams. It was often introduced in terms of information about catchment condition and processes, which corresponds with the survey responses that highlighted initiatives for information sharing. Over half (n = 10) of survey responses also indicated initiatives for information sharing across planning teams; for example, in the Netherlands, the information used in RBMP and FRMP planning is held across the same institutes, and is also shared with the general public. This is a relatively visible aspect of information sharing, but the interviews also highlighted that it was important to share information about people themselves and their differing goals, as well as specific data sets: "you need to start with that [collaboration] and get people to know each other" (N4).

Discussions on collaboration often focused on connecting people in parallel groups or organisations working on water quantity and quality issues, but were also relevant to enabling connections across levels. Those working at the regional level felt that the support of national-level policymakers was essential to advance integration: not only providing official visions and statements of support, but also helping to initiate the process of integration. However, it was also felt that the drive to achieve an integrated vision should not solely be top-down: "you need to create one vision, for all the water managers" (F4). Furthermore, when we asked for examples related to integration, many interviewees highlighted catchment-level initiatives and pilots. There was an expectation that working at smaller scales and/or at lower levels of organisation may somehow be key to achieving integration. These are often styled as pilots, with an explicit plan to generate knowledge to connect back into national-level learning and planning.

The expectations of the general public were sometimes cited as challenges to integration, yet involving them in planning was also mentioned as enabling. Survey responses referred to shared consultations, whilst some interviewees talked about going beyond these to indepth and/or interactive processes of engagement. The extent to which this should focus link with the catchment-scale focus was unclear in our data.

3.3. Challenges to Integration

The content analysis did not indicate anything about challenges to integration; however, seven survey responses and all of the interviews offered a mix of challenges experienced and anticipated. These data reiterated the importance of policy requirements and procedures, as well as more informal

or organisational practices: it also indicated the connections between these and some issues identified both as enablers and challenges.

Challenges from the differing requirements of the policies were identified as problematic in the surveys, especially in the differing scales of work and procedural obligations. Some interviewees also identified the differing rationales of the WFD and FD as problematic, i.e., as eco-centric versus human-centric, with F4 accusing the FD of enabling a focus on "end of pipe" solutions in contrast to the WFD. The interview data gave insight into exactly why these issues matter, and highlighted interconnections between formal processes and requirements and the more informal processes relating to coordination and collaboration. For example, S1 stated that as the formal cycles for implementing and reporting these directives had not been perfectly aligned, there had been reduced opportunities for individuals and teams to make connections on related issues. Formal structures and procedures could assist or provide a focus for integration—but could equally squeeze the spaces and opportunities required for individuals and teams to coordinate across and between levels.

Another connection between the formal procedures and the more informal organisational practices is illustrated by the resources allocated to the planning processes. The absence of top-down allocation of specific resources for integration was often reported as problem in both the survey and interviews: trying to integrate two policy processes was seen as adding complexity to processes that were already complex, therefore requiring more attention and resources.

Discussion of challenges not only highlighted interconnections, but also identified several issues that were discussed both as enablers but also challenges: collaboration, public engagement and balancing work across levels. These "ambiguous" issues warrant further attention.

As discussed above, collaboration was often cited as key to integrating policy delivery: however, the interviews gave insight into the in-depth complexity of the practices employed to achieve this, with the difficulties of collaboration being seen as a key difficulty as well as key priority. Building collaborations requires not only resources but patience and skill: "[It] takes time and it takes effort and it takes compromise, you know, it's a tricky thing to manage." (E3). Similar references were made to information sharing to enable collaboration as different datasets are not easy to share or connect. These challenges do not just relate to formal datasets but also to understanding other points of view and relevant plans and "keeping that up to date" (N4).

Sharing information and collaborating is especially challenging when separate departments, organisations and consultants have work cultures that favour working in silos rather than collaboration. This tendency can be exacerbated when faced with budgetary constraints, especially as environmental protection is often seen a "Cinderella" issue (N3), i.e., a low priority issue that is ranked behind other policy goals. Therefore, developing a plan within one team can be seen as "quick and easy" (S4) versus trying to understand and incorporate other options and involve other actors. Furthermore, internal appraisal processes may reinforce less formal work cultures. For example, F3 described how middle managers must work with metrics for water quantity, and metrics for water quality, but there is no "metric for integration" to drive or evaluate performance in this regard. Thus, the individuals and departments planning for water management may continue to focus on either water quality or quantity.

Public engagement was cited both as an enabler and as a challenge. In the interviews, the public and politicians sometimes mentioned having expectations that were unhelpful for integration, mostly because they expected immediate, visible and familiar responses to flood events. This can drive adoption of schemes that can be installed relatively quickly, at the expense of long-term holistic approaches that include NWRM. Involving the public in decision-making about water management, was thought to help alter these expectations, but some also worried that it may exacerbate the problems of processes being slow, complex and costly. Participatory processes also add in local priorities for a particular place or catchment, which can complicate (and potentially conflict with) top down policy goals and mandates.

The final ambiguous issue was the challenge of working across levels. Although the need to work and connect national to catchment levels was advocated (previous section), the appropriate balance of effort across levels, and in connecting levels, was unclear. Some interviewees worried there was an over-reliance on high-level visions to achieve change by themselves, without altering pre-existing structures, procedures or responsibilities. The responsibility for coordinating integration was often perceived to be unclear ("everybody is looking at each other" F2), despite the roles and responsibilities being formally specified under the policies. To many it seemed that the goal of integration, as a shared responsibility, has no clear 'home', ownership or driving actor.

4. Discussion

We return to our research questions, and ask first, how can integration be enabled? Our findings demonstrate several ways in which delivery of the WFD and FD is being integrated (Table 1). Looking across these diverse initiatives, it seems important to distinguish between formal procedures that are often associated with policy requirements and quite public, and practices that are less prescribed and typically concerned with processes for coordination or collaboration between teams and organisations. The latter initiatives, such as building cross-policy teams, are less visible outside of organisations, even though significant effort may be invested in them and the individuals involved see them as key to achieving integration.

Those seeking to enable integration of the WFD and FD, or similar policies, can usefully build on the type of experiences reported here with the caveat that all practices must be adapted to the particularities of specific social and policy contexts. When doing so, it is important to balance attention between the formal initiatives and more informal practices. In this study, what was publicly documented focused more on the former [14], so emphasising organisational practices may be an important future priority. This can be informed by ideas from the EPI literature about how to promote policy integration at the level of policy operationalisation [39].

The ambiguity around certain issues reported here, i.e., collaboration, public engagement and multi-level working, also cautions that integration is not straightforward. These were identified not only as enablers but also as challenges to achieving integration, in particular by increasing the cost and complexity of working. These challenges are recognised in the literature on stakeholder participation [61] and multi-level governance [62]. So, initiatives and approaches to achieving integration may be costly and complex, yet integration is often assumed to result in efficiency and win-win solutions [15]. The apparent paradox may be the result of different time perspective, perhaps costs in the short-term will be rewarded by long-term efficiency savings, but cannot be taken for granted. There is a clear need to critically appraise and evaluate these efforts using a mix of datasets, since different sources of data given prominence to different initiatives and issues. This paper makes a start at assessing how these insights could be used to help understand enabling integration by focussing on the planning cycle: further research is needed on how measures are implemented and this should include attention to the local governance processes as well as the outcomes of changes in management practices.

Our second question asks: what are the implications for integrated water governance? Integration seems a widely relevant concept, not only in the academic literature on IWRM, but also with policy and practitioners, so this concept warrants further consideration. Existing bodies of work on EPI and environmental governance (e.g., Pahl-Wostl [22]; Swartling et al., [55]) do provide useful insights as to how and where different goals for water management may be coordinated. However, at present, there is no clear framework specific to integration, either to guide its study or its implementation, and this should be redressed. Furthermore, this study indicates that collaboration within organisations, or across organisational sub-units can be a major factor shaping how objectives are achieved, so this level of analysis should be given equal weight, perhaps envisaging collaboration as nested, multi-level and polycentric set of practices, requiring relational processes within as well as between organisations and across administrative levels. Of course, these different processes are not necessarily

mutually supportive nor straightforward, so further empirical data is needed to track ongoing and unfolding processes of policy implementation, and to interrogate whether and how these connect with, complement or even conflict with initiatives for IWRM at the local and catchment scale. This also draws attention to wider debates about the extent to which state actors should lead and/or participate in steering governance processes [28,29].

Overall, transdisciplinary partnerships between academics, policymakers and practitioners are required to ensure all aspects of integration processes are documented, used to inform theoretically-informed reflection, and harnessed to achieve changes in water management.

5. Conclusions

The general conceptualisation of progress in integration amongst the member states in this study, and the drive to improve and build on processes of integration, indicates the relevance and appeal of integration as a concept. Governance is perhaps inherently an integrating concept—in that it is typically associated with multiple actors, objectives and processes—but we argue that focusing on the concept and aim of integration within governance, as per "integrated water governance", brings attention to the expectations and practices specifically entailed by trying to achieve multiple objectives. These warrant further critical examination, balancing attention to the informal and formal, and recognising that networks are nested within and between organisations. Doing so will usefully complement the focus of many IWRM studies. We believe that integrated water governance, an approach that looks at structures, actors and practices, with attention to the power effects and emotional labour entailed in such networks, will be a vibrant and important topic of research for many years to come.

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Appendix A

Information about the cases and set of plans subject to content analysis.

Table A1. The set of 160 plans from 9 cases used in content analysis. The process of planning under the WFD predates that of the FD; therefore, two sets of RBMPs were available, and one set of FRMPs.

Case	Rationale for Selection	Plans Analyzed
Czech Republic	Experience of coordination across basins	3 × 1st cycle RBMPs 3 × 2nd cycle RBMPs 3 × FRMPs
England (U.K.)	Devolved administrations within the U.K. offer "natural experiment"	7 × 1st cycle RBMPs 7 × 1st cycle RBMPs 8 × FRMPs

Table A1. *Cont.*

Case	Rationale for Selection	Plans Analyzed
Flanders (Belgium)	Have formally integrated legislation and plans made	2 × 1st cycle RBMPs 2 × 2nd cycle RBMPs incorporating FRMPs
Northern Ireland (U.K.)	Devolved administrations within the U.K. offer "natural experiment"	3 × 1st cycle RBMPs 3 × 1st cycle RBMPs 3 × FRMPs
Rhine	Experience of coordination for transboundary management may assist in policy coordination	1 × 1st cycle RBMPs 1 × 2nd cycle RBMPs 1 × FRMPs
Scotland (U.K.)	Administration funding the research	2 × 1st cycle RBMPs 2 × 2nd cycle RBMPs 14 × FRMPs
Spain	Geographical contrast with the other cases	24 × 1st cycle RBMPs 18 × 2nd cycle RBMPs * 17 × FRMPs
Sweden	Geographic similarity to Scotland (who fund the research) plus personal recommendation	5 × 1st cycle RBMPs 5 × 2nd cycle RBMPs 17 × FRMPs
Wales (U.K.)	Devolved administrations within the U.K. offer "natural experiment"	3 × 1st cycle RBMPs 3 × 2nd cycle RBMPs 3 × FRMPs

* In Spain we analysed fewer 2nd cycle than 1st cycle RBMPs, since at the time of review they had not published 2nd cycle plans for the Canary Islands.

Appendix B

Table A2. Questions asked by email and in person to members of European Commission "Working Group F".

1	Are there any examples of integration within your country's processes of flood risk and river basin planning and management?
2	In your opinion, what are the main challenges or barriers to improving integration between the two planning processes?
3	We are seeking to collect key experiences and ideas from across Europe. If we wish to find out more about your country, may we contact you to talk to us about your experiences and ideas? Alternatively, who else would you recommend we speak to (please provide their name and contact details)?
4	Are units of management shared by RBMPs and FRMPs in your member state?
5	Do the same competent authorities lead the creation of your FRMPs and RBMPs?
6	Do the processes used to create your FRMPs and RBMPs have any connections or shared elements, i.e., information sharing, consultation processes?
7	Are your RBMPs and FRMPs reported separately, or in combined reports?
8	In your judgement, are there direct text cross-references between your RBMPs and FRMPs?

Appendix C

Further information about the semi-structured interview analysis. Table A3 lists the six cases and the main organisation associated with policy delivery in each case; Table A4 lists the individuals interviewed for each case, and lastly, Table A5 presents the topic guide used to guide the interviews.

Table A3. Summary of the 28 interviewees who discussed integration.

Case	Level	Interviewee ID	Policy Focus	Organization
England	National	E1	RBMP	Department for Environment, Food and Rural Affairs
	National	E2	FRMP	Department for Environment, Food and Rural Affairs
		E3	RBMP	Environment Agency
		E4	FRMP	Environment Agency
		E5	FRMP	Environment Agency
	Regional	E6	RBMP	Environment Agency
	Regional	E7	FRMP	Environment Agency
	Regional	E8	RBMP	Environment Agency
Flanders	Regional [1]	F1	FRMP	Flanders Department for Mobility and Infrastructure
	Cross-scale	F2	FRMP	Flanders Environment Agency
	Cross-scale	F3	RBMP	Flanders Environment Agency
	Regional	F4	RBMP	Flanders Environment Agency
Northern Ireland	National	N1	RBMP	Northern Ireland Department for Agriculture, Environment and Rural Affairs
	National	N2	FRMP	Northern Ireland Department for Infrastructure
		N3	FRMP	Northern Ireland Department for Infrastructure
	Regional	N4	FRMP & RBMP	An urban Local Authority
Scotland	National	S1	FRMP	Scottish Environment Protection Agency
	National	S2	RBMP	Scottish Environment Protection Agency
	Regional	S3	RBMP	Scottish Environment Protection Agency
	National	S4	FRMP	Scottish Environment Protection Agency
Sweden	National	Sw1	FRMP	Swedish Civil Contingencies Agency
	National	Sw2	RBMP	Swedish Agency for Marine and Water Management
	Cross-scale	Sw3	RBMP	A Swedish Water District Authority
	Regional	Sw4	RBMP & FRMP	A County Administrative Board
	Regional	Sw5	RBMP	A Swedish Water District Authority
Wales	National	W1	RBMP	Natural Resources Wales
	National	W2	FRMP	Natural Resources Wales
	Regional	W3	FRMP & RBMP	An urban Local Authority

[1] Belgium is a federal state, which has designated its three regions (Brussels Capital Region, Flemish Region and Walloon Region) as competent for the implementation of the WFD. Therefore, in this table, "regional" refers to the central or highest level for Flanders, whereas for the other cases it refers to a subsidiary level.

Table A4. The main organizations leading WFD and FD implementation in our nine interview cases, as derived from WFD implementation reports and our interviews. Where more than one organisation is listed as providing central coordination, the first is the "competent authority". Published sources provide further reading on the formal governance structures in each case.

Case	Policy	Central Coordination	Regional Level Planning	Further Information
England (U.K.)	FRMP	Environment Agency; Department for Environment, Food and Rural Affairs (DEFRA)	Environment Agency (EA); local authorities	[63]
	RBMP	EA, DEFRA	EA	[64]
Flanders (Belgium)	Joint FRMP & RBMP	Committee on Integrated Water Policy (CIW); coordination for the Scheldt and Meuse, respectively assigned to the International Scheldt Commission and the International Meuse Commission	Basin management secretary and council for each sub-basin; Flanders Environment Agency; Provinces; municipalities for smaller water courses	[65]

Table A4. *Cont.*

Case	Policy	Central Coordination	Regional Level Planning	Further Information
Northern Ireland (U.K.)	FRMP	Department for Infrastructure—includes Rivers Agency; and Northern Ireland Water	Department for Infrastructure; local authorities responsible for land use planning	[66]
	RBMP	Department for Agriculture, Environment and Rural Affairs (DAERA)—includes Northern Ireland Environment Agency	DAERA	[67]
Scotland (U.K.)	FRMP	Scottish Environment Protection Agency (SEPA)	SEPA; lead local authorities	[68]
	RBMP	SEPA	SEPA	[69]
Sweden	FRMP	Swedish Civil Contingencies Agency	County Administrative Boards—five of which host a District Water Authority; Swedish Civil Contingencies Agency	[70]
	RBMP	Swedish Agency for Marine and Water Management (from second cycle)	County Administrative Boards—five of which host a District Water Authority	[71]
Wales (U.K.)	FRMP	Natural Resources Wales (NRW)	NRW; lead local flood authorities	[72]
	RBMP	First cycle RBMPs; EA: second cycle NRW for Western Wales RBMP; EA and NRW for the Dee and Severn RBMPs	EA; NRW	[73]

Table A5. Topic guide used as the basis for semi-structured interviews.

Section 1: Biographical issues, career history	Professional career to date Current role and responsibilities Extent of involvement and role in planning
Section 2: General views on integration, opportunities and challenges	In your view, to what extent is Floods Directive (FD)—Water Framework Directive (WFD) integration important? How could we judge what "good" integration looks like? What would this mean for water management practices and policy delivery? To you, does integration imply something different to coordination or alignment? On the scale [shown] where do you think your country sits in terms of WFD and FD integration? What are the challenges to integration? How do you deal with/have dealt with these challenges? Some of the people we have talked to have identified a range of challenges [list updated between interviews]. Have you encountered any of these challenges in your country? What are the main opportunities for improving FD-WFD integration? What would need to change in order to enable more integration? Are other priorities more important for helping to achieve FD and WFD goals?
Section 3: Why plans may or may not show signs of integration	What specific parts of the planning process may (or may not) allow connections? Is there evidence of integration in other plans or documents for water management (e.g., smaller-scale plans)? Are there examples or initiatives for integration that are not (yet) reflected in the formal plans? If so what, how did this occur?

Table A5. *Cont.*

Section 4: About the future	In this section we would like to discuss what the next steps might be. In general, what are your priorities in implementing the current plans? What are your priorities for the next cycle of planning? Do you foresee any actions or changes to enable integration in future? If so what? Why?
Debrief/next steps	In this section we would like to discuss what the next steps might be. In general, what are your priorities in implementing the current plans? What are your priorities for the next cycle of planning? Do you foresee any actions or changes to enable integration in future? If so what? Why?

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IWRM through WFD Implementation? Drivers for Integration in Polycentric Water Governance Systems

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Abstract: This paper uses an empirical approach to explore what motivates the adoption of integrated water resources management (IWRM). The study compares cases of local implementation of the EU Water Framework Directive (WFD) from five German federal states representing various types of local policy addressees. Data were collected using policy analysis methods, including participatory observation and interviews with planners who had implemented WFD measures and conducted integration attempts of various types throughout the planning processes. The planning narratives on integration were analysed iteratively and its characteristics, drivers, and hampering factors were identified. It was found that policy addressees attempt integration due to the incentives for reaching their goals rather than according to their paradigms. Depending on the power relations, incentives result in the integration of different actors during different planning phases. The findings suggest that in order to strategically induce integration, it would be necessary to enhance the incentives based on a detailed knowledge of power relations. The WFD as a general regulatory framework was found not to be a driver for local integration, but the WFD did induce increased integrated management through setting goals.

Keywords: IWRM; integrated water resources management; drivers; EU water framework directive; implementation; coordination; participation; Germany; water governance; polycentricity

1. Introduction

The EU Water Framework Directive (WFD), due to its flexibility, is known as a directive of a new generation. Although this flexibility was introduced to avoid problems of fit in order to improve implementation efforts [1], many member states are far away from reaching the Directive's goals to achieve a good (ecological/chemical) status or potential in all European Waters by 2015 or with exemptions latest by 2027. Extensions became the rule ([2], for Germany see e.g., [3]). Two of the variously mentioned reasons for the implementation deficits which may be influenced by integration are the numerous usage conflicts and institutional interplay/policy incoherence [3].

This paper is inspired by discussions at the Workshop 'Rethinking the Governance of European Water Protection' which revealed the research gap which is addressed here (International Workshop "Rethinking the Governance of European Water Protection" 8–9 January 2019 at UFZ Leipzig organized by the author in cooperation with the UFZ Leipzig and ZALF with 38 water governance researchers from Germany, France, United Kingdom, Switzerland, Denmark, the Netherlands, Norway, Austria and Australia participating. In preparation for the discussions, 25 participants handed in two-pagers before the workshop answering the following questions based on their prior research: What do we already know about European water protection implementation? What do we still need to know on water governance to eliminate implementation deficits? What are the most important/urgent problems of European Water Governance? And what should political-administrative actors do (differently) to improve policy implementation?). However, this paper does not present findings from the workshop.

Increased integration was in varying governance contexts repeatedly discussed as a solution to overcome WFD's implementation deficits which also result from a governance point of view from numerous usage conflicts and institutional interplay. Discussions also revealed that there is a lack of clarity regarding who, where and how integration should occur. This challenge is reflected in the wider integrated water resource management (IWRM) literature, such as: "How can these issues be integrated (even if they can actually be integrated since many of the issues are mutually exclusive), who will do the integration and why, what processes will be used for integration (do such processes currently exist?), or will the integration, if at all it can be done, produce the benefits that proponents have claimed." [4] (see also [5,6]) Additionally, in looking for a possible pathway to overcome WFD implementation deficits, "at present the main question is not whether such a process is desirable, but rather can this be achieved in the real world in a timely, cost-effective and socially acceptable manner?" [4] Because the concept demonstrated to be a challenge for operationalization by decision-makers and planners [7]. Gallego-Ayala reviewed the IWRM literature from 2000 to 2011, but nevertheless, drivers for integration are not covered by the list of research topics treated in IWRM literature [7]. Considering also the literature on environmental policy integration, Waylen et al. found that little is known yet about drivers to policy integration in practice, the importance of individual and organization processes [8].

This situation leads me to ask here what motivates actors to adopt integrated management practices? I compare local German WFD implementation cases with a range of varying practices concerning WFD measure realization. Although the WFD prescribes elements of IWRM in various ways (compare Junier and Mostert [9]) and shows the relevance of integration for implementation, Boeuf and Fritsch still found gaps in WFD research on basin approaches and sector integration [10]. Generally, it is contested whether the WFD itself can be regarded as an example for IWRM. Some authors clearly consider the WFD to be IWRM in practice [9,11,12], but overall Beveridge and Monsees found the WFD and IWRM to be two distinct discourses in the research literature. There are only a few articles addressing both IWRM and WFD [13]. Those articles raise the question of whether it is "useful or even appropriate to categorize the WFD as IWRM", but see as well the little research conducted on the interrelationships between those two and the potential for mutual learning [13]. Waylen et al. elaborate that further research on implementation processes is needed and that these do not necessarily need to be supportive for IWRM at the local and catchment scale [8]. In this spirit, I analyse how local WFD policy addressees integrate, who is involved, which drivers and obstacles are important for integration, including whether in the light of the results the WFD itself can be seen as a driver for integrated water resources management.

The concept of polycentricity (compare Schröder [14] and see next section) and the findings on the relevance of local factors for WFD implementation in Schröder [15] informs this current paper by focusing on the role of decision-makers and the organizational context their decisions are embedded in for WFD implementation. In Germany environmentally relevant decisions are taken by more or less independent policy actors at a very local level and in various organisational settings (for their relation to higher levels see Section 4.1). Gallego-Ayala's literature review on IWRM analyzed the scale of analysis for IWRM researched and lists seven scales oriented on hydrological units (river basin, lake, aquifer, irrigation scheme) and administrative units (municipality, regional, country) [7]. Individual decision-makers are missing as unit of analysis. I argue here that integration also needs to be analyzed as an individual and strategic decision repeatedly taken for every new measure in a polycentric system of independent actors, despite the fact that there is national regulation prescribing integration such as the WFD. Independent decision-making centres always have some degree of discretion. In terms of WFD implementation and integration in Germany, this discretion is extensive. Policy addressees in Germany are not just about realizing plans elaborated at higher levels such as River Basin Management plans, as they have their own interests, goals and decision-making rationales (see Section 4.1). As Watson et al. described "political, administrative and cultural beliefs, attitudes, customs, and norms vary from country to country, from region to region, and even in some cases, from

community to community" [16], therefore the decision-makers themselves are an important unit of analysis for researching integration drivers.

This paper uses data drawn mainly from semi-structured interviews with WFD planners and WFD related decision-makers at various administrative levels. By analyzing their narratives iteratively, the paper offers an empirical perspective on IWRM with the focus on what these empirical accounts show. It keeps the following conceptual part on IWRM and polycentricity short. The empirical part of the paper, which appears after the section on methods and cases, covers evidence of integration attempts, how they may be characterized, and what actors influenced to adopt those approaches. The empirical part concludes by relating back the findings on WFD implementation to the conceptual basis of the paper. The final discussion reflects on the transferability and the applicability of the results for strategically approaching integration and broader insights for IWRM.

2. IWRM and Polycentricity

The term 'IWRM' is as fuzzy as widespread. This paper is not going to enlarge the number of available definitions. Rather, it is seeking a working definition feasible to subsume the phenomena in the field. Three definitions out of the literature shall help to approach this fuzzy concept.

First, the most often quoted definition formulated by the Global Water Partnership (GWP) in 2000, IWRM is "a process which promotes the coordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems" [1].

Second, the definition of Grigg [6] who illustrated vividly the various possibilities of what should or could be integrated: "Integrated water resources management is a framework for planning, organizing and operating water systems to unify and balance the relevant views and goals of stakeholders."

Third, a basic working definition of Cardwell et al. proposed by parsing the term word by word that: "Integrated Water Resource Management is a coordinated, goal-directed process for controlling the development and use of river, lake, ocean, wetland, and other water assets.", with "Integrated" defined as "to have made whole by bringing all parts together; unified n.: Integrity—completeness, unity" [17].

What do these definitions have in common and how do they differ? At first glance, these definitions look similar, but it is not trivial to find real commonalities. GWP and Cardwell et al. define IWRM as a process whereas Grigg use the term 'framework' which would lead me to analyze the organizational and institutional setting as a means of giving the frame for management processes with a certain aim. This aim is unifying and balancing views and goals, as in Griggs definition, but maximizing welfare in GWPs definition. Cardwell et al. do not provide a specific aim. GWP defines the process by the promotion of a result—the coordinated management. The use of the term 'promote', instead of e.g., 'lead', implies that the intention but not necessarily the process outcome may define a process as integrated. Cardwell et al. describe the process itself as coordinated and goal-directed, which would lead me to consider any type of coordination process with a goal.

These three definitions neatly illustrate the fuzziness of the concept and possible contradictions in using the concept for analysis. The questions of who integrates whom or what, and how, are not even addressed. Some other questions are also left open—see Biswas [4] for a detailed analysis of the GWP definition. If goals and views, according to Grigg [6], shall be unified, in which direction shall they be unified? Do we still call it IWRM if goals are unified in favour of agricultural land use instead of water quality protection, or just in favour of flood protection instead of water quality? Biswas [4] phrase this concisely: "what makes the water profession believe that they can superimpose their views on the other professions, who were not even consulted and on which they have only limited knowledge and expertise? Equally, why should the professionals from other professions accept the view of some people from the water profession?"

Reflecting this complexity, in the following analysis, I include all kinds of coordination, cooperation and participation processes in my cases of implementation of WFD measures. I treat the cases as

attempts for integration. Following the more encompassing definitions, the sum of processes would need to prove whether they are unifying or balancing views and goals and/or overall maximizing welfare. Analyzing the drivers leading to such coordination processes also allows analysis of whether there is a framework leading to processes which unify and balance views and goals.

Based on Biswas' [4] list of 35 categories of what can be integrated, Grigg [6] composed a list of eight elements to be integrated:

- Policy sectors
- Water sectors
- Government units
- Organizational levels
- Functions of management
- Geographic units
- Phases of management
- Disciplines and professions.

For the data collection and the categorization of empirical findings I focussed on elements given by the WFD (articles 3 and 14) such as sectors (policy and water sectors), geographic and government units and, out of the range of Grigg [6], the wider public (it might be a matter of perspective whether some actors would count as public or as representatives of a sector e.g., individual farmers or volunteering environmentalists). This allows assessing the fulfilment of these kinds of WFD process requirements.

"The governance literature demonstrates that nearly all processes are to varying extents polycentric and multi-level, working within between and amongst horizontal and hierarchical networks" [8]. Actors analyzed here are embedded in polycentric governance systems. Polycentric governance is understood here "as characterized at least by a multiplicity of decision-making centres, which, for system comparisons, are governing a certain good or problem within defined system boundaries." [14]. Polycentric governance demonstrates a plural landscape of definitions similar to that of IWRM. For an analysis of different nuances in those definitions and their relevance for identifying polycentric governance systems see Schröder [14]. In relation to IWRM, especially the multiplicity itself, the independence and interdependence of decision-making centres may be important factors influencing coordination—which is also often treated as a defining element of polycentric governance—and overall integration.

First, concerning the multiplicity of actors, it can be assumed that creating an integrated system gets increasingly complex and difficult with an increasing multiplicity of decision-making centres which affect the goal which shall be supported by integration.

Second, independence (see [18,19]) of decision-making centres characterizes polycentric governance systems. It is assumed here that independence creates discretion which may also leave decisions on whom to integrate, when, and how to the various decision-making centres. Independence may also reduce incentives for integration if centres may reach their goals independently. Nevertheless, no decision-making centre is completely independent, and must face interdependencies which may incentivize integration attempts.

Due to the combinations of independence and multiplicity, IWRM in polycentric governance systems may be analyzed as a collective action problem [20] or a matter of self-organization, which leads to the practical implications of polycentricity for adopting integrative approaches. This is the non-trivial identification of stakeholders and their integration [13] which becomes an ever-more challenging task with an increasing multiplicity of actors. Furthermore, it is a question whether such systems require some sort of centralization to reach IWRM or whether actors need to find ways to interact and address coordination problems [8,12,21,22]. Waylen et al. state this problem as follows: "Whilst much of the literature on IWRM stresses integration of topics, the governance literature stresses coordination between actors. This has implications for how integration might practically be achieved;

for example, it might be more important that different individuals are able to liaise and meet, rather than necessarily subsuming them into an integrated organisation." [8]

3. Methods and Cases

Data presented here are drawn from an in-depth comparative case study. WFD implementation in Germany demonstrates polycentric governance in various forms (compare [14]). Concerning governance, the WFD itself is very complex, requiring an in-depth analysis of dependencies and therefore restricts the scope of the study to one-member state. However, the situation also offers a vast plurality of settings making commonalities in integration characteristics relevant for learning on general integration drivers. The cases selected here represent various organizational structures used to implement the WFD in Germany. German federal states can be classified as area states or city states. Furthermore, area states can be classified according to having government districts, a middle authority or neither government districts nor middle authorities. Cases presented here are located in Saxony, Hesse and North Rhine-Westphalia (NRW) (with government districts; note that Saxony had government districts only until 2012. Districts themselves do not appear to plan WFD measures in contrast to Hesse and North Rhine-Westphalia. Nevertheless, basic organizational structures of former districts prevail and may induce additional variety within Saxony) as well as Saxony-Anhalt and Thuringia (with middle authority). States without government districts or middle authority are not represented by the case selection here. However, local level policy addressees in those states are water maintenance associations (The specific governance structure and name of those associations may vary among and within states, compare with Monsees [23]) which also can be found in Saxony-Anhalt (covering the whole state) as well as in NRW and Thuringia (covering parts of the states). I intended that cases cover all types of policy addressees in each state planning specific measures on hydromorphology and connectivity to reach WFD goals, but missed very small-scale actors such as communities and water and soil associations (Those actors are generally weak WFD implementers in Germany as they often have no personnel capacities really covering WFD implementation or water maintenance as a task). A few of them, I could assess indirectly, for example, by interviewing umbrella organizations. Interviewees of small-scale actors were identified using a snowballing approach and asking higher level authorities for details regarding who was actively implementing WFD measures.

The states covered in the study share common types of policy addressees in varying combinations, allowing sub-groups to be identified and identification of similarities based on organizational structures and differences resulting from other factors. Table 1 provides an overview of local policy addressees for WFD implementation, and the cases selected for each federal state. Entries shown in grey indicate a weak database either because the actor type was not interviewed or the actual planner in this organization could not be interviewed, but another relevant person was interviewed. In cases that were indirectly assessed, when data are included in the following tables and they are shown in grey.

By focusing only on hydromorphology and connectivity measures, the usage pressures and the problems actors need to cope with generally were kept constant across cases. Those pressures are the availability of land and conflicting usage interests with agriculture, city development, nature conservation and so on as well as the needs for personnel and financial resources. Therefore, the cases essentially share the needs for and prospects of integrated management.

For each state official websites, policy documents and documented information materials from participatory processes were analysed to identify relevant decision-makers and interviewees at higher levels. This was complemented by participatory observation data on processes between 2016 and 2019 (according to opportunities that arose, such as meetings and conferences). The latter also supported the identification of, and access to, active decision-makers for interviews and the assessment whether pre-plan integration may have an influence on local planning. The majority of data here are drawn from semi-structured interviews with policy addressees as well as lower, middle and upper authorities which have steering functions related to measures on hydromorphology and connectivity. These interviews were complemented by interviews with non-state actors with related responsibilities and

aims, or in positions to give a detailed overview of the implementation situation in the states especially nature conservation associations which took the position of a critical observer and environmental advocate in political processes in the chosen states (According to my observation there is a difference between nature conservation authorities and nature conservation associations and lower and higher levels whereas associations act supportive for WFD implementation at higher levels, at local levels more conflicts arise due to institutional interplay between WFD and nature conservation law which needs to be implemented by nature conservation authorities). The 54 conducted interviews lasted two hours each on average.

Table 1. Local policy addressees for realizing specific measures to reach Water Framework Directive (WFD) goals in each selected federal state and cases analyzed.

Actor Type	Saxony	Saxony-Anhalt	Hesse	North Rhine-Westphalia	Thuringia
District governments	(-)		X RP Darmstadt	X BR Arnsberg	
State enterprise	X LTV	X LHW			X Thüringer Landgesellschaft
Counties				(X) Soest	
County-free cities	X Dresden		X Wiesbaden	X Hamm	X Erfurt, Gera
Communities	X		X City Taunusstein	X	X City Blankenhain
Maintenance associations		X UHV Ehle-Ihle			
Water and soil associations				X WuB with County Coesfeld	
Special-law water associations				X Lippeverband	
Special purpose associations			X Abwasser-verband Main-Taunus		X GUV Harzvorland
Nature conservation associations					X NATURA2000-Station
Landscape planning associations	(X)				(X) LPV Thüringer Grabfeld

RP (Regierungspräsidium: government district) Darmstadt, BR (Bezirksregierung: district government) Arnsberg, LTV (Landestalsperrenverwaltung: state dam administration), LHW (Landesbetrieb für Hochwasserschutz und Wasserwirtschaft: state enterprise for flood protection and water management), Thüringer Landgesellschaft (Thuringian land society), UHV (Unterhaltungsverband: maintenance association) Ehle-Ihle, WuB (Wasser- und Bodenverband: water and soil association), Abwasserverband (waste water association) Main-Taunus, GUV (Gewässerunterhaltungsverband: water maintenance association) Harzvorland. X policy addressee, (X) special actor generally not addressed, X not interviewed, interviewed actor other individual than planner (indirect assessment).

The purpose of the analysis, observation, and interviews was to trace who is taking environmentally relevant decisions in such polycentric governance systems (compare Schröder [14] for categories of decision-making centres) and how those decisions are influenced by other decision-making centres. The specific issue of drivers for integration presented here is analysed using interviewees answers on how they plan measures (step by step until construction), how they generate ideas for measures, who they coordinate with or which participation/coordination processes they use and participate in,

complemented by questions on barriers, conflicts, their relevance and possibilities for improvement. The questions were open-ended and in order to avoid answers being unduly affected by concerns about political correctness, I did not ask directly why they coordinate and why with specific actors and not with others. Most interviewees gave their own reasons and interpretation without prompts from the interviewer. Therefore, instances for integration and driving factors are identified based on the researcher interpreting their narratives iteratively. Several interviewees made direct statements regarding processes and why they acted in a certain way. Those responses where used to identify initial categories of integration instances and driving factors. The interviews were analysed iteratively twice to identify statements more indirectly pointing to categories found in the first (and second) round of data analysing. There may be other drivers and hampering factors in addition to those described here, as the method of data collection focussed particularly on individually perceived drivers which are then used to describe the planning processes. Other potential factors may not be perceived (as important) and therefore not mentioned by interviewees (Nevertheless, if factors were not perceived as relevant by actors for reasoning their proceeding, this is an important finding in itself). Therefore, in order to avoid politically correct answers, this procedure may miss out some other drivers hampering integration. The latter are elaborated here as far as the data allow, but a systematic analysis is not possible.

4. Empirical Findings

WFD implementation in Germany is under the purview of the federal ministries. It is expected that policy addressees voluntarily implement measures to reach the WFD goals. These policy addressees have different organizational structures as categorized in Table 1. They largely existed prior to the WFD and have mainly primary tasks related to water maintenance with goals such as flood protection, navigation and land drainage for agriculture.

In the context of WFD implementation, integration initiatives exist at various levels. There are processes with the intention of advising, information exchange, conflict resolution, coordination and acceptance organized by ministries, middle authorities/government districts and technical authorities, which are mentioned on websites and in policy documents in order to fulfil the WFD requirement of public participation and coordination. Beyond accompanying the WFD implementation process in general these processes intend to coordinate activities for setting up the river basin management plans (RBMP) and programs of measures (PoM) according to the requirements of the WFD. These might be understood as attempts to integrate several perspectives into planning documents. Article 3 and 14 of the WFD states "active involvement of all interested parties (...) in particular in the production, review and updating of the river basin management plans" (article 14) and coordination in particular of all programs of measures (article 13). Therefore, it seems to be inherent to the WFD that a classical approach to implementation from goal setting over strategy development, planning and realization applies. This implies that plans developed at higher levels are simply realized by local policy addressees with very little if any discretion. In such a case, developing plans such as the PoMs with integrative processes might lead to integrated management. However, this way of approaching WFD implementation ignores that local policy addressees need to be considered as independent decision-makers in a polycentric governance system (compare Schröder [14]). Additionally, the PoMs and related more detailed plans are still so general that the idea generation and development for measures needs to be done by local policy addressees (the relation between pre-plans and local planning is elaborated in 4.1). The more detailed a plan gets the more conflicts and restrictions become visible due to dependence on the same land resources and time frames required for different goals and activities. This implies that, if integration has the goal to unify or balance views and goals or to maximize welfare or to control water resources, it also needs to happen locally for hydromorphology and connectivity measures due to the nature of the good.

Local integrated management is not explicitly prescribed in the WFD like RBMPs or PoMs. However, I decided to focus here only on local integration attempts. This has the advantage that drivers for adopting integrative procedures can be studied with a decreased effect of (perceived) institutional

coercion for integration. I analyze integration attempts which resulted in measure realization, and not those which generally led to strategy or PoM development.

This section starts by showing the planning stages with integration attempts observable in local cases, by characterizing the integration attempts by actors involved, integration along vertical or horizontal scales, sectors and the public. It is followed by analyzing the factors which led to those integration attempts and the factors which hamper integration. The section is completed by analyzing whether the described cases can be regarded as being integrated through the WFD.

Interview sources are only noted in the following if the respective actor (case) is not named in the text passage or if there are multiple interviewees making statements for one case. All interview partners are listed in Appendix A and are numbered by I1–I54 for referring to them in the text. Participatory observation data are numbered by O1–O9 for referring to them.

Empty table cells mean that there were no instances in the interviews for this category but do not allow conclusions on the absence of characteristics.

4.1. What Kind of Integration Is Observable in Local German WFD Implementation?

The federal states of Germany established multiple processes to fulfil WFD prescriptions on coordination and participation. However, due to the conflicts especially arising when a measure is realized on the ground, an integration process needs to reach/influence the decisions for realizing measures. This would mean that the plans written at higher levels with integrative processes need to be used by policy addressees e.g., for idea generation. If larger plans or pre-plans do not affect local decision-makers, this level might only be considered as integrated if local decision-makers conduct their own integration attempts.

Sevä and Sandström found that only one-third of the street-level bureaucrats in Sweden made their decisions based on the programs of measures, which may increase the probability of working "in line with old routines and well-established practices rather than with new policies" [24]. In Germany, the influence of pre-plans varies across the analyzed federal states. River basin management plans and programs of measures are widely described as being too unspecific to derive specific hydromorphological and connectivity measures from them. *Saxony* did not prepare more detailed plans above the local level. Dresden uses its own pre-plan for idea generation, but this was not compiled integratively (I16, I17, O3). *Hesse* conducted participation platforms for its PoM. Several local water development concepts thought as pre-plans were prepared, mainly ordered by government district authorities. However, there is no instance that those pre-plans were prepared with integrative processes. They are thought of as a "wish-list" (I30), they do not contain restrictions (I30) and they are questioned for their implementability by local actors (I25, I30) and alternative ways for idea generation are used such as water shows (I30) or own pre-plans and experiences (I25,I31). For *Saxony-Anhalt* water development concepts are prepared one after another with project accompanying working groups compound by various actors for each concept. These concepts are intended to be a pool for measure idea generation by maintenance associations (I5, I6). However, those who were interviewed for the maintenance association reported that they did not use the concept for its territory since its completion (three years before) and that they do not intend to use it in the coming three years. They implement ideas developed in their network of actors many years before the concept completion. *North Rhine-Westphalia* prepared its PoM with round tables for participation and implementation road maps with a higher level of detail. The cooperation along this compilation process seems to vary regionally. One actor stated she had used some ideas for measures out of a road map (I34), another one stated that the road maps are already outdated and no longer fitted due to a different availability of land (I37). *Thuringia* compiled water framework plans for priority waters conducting participatory workshop talks. The less detailed PoM was upscaled from these plans. Water framework plans are used to generate ideas for compensation measures (I54) and connectivity measures (I43) and idea generation is complemented by water maintenance plans (I48). However, one actor indicated to often zeroise the

plans due to the fact that the measures would have only been derived for water management needs and do not consider restrictions (I49).

Overall, Thuringia is the state in this comparison with the highest influence of pre-plans on local measure implementation. How integrative procedures to compile pre-plans have been remains an open question. Nevertheless, participatory observation of a recent workshop talk for plans of the coming WFD cycle allowed me to explore the statement that plans merely consider water management needs and take up less of the remarked local restrictions. This is illustrated with the explanatory statement often appearing in measure overviews for participants that measures are kept in the plan because they are indispensable for WFD goal achievement (O9).

This overall observation suggests integration attempts are left to the local decision-makers. Table 2 shows categories of integration attempts of local policy addressees derived from interviewees answers given on questions on cooperation and participation processes on the way to realize measures. The iterative categorization led to the identification of integration attempts according to different planning stages from idea development via approval procedures to construction site briefing (the latter was only a single case (Abwasserverband Main-Taunus) and therefore left out in the table). It is complemented by two categories not related to specific stages: organizational structure and project accompanying working groups.

The *organizational structure* comprises an overall, institutionalized integration attempt. Its effect depends on its specific characteristics but shares to be applicable on the general discretion range of a policy addressee. All kinds of associations and two cities analyzed here show this specificity. Measures taken by the UHV Ehle-Ihle need the agreement by the members assembly comprised of farmers (I3). This way farmers views are integrated in WFD measure planning (In the long run it might be interesting to research whether the repeated process of agreeing on suggested measures lead to an integration of WFD supportive behaviour in farmer's management decisions). In this case, this leads to a restriction to certain types of measures (basically not requiring land). The GUV Harzvorland has a public member's assembly (members are communities) which decides on all measures and specifically on financial resources spent. However, all intended measures are related to primary tasks. WFD measures are mainly taken to compensate interventions for flood protection measures and are not influenced content-wise by the member's assembly. Similarly, the member's assembly of the Lippeverband (communities, industry, mining industry) decides on financial resources to spend. Communities raise there their voices on issues of land, tourism and experiencing landscapes but rarely veto the ecological plans itself. The LPV Thüringer Grabfeld reported that its member's assembly (communities, nature conservation, agriculture—one third each) improved the general cooperation. However, WFD specific measures are agreed upon between the LPV and the concerned/ordering community. For the city Taunusstein, one single person is responsible for reaching the goals of city development, nature conservation and water protection. This necessarily needs finding synergies or weighing up trade-offs of conflicting goals. Whereas, construction measures usually pass approval procedures, in Hamm maintenance measures need to be prescribed in water maintenance plans. Yearly, those plans need the agreement of the nature conservation advisory board which is comprised of seven users and seven conservationists with a farmer as a chairperson. The case of WuBs in NRW are more complex. WuB members are land owners along the river stretch and within the catchment and hinderers (e.g., owners of bridges, water treatment plants). Above a certain level of total costs, decisions cannot be taken by the association's chairperson, but by the elected association's council. The county Coesfeld (lower water authority) tried to foster WFD implementation by offering to pay the WuBs co-payment required by the WFD financial scheme in NRW. This offer was realized with financial resources from ecological compensation requirements through cooperation with the lower nature conservation authority of county Coesfeld. However, the county's council take over decisions of how to spend compensation money above a certain sum of costs.

Table 2. Integration attempts of local policy addressees according to planning stages.

State	Policy Addressee	Organizational Structure	Project Accompanying Working Group	Idea Development Stage	Planning Start Consultation	Preliminary Reconcilement (Restrictions)	Approval Procedures	Sources
Saxony-Anhalt	UHV Ehle-Ihle	X	X	X	X		X	(I3)
Saxony	LTV			X				(I18)
	City Dresden			X			X	(I16) (I17)
	Community			X				(I13)
Thuringia	Thüringer Landgesellschaft				X	X	X	(I49)
	City Erfurt			(X)	X	X	X	(I43)
	City Blankenhain			X		X	X	(I47)
	GUV Harzvorland	X		(X)		X	X	(I54)
	LPV Thüringer Grabfeld	X		X		X	-	(I48)
Hesse	City Wiesbaden					X		(I25)
	City Taunusstein	X		X			-	(I31)
	Community ideally			X	X		X	(I26) (I21)
	Abwasserverband Main-Taunus				X	X	-	(I30)
North Rhine-Westphalia	BR Arnsberg		X				X	(I40) (I42)
	Lippeverband	X		X				(I36)
	County Soest				X	X	X	(I34)
	City Hamm	X		X		X	X	(I37)
	Water and soil associations with County Coesfeld	X		X			X	(I41)

X incidence for this kind of integration attempt; (X) no incidence for regular procedure (Erfurt: A single measure was realized as a compensation measure; GUV Harzvorland: a pilot project at the early times of WFD implementation); - explicit incidences for no integration at this stage. Grey Indirect Assessment.

Beside the organizational structure, cases are characterized to varying degrees by integration attempts throughout the whole planning process. Integration processes, therefore, have differing degrees of influence on the outcome - which is expected to be highest at the idea development

stage. Surprisingly all cases show attempts aimed at integration at an early planning stage (project accompanying working groups, idea development stage or planning start consultation). In eleven cases measure plans pass approval procedures which are classified here as (institutionalized) integration attempts in their function to weigh up different interests and affectedness and to make regulatory requirements such as changing plans or making amendments. However, in three cases, approval procedures are avoided using actors' own discretion, although those cases show integration attempts during earlier phases. Four cases explicitly mention regulatory requirements by the lower nature conservation authority (GUV Harzvorland), the lower water authority (city Blankenhain), by built heritage conservation (county Soest) and requirements made for funding approvals without another approval procedure (Abwasserverband Main-Taunus).

Additionally, it was analyzed which actors were involved in the aforementioned integration processes and in which planning phase they were involved. For a detailed table see Appendix B. Cooperating actors mentioned in the interviews were listed and grouped. (The list is likely to be incomplete, but it is assumed that interviewees mention the most important actors coming to their mind. Especially the less important actors were sometimes named vaguely such as 'agriculture' in general without specifying whether authorities, associations or individual farmers are meant. Specifications in the table in Appendix B are made if given. Sometimes only the process itself was mentioned. This was especially the case if the process, such as an approval process, was not conducted by the interviewee but by another authority.) The most important actor types (mentioned in four or more cases) were: Financial authority, upper water authority, lower water authority, lower nature conservation authority, (other) nature conservation actors, actors from fishery/angling, agriculture and concerned communities. Other actor types were more rarely mentioned.

One or the other actor category was mentioned for several phases especially for the early planning stage, which is not surprising. Additional work can be avoided if the non-agreement for a measure is given at an early planning stage. Financial authorities and upper authorities are less often involved than lower authorities, but if so, mainly at an early planning stage. Financial approvals are often given by upper water authorities (in Thuringia by the Thüringer Aufbaubank). Therefore, some cases cooperated with only one actor combining both actor types. The entries for lower water and nature conservation authorities correlate with institutional dependencies through required approval procedures. Both lower water and lower nature conservation authorities were involved in nearly all analyzed cases either at an early planning stage or for preliminary reconcilement. Only those cases miss an entry which rely on upper instead of lower authorities for their measures (Dresden is a mixed case and responsible actors within Dresden work closely together). Communities have no entry when the actor in focus itself is a community or county-free city. Therefore, integrating communities does not seem to be necessary. Nevertheless, it also means that communities outside the territory are not integrated. It depends on the kind and size of measure and its effect on the basin whether other communities should be considered as concerned or having a stake in decisions made. Non-community actors involve the concerned communities mainly at an early planning stage or through their organizational structures.

Integrating agricultural perspectives ranges from institutionalization in the organizational structure to cooperation with agricultural authorities, associations, and professionals (farmers). It is difficult to identify commonalities among actors integrating agricultural perspectives. However, actors which did not mention agriculture for cooperation share that they are less directly dependent on agriculture (Agriculture has a higher importance for WFD goals concerning nutrients and other pollution whereas for actors here land and the type of agricultural usage close to rivers is most important) or that the local way of planning reduces direct contacts. Blankenhain and GUV Harzvorland for example justify their measures with the flood protection argument. This is reported to be more convincing and has additional legal possibilities to require necessary land resources from owners such as farmers. This may lead to reduced incentives to convince agriculture for cooperation. Others, such as Erfurt and Dresden, avoid requiring land for implementing their measures, which is perceived to be

difficult to realise or alternatively they rely on other authorities and processes (rural replotting) for obtaining land (Taunusstein, Abwasserverband Main-Taunus, Hamm).

In Saxony, it is a requirement that the fishery authority joins for the water show of the lower water authority. This specific water show has the intention to generate ideas for WFD measures. However, it is reported that the fishing authorities are often lacking personnel capacities to join water shows (I18, O3). The few other cases with entries for fishery/angling or nature conservation mention those actors predominantly for early planning stages. This supports the assumption to integrate them because of their knowledge about and interest in local water bodies.

Other actors mentioned, merely for preliminary reconcilement and approval procedures, were: (named more than once:) built heritage conservation/archaeology, civil engineering and green space office, line providers, building authority, waste, and were (named once:) lower soil protection authority, road traffic authorities, tourism, forest management, canoeists, industry, explosive ordnance disposal service and a rural replotting authority.

The following summarizes the integration attempts from the conceptual perspective. I have elaborated above that integration may have different dimensions, that decisions may be integrated by scale (vertically and horizontally), by sector and by public. The integration attempts described above are categorized according to those dimensions in Table 3.

Vertical integration appears to be widespread. However, a closer look shows vertical integration attempts mainly involving upper water authorities/financing authorities due to financial approval processes. Large scale actors also involve lower scale actors and middle scale actors such as the Abwasserverband Main-Taunus upper and lower water authorities. Therefore, it is not surprising that actors relying less on funding programs did not or rarely indicate vertical integration.

In contrast, horizontal integration was rarely being observed at all. It gets more obvious that (sub-)basin approaches are rarely applied on the local level as this would require cooperation across organizational units with non-hydrologic boundaries. Most of the analyzed cases are characterized by administrative boundaries or are just partially following hydrologic boundaries (e.g., Lippeverband, water and soil associations). As maintenance tasks are organized according to basins in Saxony-Anhalt, maintenance associations come closest to realize a basin approach by its own. (Nevertheless, those hydrologic boundaries do not match with hydrologic boundaries applied with WFD implementation and additionally maintenance associations do not cross state borders to apply a basin approach completely.) Wiesbaden mentioned one project cooperation with surrounding communities. BR Arnsberg is providing maintenance tasks for parts for of the neighbouring government district and mentioned a regular exchange with responsible persons from all other government districts in North Rhine-Westphalia, which roots in yearly budget talks organized by the ministry.

There is no case demonstrating not at least some sector integration, but it is elaborated above that there are numerous variances of which sectors are involved and at which planning stage.

In contrast, the public was less often mentioned to be integrated. In such cases, participation lies closer to information giving than counselling or joint decision-making. Dresden, Wiesbaden, LPV Thüringer Grabfeld (also informing via telephone), GUV Harzvorland and Erfurt described the plan presentation in local councils. The Thüringer Landgesellschaft named public relations, county Soest press releases at the beginning and the end of projects and Hamm the description of measures in the planning process on their webpage which provided the occasion for interested citizens to ask questions. Other attempts named are the water inspection with citizens and communities and question times. The LPV Thüringer Grabfeld pointed to public participation in workshops conducted to compile PoMs and Soest noted that concerns by neighbours are probably gathered and considered by the contracted engineering office.

Table 3. Conceptual categorization of integration attempts.

State	Policy Addressee	Sector	Measure Implementation Incentive	Scale		Sector	Public	Sources
				Vertical	Horizontal			
Saxony-Anhalt	UHV Ehle-Ihle	Maintenance (agriculture)	Positive for region	X		X	-	(I3)
Saxony	LTV	Water provision/flood/maintenance		X		(X)		(I18)
	City Dresden	Maintenance/flood	Positive for region, flood protection and WFD			X	X	(I17)
	Community	(probably varying)		X		X		(I13)
Thuringia	Thüringer Landgesellschaft	Land management/WFD/flood protection	WFD as mandate	X		X	(X)	(I49)
	City Erfurt	Maintenance (flood)	WFD and flood protection	X		X	X	(I43)
	City Blankenhain	Maintenance (flood)	Flood protection	X		X		(I47)
	GUV Harzvorland	Maintenance (flood)	Flood protection			X	X	(I54)
	LPV Thüringer Grabfeld	Landscape management/maintenance/WFD	WFD as mandate			X	(X)	(I48)
Hesse	City Wiesbaden	Maintenance/lower water authority for non WFD-measures	WFD and flood protection/climate change	(X)	(X)	X	X	(I25)
	City Taunusstein	environment	Sustainable environmental protection	(X)		X		(I31)
	Community	(probably varying)		X	X		(I26)	
	Abwasserverband Main-Taunus	Maintenance/waste water/flood	WFD within maintenance (without approval procedures)	X		(X)		(I30)
North Rhine-Westphalia	BR Arnsberg	maintenance/construction	WFD	X	X	X		(I40) (I42)
	Lippeverband	Mixed/mining aftermath	Mining aftermath with renaturation	X		X		(I36) (I38)
	County Soest	Maintenance	WFD	X		X	(X)	(I34)
	City Hamm	Lower water authority	WFD with compromises	X		X	(X)	(I37)
	Water and soil associations with County Coesfeld	Maintenance (agriculture) with Lower water authority	support WFD implementation	(X)		X		(I41)

X incidence for this kind of integration attempt; (X) no incidence for regular procedures; - explicit incidence for no integration. Grey Indirect Assessment.

Additionally, Table 3 presents the case characterization by the sector, actors originate from, and the incentives decision-makers had to implement WFD measures. In two cases, decision-makers perceive flood protection as their primary task where WFD aims were integrated in (here mainly due to approval procedures and financial incentives). Other cases intended to integrate other sectors into WFD implementation decisions and approximately half of them already combine WFD aims with other aims such as recreation and flood protection in their incentive to implement WFD measures. Only a few of them perceived WFD implementation as their primary task, more actors perceive it like an instrument and occasion to decide according to their personal conviction (Dresden expressed it very explicitly: Also without WFD I would not do anything differently. With WFD I can justify it by law (I17)).

4.2. What Leads to Those Forms of Integration?

Above, it was shown that the integration attempts vary by who is when included in decision-making processes along the planning procedure. The question is now what drives this kind of integration attempts? What motivates the adoption of integrative decision-making?

Drivers were examined iteratively, with the same procedure as above, collected and are presented in Table 4. Those categories cover drivers which are named directly or indirectly by interviewees to justify or explain their planning approach. It should not be confounded with the integration attempts itself. A decision-maker, for example, may involve another actor at the idea development stage but might do this with the intention of conflict prevention and not idea development. Some drivers are closely related to each other (see below).

Table 4. Drivers to adopt integrative practices.

State	Policy Addressee	Organizational Structure	Idea Development	Improve Decisions	Finding Synergies	Conflict Solution/Prevention	Goal Achievement	Financial Reasons	Regulation	Knowing Each Other	Conviction	Sources
Saxony-Anhalt	UHV Ehle-Ihle	X		X			X	X	X	X	X	(I3)
Saxony	LTV								X			(I18)
	City Dresden	(X)					X	X	X	X	X	(I16) (I17)
Thuringia	Thüringer Landgesellschaft					X	X			X	X	(I49)
	City Erfurt					X	X					(I43)
	City Blankenhain					X			X			(I47)
	GUV Harzvorland					X	X		X			(I54)
	LPV Thüringer Grabfeld					X	X		X	X	X	(I48)
Hesse	City Wiesbaden						X					(I25)
	City Taunusstein				X		X	X				(I31)
	Community							X	X			(I26)
	Abwasserverband Main-Taunus							X				(I30)
Northrhine-Westfalia	BR Arnsberg			X		X	X		X		X	(I40) (I42)
	Lippeverband								(X)			(I36)
	County Soest	X				X			X	X	X	(I34)
	City Hamm		X			X	X	X	X	X	X	(I37)
	Water and soil associations with County Coesfeld	X						X	(X)			(I41)

X incidence for this kind of driver; (X) no incidence for regular procedures. Grey Indirect Assessment.

The drivers may be summarized in four groups: drivers relating to the decision itself (idea development, improve decisions, finding synergies), drivers influencing whether an actor is able to realize goals (conflict solution/prevention, goal achievement, financial reasons), drivers

related to the personal characteristics of a decision-maker (knowing each other, conviction) and the institutionalization of integration (organizational structure, mandatory (legislation)).

The majority of cases show three or less drivers for actual integration attempts which are mainly in the group of realizing goals. These are precisely the cases that do not show drivers of personal conviction that integration is important or networks of that different actors are also integrated because of knowing each other well. Only two of the cases named more than six drivers each. However, the number of mentioned drivers does not seem to relate directly to the kind of integration attempts or kind or number of sectors involved by those decision-makers. Interestingly, although a majority of cases reported integration attempts at an early planning stage, especially in the phase of idea development, drivers show that only a few of them intended *idea development*, *improving decisions* generally or *finding synergies*, but rather do early steps to ensure realizing their goals considering known conflicts, possible lacks of acceptance and the necessity to gain sufficient resources.

Conflict prevention/solution is operationalized by noting worrywarts (I42) such as nature conservation authorities (I42, I34, I48), built monument conservation (I34) and land owners (I37, I49, I54) and the necessity to get them around the table for solving conflicts as well as by noting the intention to realize measures based on consensus to convince land owners to provide land (I37). WFD implementation does not happen in a dependency-free orbit (I49).

Goal achievement includes acceptance considerations (I54, I49, I25, I43, I42, I3) but also incentives of expected results from integration. Cooperation with other actors to implement measures, measures which wouldn't have a chance within the regularly used procedures, may disclose other funding opportunities (I43, I37, I48, I17, I42) but also enhance the discretion of an actor. In example, the cooperation and the agreement between Taunusstein and the lower water authority based on trust allows categorizing more measures as maintenance and funding them with compensation money in cooperation with the lower nature conservation authority avoids complex and long-lasting financial approval processes (I31). On the one hand, this may lead to an easier and faster implementation, but on the other hand, it may reduce institutionalized integration attempts for measures else wise being categorized as measures requiring an approval procedure. The approval procedure would integrate other actor's perspectives.

Overlapping with the goal achievement category, *financial reasons* include that decision-makers have to cooperate with a certain actor purely to obtain sufficient funding. It is treated as a separate category because decision-makers have less discretion avoiding the following integration process and face this issue on their regular way of planning instead of disclosing additional possibilities. Predominantly this means that decision-makers need to integrate upper and/or lower water authorities throughout the financial approval process (I3, I26, I30) or that the generally offered funding possibilities do not apply (I17) or require a co-payment (I37). An interviewee for Dresden reported that they do not have any target water body which would be covered by the funding scheme and Hamm noted that the lower nature conservation authority is the only actor possessing financial resources there. The county Coesfeld attracted water and soil associations to implement WFD measures to cover their co-payments out of compensation money, which required cooperation between the lower water authority, the water and soil associations and the lower nature conservation authority.

The category *regulation* comprises named regulations inducing the integration of other actors except for pure financial reasons. Water shows/water inspections need to be undertaken, by the UHV Ehle-Ihle according to its own statutes and by all lower water authorities in Saxony (it is also reported that actors cannot manage to fulfil this in its entirety) (I18) and by lower water authorities in Hesse with various actors. In NRW (Soest) the financial approval authority requires approval procedures for all measures no matter whether they might be categorized as maintenance measures by the lower water authority not requiring any approval. GUV Harzvorland and Blankenhain described the necessity of approval procedures for flood protection measures, which offers the chance to integrate WFD aims to the lower water authority by making obligations and to the nature conservation authority as any construction need an equivalent compensation. Dresden described this necessity for compensating

any construction plans as the driver that other actors seek the cooperation (being integrated in that actors planning so to say). Furthermore, project accompanying working groups (BR Arnsberg) are said to be prescribed in all regulations and authorities of the same level need to be involved in any official decision. This category also comprises the rules to obtain the agreement for water maintenance plans from the nature conservation advisory council (Hamm) and for compensation measures from the county council for measures above a threshold of costs (Coesfeld). Ultimately, coordination might also be perceived as mandatory (Lippeverband: the compilation of measure overviews) without knowing what coordinated specifically means under the given conditions.

The category *organizational structure* is less perceived as a driver than regulation although it is more present in the integration attempts similar to idea development. In Soest, the responsible person partially fulfils also tasks from the nature conservation authority and has a farmer's background leading to the will of integrating conflicting perspectives and finding solutions. The agreement necessity by members of an association (Coesfeld, UHV Ehle-Ihle) on measures taken lead to the consideration of members in the planning process. However, sometimes are those considerations taken into account in a way that certain measures are not even planned (presumption of possible non-agreement if asked later in the planning process). An effect of the organizational structure is based on dependencies and physical vicinity which may facilitate learning on others interests and possible solutions (Waylen et al. also found a relevance of physical co-location or virtual teams as being relevant for practicing coordination and collaboration for integration [8].). The latter is also given in Dresden if city's politicians urge an actor to do public participation who depends on their support e.g., for obtaining funding. Potentially, the strength of dependencies and related discretion, as well as a perception of the organizational structure as probably more given (unchangeable) than regulations (which also changed throughout the period of WFD implementation), may lead to the few entries as a driving force.

The vicinity through organizational structures supports here the driver of *knowing each other*. Soest, Hamm, and Dresden noted that integrated sectors sit in the same building which leads to ensured meetings and intensive exchange (I37) or that other actors such as investors approach decision-makers personally or that nature conservation associations approach the nature conservation authority which forward ideas because of knowing each other (I16, I17). The Thüringer Landgesellschaft uses this effect for identifying further actors for integration processes when asking involved actors whether they know further important actors to be involved. In projects of the UHV Ehle-Ihle, cooperating actors know each other since study times and from voluntary work within the association (I3, I8). The LPV Thüringer Grabfeld established this kind of network with communities through regular contacts during its own activities which moved the coordination from community council meetings to communication via telephone.

Conviction takes two forms here: One is that integration is generally important e.g., it is a task to enthuse humans (I42), it needs environmental education (I49), it is a give-and-take basis requiring the search for compromises (I34) and sitting together at one table, from the beginning on, should not be avoided (I48). On the other hand, integration helps to realize own goals e.g., the believe, that they never would have obtained so much land with coercion, WFD implementation deficits result from a lack of communication (I42) and processes proved of value (I3, I37).

Overall, drivers of realizing goals and institutionalization (regulation is absolutely dominating) dominate across all cases. Approximately half of the cases with sufficient data show conviction and knowing each other as drivers.

4.3. What Hampers Integration?

The cases analyzed here also provided insights regarding factors which hamper the adoption of integrative procedures. Statements can be grouped by categories such as personnel resources, effort for integration, willingness to compromise and independence in decision-making.

In many cases, it is mentioned that *personnel resources* are neither sufficient for planning the measures itself nor for conducting time-consuming integration procedures. Whereas Dresden and RP Darmstadt, although being aware of the necessity for integration, are recognized to be better situated with personnel resources than other WFD implementers, they note that they do not have enough personnel for integrated management to its full extent (I16, I21). The small water and soil associations in NRW are lead by volunteers not professionals. Having the personnel resources in such cases is even more unlikely (I35). Additionally, integration does not only depend on the personnel resources of the integrating actor but also of the actor to be integrated. Actors might be invited but do not show up due to low personnel capacities (I18). This barrier for integration is also described in the IWRM literature [7,8].

Personnel resources are strongly related to the perceived *effort* of integration and the perceived outcomes. Participation processes take a lot of time (I42). The effort of planning with round tables stands in no relation to the outcome (I37). Most measures are far away where nobody is interested (I34) or there is no benefit from public participation, we talk to affected people directly, they know us (I17).

Besides the fact that actors need to participate in an integrative procedure the perceived *willingness to compromise* plays a role on both sides. This factor can also be found in Waylen et al., it is described that collaboration needs patience and skill and takes compromise [8]. BR Arnsberg described other integrating processes as cultivating enemy images and the trouble-shooter needs to cope with personal offences (I42). Hamm avoids funding approvals by using compensation money in cooperation with the nature conservation authority in order to avoid the influence of the upper water authority which is perceived as not being willing enough to compromise (I37). Therefore, here one actor is involved more to involve another actor less.

Another factor which may reduce integration attempts seems to be *independence* in terms of decision-making (not in an ecological sense). Measures are kept (small) within the own discretion range (I30, I27, I31). Cooperation for financial reasons is not necessary given the funding structure (I36). The county Coesfeld raised concerns about losing influence on water and soil associations with the change of the water law 2016 due to the fact that these associations became financially independent. Before, the county's water authority and nature conversation authority had influence through the incentive of covering the necessary co-payment and prefinancing of planning costs by compensation money (I41).

Some actors also see the *responsibility for integration* processes with other actors, e.g., the federal state (I48) or see it already fulfilled by processes on the pre-plan stage (I21).

4.4. Integrated Water Management through WFD?

The WFD prescribes, in order to achieve its high ecological goals, process requirements which encompass ideas pertaining to IWRM. However, do the analyzed integration attempts match with the ideas of IWRM? It was shown above that single processes variously address vertical integration, but rarely follow a (sub)basin approach and that they realize to various degrees sector integration, especially with flood protection and nature conservation, and fewer times include (simple) public participation. In order to fully answer this question, it needs to be noted that two of the above chosen IWRM definitions tend to focus on a system's overall status instead of single processes which were analyzed in the previous sections. Whether integration happened is not then a matter of the intention of single processes, but of the result of processes in sum. The WFD itself might be understood as the process or framework promoting coordinated management or unifying/balancing views and goals according to the GWP and Grigg's definition. What is out of the scope of this study is analyzing whether actual views and goals were unified or balanced through the analyzed processes and even less whether any welfare has been maximized locally, regionally or nationally by implementing measures with the given processes. Nevertheless, as these cases of successful WFD measure implementation indicate, actors often managed to circumvent or solve power relations with negative effects on their goal achievement. This limitation is important: It means that a dependency on actors is known

which probably hampers goal achievement and that predominantly those actors tend to be integrated. Critically, actors with less power but probably important interests are not integrated in such processes either because their (actual or future) interests are not known or perceived or are for the sake of a smoother implementation ignored. Considering the factors hampering integration it suggests itself that actors restrict their effort on integration attempts.

Taking the system's perspective again, integration attempts may happen at different levels such as policy, strategy development, pre-planning and detailed planning. Certain levels for certain issues might be more appropriate than others. Concerning WFD implementation there are as shortly described above integration attempts at higher levels in each federal state but found to have merely little effects on local decisions of measure choice. For other issues than hydromorphology and connectivity, another picture might be drawn.

Considering the drivers for integration found here, they are beside several funding instruments not a result of the WFD as a regulation as such. They base on individual backgrounds, pre-existing organizational structures and pre-existing institutions such as plan approval procedures and compensation law and resultant incentives. Therefore, it could be said, that the WFD is not the framework leading to more unification/balancing views and goals at the local level in Germany. Nevertheless, WFD implementation was the occasion for many integration attempts at different levels although integrating effects as an outcome cannot be traced (yet). The WFD put goals on the agenda. These achievements are rarely possible without more integration attempts due to the given power relations. Whereas the original tasks such as maintenance (e.g., draining fields) can be managed often rather independently by the respective actors. This way the WFD as a process is thoroughly the reason for more integrated water resource management in the analyzed federal states.

5. Discussion

The following section discusses the transferability of results, their applicability and their implications for IRWM as a paradigm.

5.1. Result Transferability

The analyzed cases represent policy addressee's experience regarding hydromorphology and connectivity measures in the selected federal states. The comparability of characteristics and drivers for actors in the same category vary in quality and quantity. Whereas, related to this policy only one state enterprise (with the possibility of differently proceeding sub-units) in a federal state exists, there are five government districts in NRW and three in Hesse. The former described rather different communication styles affecting integration processes among the government districts (I40). The number of county-free cities per federal state ranges from three to 22 and the number of communities from 396 to 664. Based on the in-depth analysis of the chosen cases, it can be assumed that characteristics vary with the size of the community and whether it has special personnel e.g., for water maintenance or flood protection, one person for all environment-related tasks, an official for a very broad range of tasks or only a volunteering mayor for everything what needs to be done. With decreasing community size, the hampering effects of personnel resources and effort may increase.

The maintenance associations in Saxony-Anhalt are established on the same basis by (one) law and are assumed to be quite homogeneous. Though, the special-law water associations in NRW cannot be expected to be represented by the Lippeverband. Each of them was established on its own law and fulfils diverging tasks. They are traded as examples of more successful WFD implementation in NRW compared to other policy addressees e.g., due to better resources. The Lippeverband interviewee itself was less optimistic.

The other cases were special cases of local solutions, and do not represent a larger set of actors. Differing characteristics, especially the task distribution, may lead to differing power relations and therefore incentives for integration beyond processes which are more or less mandatory through institutionalization.

5.2. Result Applicability

The underlying question of this study is what motivates actors to adopt integration approaches, with the intention to investigate how policy transfer takes place in order to reach a more integrated approach for solving implementation deficits. However, it should not be called policy transfer from the WFD as it was shown that the driving forces for integration here are not a result of WFD prescriptions. Nevertheless, some drivers root in other policies such as nature conservation law.

Watson [25] stated that the question on how IWRM "implementation should be approached strategically (. . .) have been largely overlooked". Which of the drivers found here can be influenced strategically to achieve more integrated approaches?

Drivers relating to the quality of decisions itself and drivers related to personal characteristics very much depend on individual's opinion and experiences. Of course, there might be experiments for creating acceptance and learning. There are already projects with water advisors for convincing policy addressees on implementing any WFD measures (NRW (I33), Thuringia (I45)). However, considering the sheer number of policy addressees and the time and effort needed to convince them one by one seems not to be a promising approach. In the (very) long run there might be institutional change in the direction of more conviction on the necessity of integration due to a generation change. Though, that hampering factors also apply to convinced policy addressees should not be forgotten.

Making integration mandatory might be an alternative. Saxony decreed integrative water shows for idea development, but interviewees reported that other actors such as the fishery authority did not participate in several cases due to similar personnel shortages. If actors show up which are not willing to contribute to the process, can goal-oriented processes be expected? This gives an illustrative glance on the importance of the necessity of two sides for integration, the integrating and the integrated, and both need the willingness and the capacities to make integration successful.

Regulations and organizational structures as institutionalized drivers are numerously mentioned. This induces again the idea of steering integration by mandating integration processes but leaving open who needs to be integrated at least (and who decides on this). Nevertheless, some cases show that discretion may be used to circumvent mandatory processes which are perceived as hampering in goal achievement. Sometimes certain integration processes are circumvented by using integration processes with other actors. It may be discussed what would be the favourable situation and whether the goal achievement regarding water issues would take precedence over integration processes if goals can only be achieved in avoiding integration processes.

The fourth group of incentives found relates to goal realization considerations such as preventing and solving conflicts, financial issues, and acceptance. These drivers might be addressed by increasing advantages of cooperation and lowering barriers for the usage of known incentives. Increasing advantages may be additional financial (see also Watson et al. [16]) or personnel resources through cooperation (short-term or long-term), increased discretion (there might be a trade-off with accountability or democratic issues), technical support or increased planning security and so on and so forth. Important is that any approach needs to take into account the local barriers and needs to go beyond the usual approaches for incentivizing, e.g., a 80% funding for a measure is solely not an incentive to implement this measure for an actor which is not convinced of the importance of this measure, which holds for integration procedures as well if not mandated - contrariwise the 20% gap and the extra workload would be disincentives. Several federal states offer funding schemes for the implementation of WFD measures which are thought as incentives but require a co-payment by policy addressees. Saxony-Anhalt is (by 2019) the only state in the case selection here offering a 100% funding for WFD measure implementation for local policy addressees. However, this example demonstrates that also with 100% funding other incentives are necessary to convince individuals to take action such as the personal opinion in favour of the environment or synergies with the goals of the own organization.

Incentives need to be thought about not only for water managers but also for actors to be integrated, e.g., farmers were described to be more cooperative on land changes through saving notary fees if land

change is conducted by the authority (I34). This example demonstrates that the interests of relevant decision-makers in the field and their drivers need to be understood to conduct successful integration procedures. A precondition for influencing complex water governance systems strategically is a deep analysis of prevailing power relations and interests. This analysis needs to go beyond preconceived opinions: e.g., farmers are not necessarily hinderers by themselves but they also stick in dependencies (e.g., created by EU agricultural policy) and nature conservationists are not necessarily supporters as they follow nature conservation law which has its own rationale for environmental protection which may locally conflict with WFD rationales.

Overall, it is clear that these drivers are not easily to influence, and this points on the question of at which level or levels drivers need to be addressed? Further important questions include:

- 'Do any of the drivers found here need to be jointly present in a case to drive integration?'
- 'Is conviction significantly changing the perception and influence of other integration drivers and should this be considered for a potential strategy?'
- 'How to design more general integration procedures, like given on higher administrative levels, to induce positive effects (positive experiences, not cultivating enemy images) and may those support the adoption of integrated approaches at other levels—integration fostered by integration?'
- 'Is the intensity of restrictions and dependencies or positive synergies relevant for factors playing out as driving forces?'

The findings of Lundin [26], showing the complexity of a policy influences the effectiveness and therefore necessity of inter-agency cooperation, support this observation. The WFD can be considered a highly complex policy, meaning in this sense requiring cooperation for effective implementation, but how much integration is sufficient and which driving forces would be necessary for a strategic approach?

5.3. Implications for IWRM as a Paradigm?

Finally, what are the potential implications of the empirical findings for IWRM itself as a paradigm?

First, integration and who or what needs to be integrated is a matter of *perception*. There is a risk that affected actors are not perceived as significant or important by the decision-maker who might be expected to conduct an integrative planning process (e.g., Taunusstein: the fishery is not affected and would be only involved if affected, and, water advisors do not play a role as we know what we have to do, we are known as a model community (roughly depicted: I31). Some affected actors might not be noticed at all. This coincides with Beveridge and Monsees [13]. Additionally, some sectors may be perceived as being integrated but it is questionable which actor may represent a group of actors. Is it the same for integration if a sector is represented by a department on e.g., agriculture within an organisation, or an individual farmer, a farmer's association or an agricultural authority? For the finding of compromises or the negotiation of specific solutions this may change the whole setting and probably the outcome of the process. However, a precondition for balancing out interests is that it is known that there are other interests. This probably means managing the unknown.

Second, whether the management can be considered being integrated is a matter of defining integration as *a process or a result*. If integrated management is a process the process outcomes do not matter, but probably process characteristics. Do actors only need to come together to sit on a table, do all restrictions need be retrieved or does it need a specific process weighing up all interests? According to what criteria and by whom? All those nuances are present among the analyzed cases. If integrated management yet is a result, the outcomes are probably more relevant than the process characteristics. Do actors in such a case need always need to find win-win-situations, need to find a consensus or at least a consensus about a conflict resolution mechanism to consider it being integrated management? WFD measures with various extents were implemented in all analyzed cases. Some win-win-situations were found (e.g., I47, I54), but others found their solutions in rejecting the aims of another actor (e.g., I49). Overall, integrated management as a result cannot be assessed here. Furthermore, is it more or less integrated if one actor is integrated in order to exclude another actor or a certain integration

process (e.g., I48)? Is it IWRM if aims of the water sector are lowered down to not affect the goals of other actors (e.g., I3)? What is balancing and who, at least, needs to be satisfied by the process or result? In case integration leads to lowering goals, is more integrated management then desirable? Who decides on how much integration is desirable? Cases analyzed here predominantly tend to integrate as much as necessary and do not integrate for integration itself but for their goal achievement. Nevertheless, any kind of coordination or participation is a necessary precondition for elaborating solutions which are not only based on the own perspective.

Third, the preceding remarks suggest that some *levels* are more appropriate than others *for integration* attempts. Biswas [4] and the discussions on how and where to solve WFD implementation deficits led me to think about integration on different levels. Integration may happen via coordination between actors at different stages of policy implementation and at different planning stages and on different scales (locally, regionally, nationally), it may be institutionalized as well within organizational structures (separation or combination of responsibilities within the same unit) or by regulations e.g., approval procedures. Although it needs to be considered that decision-makers always have a certain range of discretion and may circumvent regulations. Here only local integration processes were analyzed, but some conflicts cannot be solved on the local level e.g., those of institutional interplay. In this case, a distinction between conflicts due to contradicting goals and instruments to reach them is worthwhile. Whereas conflicts out of instruments should be solved, it is a matter of perspective whether to integrate already the goals. Grigg [6] stated that "Integrated approaches, of course, will imply deliberately moving away from fragmented approaches" what sounds like overcoming a disadvantage. Biswas [4], though, points on possible negative implications of IWRM such as the "consolidation of institutions, in the name of integration, is likely to produce more centralization, and reduced responsiveness of such institutions to the needs of the different stakeholders". Additionally, embedding certain goals into others, e.g., water into agricultural regulations, probably gives certain goals a higher priority, this might be socially desired, but wouldn't this already go beyond balancing views and goals? In contrast, giving no goal a priority through parallel and equally applying regulations moves conflicts to lower levels, here the water managers. They need to solve political questions of what goals should get priority when win-win-situations are not possible—without having instruments for this yet and being embedded in local power relations. Leaving the priority of goals open means also leaving open to what integration may lead to. From the local self-organization perspective this is a reasonable procedure, but from the state regulation perspective this probably leads to unforeseeable outcomes of which goals are finally reached and which ones not ('participation trap' [12]). Strategically different levels for integration should be considered, but probably at any point, it will leave the management stage (see Lautze et al. [27] for the relation between water governance and IWRM).

Forth, IWRM implies that any other perspectives are integrated into water management. However, the cases illustrate that there is no 'the' water management and that matters for incentives in the given institutional and organizational setting with its power relations. Does it matter for thinking integration whether the specific policy addressee is *integrating other* perspectives *or* whether the policy goal is *integrated by other actors*? For sure it makes a difference for approaching integration strategically. Although from a theoretical perspective every sector may need more or less integrated management, the shared responsibility may lead to a lack of integration as described by Grigg [6] and Waylen et al. [8]. The necessity for integration to reach the WFD goals goes beyond the capacities and power of water management actors. They are able to integrate other's perspectives, but they cannot expect others to integrate their views and goals.

Due to the various uncertainties and open questions regarding the IWRM concept approaching it as a ladder may be useful for analysing empirical instances of IWRM. The steps of the ladder encompass the variety of increasing intensities of integration procedures. At the same time the first steps are preconditions for the following steps on the ladder:

1. knowing that there are actors with different interests
2. knowing differences in interests of actors
3. elaborating solutions for balancing out interests or conflict solutions
4. take solutions into account by integrating sector
5. take solutions into account by integrated sector

6. Conclusions

This paper takes an empirical approach to investigating what motivates to adopt integrated water resources management approaches by comparing local WFD implementation cases with various integration attempts. Cases represent the diversity of policy processes and actors in five German federal states. Integration attempts were found along all phases of measure planning from idea development to approval and construction, but also institutionalized through the organizational structures of policy addressees and regulations. Integration attempts dominated at the idea development stage and in approval procedures. Involved lower water and nature conservation authorities followed by financial authorities, fishery/angling and agriculture were predominantly involved. Vertical integration (mainly with upper or lower authorities) and sector integration (to very different extents) were quite common in contrast to horizontal integration (crossing administrative boundaries) and public participation. In contrast to the numerous integration attempts at the idea development phase drivers are much less related to idea development, but more to goal realization considerations and regulations. Integration is hampered by a lack of personnel capacities, high efforts for integration, the willingness to compromise, independence from other actors and that responsibility for integration is associated with other actors in the system. The WFD was found not to be a driver for integration as a regulative framework but induced an increased number of integration attempts through setting goals which can rarely be achieved without integration. The results are transferable to several entities with similar characteristics. Using the identified drivers strategically to induce integration, however, is difficult. It would need a critical and deep analysis of power relations and incentive structures. The latter might be enhanced to foster integration by integrating actors and also need to be addressed for actors to be integrated. Finally, an integration ladder is proposed to map empirically observable integration attempts in the context of a wider understanding of the concept. This also indicates there are some important preconditions for intensive integration approaches, starting by (1) knowing that there are actors with different interests, to (2) knowing differences in interest of actors, (3) elaborating solutions for balancing out interests or conflict solutions, (4) take solutions into account by the integrating sector and (5) taking solutions into account by the integrated sector.

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Appendix A

The following tables show the actors interviewed and processes observed for the case study analysis for each German federal state. They are numbered for referencing in the text. The time frame for interviews is indicated.

Interviews:

Table A1. Saxony-Anhalt: January 2017, March-June/August 2018.

No.	Actor
I1	Landesverwaltungsamt, department water
I2	City Magdeburg, lower water authority
I3	Unterhaltungsverband Ehle-Ihle a
I4	Unterhaltungsverband Ehle-Ihle b
I5	Landesbetrieb für Hochwasserschutz und Wasserwirtschaft (LHW), hydrology and ecology a
I6	Landesbetrieb für Hochwasserschutz und Wasserwirtschaft (LHW), hydrology and ecology b
I7	Landesbetrieb für Hochwasserschutz und Wasserwirtschaft (LHW), hydrology and ecology c
I8	Wasserstraßen- und Schifffahrtsamt Magdeburg - Burg
I9	BUND Saxony-Anhalt friends of the earth Germany
I10	Ministry for Environment, Agriculture and Energy of the state Saxony-Anhalt, waste water treatment, facilities for handling water-polluting substances, water provision, water protection, water framework directive
I11	NABU Sayony-Anhalt (Nature and Biodiversity Conservation Union) + County Börde lower nature conservation authority

Table A2. Saxony: January/April/May 2017, December 2018, January 2019.

No.	Organization
I12	City Dresden, environment
I13	Landesdirektion Sachsen—Dresden a
I14	Landesdirektion Sachsen—Dresden b
I15	Wasser- und Schifffahrtsverwaltung des Bundes, WSA Dresden
I16	City Dresden, lower water authority
I17	Community Dresden, water and soil maintenance
I18	Landestalsperrenverwaltung, EU directives, nature conservation
I19	Sächsisches Landesamt für Umwelt, Landwirtschaft und Geologie (technical authority), surface waters, water farmework directive

Table A3. Hesse: September, November 2018.

No.	Organization
I20	Hessisches Landesamt für Naturschutz, Umwelt und Geologie (HLNUG), water ecology
I21	Regierungspräsidium Darmstadt placed in Wiesbaden, surface waters
I22	Hesse Ministry for environment, climate protection, agriculture and consumer protection, surface water protection/water ecology
I23	Hesse Ministry for environment, climate protection, agriculture and consumer protection, questions of principle, state-crossing and international cooperation, coordination of water framework directive, public relations a
I24	Hesse Ministry for environment, climate protection, agriculture and consumer protection, questions of principle, state-crossing and international cooperation, coordination of water framework directive, public relations b
I25	City Wiesbaden, protection and management of waters, water maintennace/lower water authority for non-WFD issues
I26	Rheingau-Taunus-County, lower water authority
I27	Main-Taunus-County, lower water authority
I28	Gemeinnützige Fortbildungsgesellschaft für Wasserwirtschaft und Landschaftsentwicklung GmbH (organizes water neighborhoods for the exchange of experiences)
I29	NABU Hesse (Nature and Biodiversity Conservation Union)
I30	Abwasserverband Main-Taunus, water maintenance
I31	City Taunusstein, city development, technical environmental protection, nature conservation, water protection

Table A4. NRW: October–December 2018, February 2019.

No.	Organization
I32	Water network NRW (by nature conservation associations)
I33	Bezirksregierung Arnsberg, water management including facility related environmental protection, water advisor
I34	County Soest, water maintenance
I35	Kommunalagentur NRW (community agency), water advisor
I36	Lippeverband, river area development, central department EU directives, nature conservation
I37	City Hamm, lower water authority
I38	agw—Arbeitsgemeinschaft der Wasserwirtschaftsverbände in Nordrhein-Westfalen (umbrella organization of special water law associations)
I39	Ministry for environment, agriculture, nature and consumer protection of the state North Rhine-Westphalia, river area management, water ecology, flood protection
I40	Bezirksregierung Arnsberg, funding approvals, conceptual work
I41	County Coesfeld lower water authority
I42	Bezirksregierung Arnsberg–building authority, water maintenance

Table A5. Thuringia: January–March 2019.

No.	Organization
I43	City Erfurt, lower water authority, surface waters
I44	Thüringer Landesamt für Umwelt, Bergbau und Naturschutz, river area management
I45	Thüringer Aufbaubank, agricultural advancement, infrastructure, environment, regional water advisor
I46	City Erfurt, garden and graveyard authority, water maintenance
I47	City Blankenhain, building authority
I48	Landschaftspflegeverband "Thüringer Grabfeld" e.V., landscape development, water maintenance
I49	Thüringer Landgesellschaft, water construction
I50	NATURA2000-Station
I51	City Gera, lower water authority, water maintenance
I52	Flussbüro Erfurt (engineering office), representative of nature conservation associations in the Thuringian water advisory council
I53	Thuringian Ministry for environment, energy and nature conservation, water protection, flood protection
I54	GUV "Harzvorland", water maintenance

Table A6. Participatory observation.

No.	Time	Process
Saxony-Anhalt		
O1	June 2018	2nd project accompanying working group for the water development concept of the river Aller
O2	October 2018	Water advisory council
Saxony		
O3	April 2017	Regional working group for the river Elbe
Hesse		
O4	September 2018	Water advisory council
O5	November 2018	Water forum
NRW		
O6	September 2018	WFD symposium
O7	December 2018	Information of policy addressees with maintenance and construction duties on measure overviews to be compiled
Thuringia		
O8	February 2019	Discussion forum for policy addressees to establish water maintenance associations in whole Thuringia by 2020
O9	March 2019	Water workshop to determine measures for the water body 'middle of Unstrut'

Appendix B

Table A7. Involved in integration attempts (own category for a minimum of four entries).

State	Policy Addressee	Financial Authority	Upper Water Authority	Lower Water Authority	Lower Nature Conservation Authority	Nature Conservation	Fishery/Angling	Agriculture	Concerned Community	Others	Sources
Saxony-Anhalt	UHV Ehle-Ihle (alles PAG)	2		2	2		(2) L	1	2		(I3)
Saxony	LTV			2	(2)		(2) A				(I18)
	City Dresden				2		2 A			4	(I16) (I17)
	Community			2						2	(I13)
Thuringia	Thüringer Landgesellschaft			2 3	2 3			2 3 A	2	2 4	(I49)
	City Erfurt	2		2	(2) 3					3 4	(I43)
	City Blankenhain	2 3		3 4 *	3					3	(I47)
	GUV Harzvorland			3 **	3 (2)				1	3 4	(I54)
	LPV Thüringer Grabfeld			3	3		(3) A	1	1 2	3	(I48)
Hesse	City Wiesbaden	X					X As	X P	X		(I25)
	City Taunusstein			2	2						(I31)
	Community in general	2		2	2	2 As	2 P	2 PAs	2	2 4	(I26) (I21)
	Abwasserverband Main-Taunus	2 ***		2 3	(3)				2 3		(I30)
North Rhine-Westphalia	BR Arnsberg		2		2	2 As uA	2 LAs	2 A PAs P	2	2	(I40) (I42)
	Lippeverband								2	2	(I36)
	County Soest		2	2 4	2	2 P	2 L	(4) A		2–4	(I34)
	City Hamm		3	2	2	2 As				2 4	(I37)
	Water and soil associations with County Coesfeld			2	2			1	1		(I41)

Phase of integration attempts: 1 organizational structure; 2 PAG, idea stage, planning start consultation; 3 preliminary reconcilement (restrictions), 4 approval procedure, X incidences for integration but phase unclear; Actor specifications: A (Authority), u (upper), L (Leisure), P (Professional), As (Association), initiator of the process; Regulatory requirements: * by lower water authority on WFD issues, ** by lower nature conservation authority, *** by financial authority on WFD issues.

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How to Enhance the Role of Science in European Union Policy Making and Implementation: The Case of Agricultural Impacts on Drinking Water Quality

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Abstract: Throughout the European Union (EU), high concentrations of nitrates and pesticides are among the major polluting components of drinking water and have potential long-term impacts on the environment and human health. Many research projects co-funded by the European Commission have been carried out, but the results often do not influence policy making and implementation to the extent that is duly justified. This paper assesses several issues and barriers that weaken the role of science in EU policy making and EU policy implementation in the case of agricultural impacts on drinking water quality. It then proposes improvements and solutions to strengthen the role of science in this process. The analysis is conceptual but supported empirically by a desk study, a workshop, and complementary individual interviews, mostly with representatives of organizations working at the EU level. The results indicate that perceived barriers are mostly observed on the national or regional level and are connected with a lack of political will, scarce instruction on the legislation implementation process, and a lack of funding opportunities for science to be included in policy making and further EU policy implementation. In response to that, we suggest translating scientific knowledge on technological, practical or environmental changes and using dissemination techniques for specific audiences and in local languages. Further, the relationship between data, information and decision making needs to change by implementing monitoring in real-time, which will allow for the quick adaptation of strategies. In addition, we suggest project clustering (science, policy, stakeholders, and citizens) to make science and research more connected to current policy challenges and stakeholder needs along with citizen involvement with an aim of establishing sustainable long-term relationships and communication flows.

Keywords: drinking water; agriculture; EU policy; governance; integrated scientific support; water quality; nitrates; pesticides

1. Introduction

Safe drinking water is vital for public welfare and is an essential driver of a healthy economy. Throughout the European Union (EU), nitrates and pesticides are currently among the significant polluters of drinking water. High concentrations of nitrates and pesticides, with a long-term

impact on groundwater quality, have human (drinking water) and environmental (eutrophication of groundwater-dependent ecosystems) health consequences [1,2]. In order to protect drinking water sources, and sometimes for complementary reasons, the EU has developed an extensive set of water-related directives, guidelines, and policies over the last decades. The requirements of the Drinking Water Directive (DWD) set an overall minimum quality for drinking water within the EU. The Water Framework Directive (WFD), the Groundwater Directive (GWD), the Nitrates Directive (ND), and the Directive on the Sustainable Use of Pesticides (DSUP) require member states to protect, among other things, drinking water resources against pollution in order to ensure production of safe drinking water.

One of the key points in discussions among scientists, policy makers and other actors in the last decade has been the need to develop a conceptual framework to strengthen the role of science in relation to water. This is especially important when it comes to policies involving water security as various initiatives and knowledge exchanges must be enabled in order to support EU policy making and the implementation of EU policies on a national level [3]. One of the conclusions from the European Commission (EC) report on scientific evidence for policy making is that decision makers in policy and practice typically can benefit from more use of available research-based knowledge. Yet, researchers should produce more knowledge that is directly or easily usable by various specific audiences and on all levels of practical decision making [4]. It could be argued that the limited role of science in policy making will be overcome when its complexity and heterogeneity is successfully incorporated into policy measures [5]. Moving towards more evidence-based policy making within the EU necessitates better integration and collaboration (co-creation and co-design) at the science/policy interface [6]. Many contextual, structural and cultural factors often inhibit better collaboration, such as a lack of opportunities to work together, inconsistent working methodologies used in the decision-making process, political views of national governments, socioeconomic differences, and a lack of effective communication channels between nations [4]. To adequately address drinking water security, better integration of science and policy is required at all levels of policy making [7]. The literature states that existing practices that attempt to bridge the gap between research and policy making do not provide efficient solutions [8–11]. Therefore, the EU has emphasized the importance of strengthening the dialogue between policy makers and researchers at the EU, national, and regional levels with clear scientific explanations of EU policies. Clear examples of that approach are the European Innovation Partnership (EIP) groups and WFD Common Implementation Strategies guidance documents. These principles are the key to maximizing the impact of scientific evidence in policy development and implementing policy in real life. Concepts such as multi-actor platforms are devised to stimulate improved dialogues between concerned actors including scientists, policy makers, decision makers, and affected stakeholders.

The objective of this study is to analyze and discuss the role of science in EU policy making and implementation processes concerning the agricultural impact on drinking water quality. This concerns, broadly speaking, the WFD, DWD, GWD, ND, and DSUP. Specifically, we want to identify barriers that hinder the science and research sector from having effective dialogue and cooperating in knowledge sharing from policy making to actual EU policies implementation on the member state or regional level. We argue that the science/research sector's role in policy making and implementation is vague and dispersed across different stages of the process. It also has different roles in the process, as an initiator of policy, a follower of policy or political strategies, or a participant in the public discussion. Our societal aim of this analysis is to suggest possible long-term system improvements and to encourage scientists and policymakers to develop new solutions for improving communication flow. The study, while conceptual, is based on empirical data collected by a desk study, a workshop with different stakeholders, and individual interviews with EU-level stakeholders. This paper is prepared under the EU Horizon 2020 project "Farm systems that produce good water quality for drinking water supplies" (FAIRWAY).

2. Materials and Methods

2.1. Desk Study

A desk study was carried out as a basis for the workshop and interviews. The desk study focused on the following topics: (i) agriculture and water in the EU, (ii) evidence-based policy making in the EU, and (iii) implementation of the Water Framework Directive. A nonsystematic review of relevant scientific literature was carried out using scientific databases such as Scopus, Web of Science, Science Direct and Google Scholar. Other information was obtained from websites of the EU and the internet.

2.2. Workshop and Interviews

A workshop on the "Evaluation of the issues and barriers around providing integrated scientific support for EU policy" was held in Brussels, Belgium, on 6 December, 2017. The workshop was led by a FAIRWAY project partner, the University of Ljubljana. The workshop method was based on a World Café workshop type with a duration of 3 h. The primary objective of the workshop was to discuss with representative EU-level actor organizations the role of the science and research sector in EU policy making and EU policies implementation related to drinking water resource protection against diffuse pollution of nitrates and pesticides originating from agriculture.

There were four main questions discussed at the workshop:

Q1. What do you consider the main issues on the EU level related to drinking water resource protection against diffuse pollution of nitrates and pesticides from agriculture in the EU?
Q2. What do you consider the main barriers in solving the issues in the EU policies related to drinking water resource protection against diffuse pollution of nitrates and pesticides from agriculture in the EU?
Q3. In your opinion, how is the relationship between science and policy in the EU policies reflected in EU legislation and its implementation, with particular attention to drinking water resource protection against diffuse pollution of nitrates and pesticides from agriculture?
Q4. In your opinion, how can the system at the EU level be improved, i.e., what are possible solutions to enhance role of integrated scientific support for EU policy and its implementation related to drinking water resource protection against diffuse pollution of nitrates and pesticides from agriculture?

Each question was hosted by a table host, who led the discussions. There was a 15 min round per question. Altogether, 9 participants from EU-level actor organizations and 1 participant representing the H2020 project were divided into two groups (Table 1). At the beginning of each round, the table hosts briefly shared vital insights from the prior conversation, so the new group could link and build on ideas from previous rounds if they wanted to. After 10–13 min, the table hosts started collecting ideas and forming short summaries of opinions of the groups and wrote them on sticky notes, used later in the main discussion. After the break, the main discussion followed in which the table hosts presented the main opinions, which were formed into final statements by all participants.

Invitations to participate in the interview were sent in three rounds to 31 identified individuals representing top EU-level actors (European Commission [EC], European Parliament, councils, associations, federations, companies, and partnerships) with knowledge in the field of drinking water and agriculture. Altogether, the response to our inquiries was five interviews with EC and some other representatives (Table 1). The primary objective of the interviews was to gather opinions of actors unable to attend the workshop.

The interviews were performed via telephone calls with a duration of about 20 min. Interview questions were the same as the workshop questions. We decided to use the same questions to gain a more in-depth insight on the topic of issues and barriers around providing integrated scientific support for EU policy.

Table 1. Representative EU-level actor organizations attending the workshop and interviews.

EU-level Actor Organizations that Participated in the Study	
Workshop	**Interviews**
European Fertilizer Blenders Association (EFBA), Research and Advice in Agriculture and Horticulture (Inagro), European Centre of Employers and Enterprises Providing Public Services and Services of General Interest (CEEP), European Federation of Bottled Water (EFBW), FERTINNOWA H2020 project, European Federation for Water Services (EurEau), Aqua Publica Europea (APE), European Energy Forum (BDEW), European Water Partnership (EWP), European Forum for Agricultural and Rural Advisory Services (EUFRAS)	European Innovation Partnership for Agriculture (EIP AGRI) focus group (adviser), European Commission Directorate-General for Research and Innovation, European Commission Directorate-General for Agriculture and Rural Development, Independent Flemish Research Organization (VITO) WATERPROTECT project leader, Wageningen University and Research (WUR) FAIRWAY project leader

2.3. Limitations and Uncertainties

The main limitations of the workshop and interviews are related to the relatively few EU-level actors that were involved in the study. For the interviews we identified 31 individuals and for the workshop 29 EU-level organizations from 3 sectors. These included 9 from the agricultural sector, 11 from the water sector and 9 EC organizations (Directorate-General (DG), EIP). The response rate of the organizations that joined the workshop was 34%, which was an 18% higher participation rate than was received with the interviews. The difference is likely because we invited organizations to the workshop, not specific individuals, so organizations had a broader spectrum of representatives to choose from. In the case of the interviews, it was challenging to get in touch with the invited representatives, as they did not respond to e-mails or phone calls, not even after three attempts. Because answers to specific questions were collected from specific individuals representing science and policy, and due to the limited sample size, it is possible that the answers reported by workshop and interview participants reveal a limited representation of the average opinion of EU-level actors.

3. Results and Discussion

3.1. Desk Study

3.1.1. Agriculture and Water Quality in the EU

Agriculture accounts for almost half of the total EU land area and is a primary source of diffuse pollution of nutrients and pesticides significantly affecting most of the EU river basins [12,13]. Rapid changes in farming systems in the post-war decades allowed an increase in agricultural productivity and caused considerable impacts (physical and chemical) on freshwater resources [1,13–15]. The focus on groundwater mainly concerns its use as drinking water as about 75% of EU inhabitants depend on groundwater for their water supply [16].

The WFD requires that primary directives and other policies tackling point sources and diffuse pollution at the source are first implemented fully (i.e., ND, GWD, DSUP, Urban Waste Water Treatment Directive, Industrial Emissions Directive) before complementary policies and additional measures are used [17,18]. Data show that within 63% of the river basin districts reported, implementation of the ND is not enough to tackle diffuse pollution at the level needed to secure WFD objectives [19]. Implementation of the ND in 1991 decreased nutrient surpluses and improved groundwater quality by 16% by 2008 [20]. However, according to communication from the Commission to the European Parliament and the Council, diffuse pollution of nitrate significantly affects 90% of river basin districts, 50% of surface water bodies and 33% of groundwater bodies across the EU [18,19,21]. The nitrate target of 50 mg/L is still exceeded in areas of shallow and sandy groundwater and intensive agriculture [22].

Despite substantial progress in reducing the consumption of mineral fertilizer, there are other important sources of fertilizers such as manure and other organic sources that must also be reduced.

There are still many gaps in the basic measures that have been put in place by member states to address agricultural pressures, including a lack of measures to control phosphate and nitrate emissions outside nitrate vulnerable zones established under the ND [19] and within and outside of the drinking water protection areas. Additional loopholes are that member states have the opportunity to apply for derogation within ND (e.g., a manure application rate that contains more than 170 kg nitrogen (N) per ha under certain conditions) or in the interpretation of the nitrogen application limit (e.g., adding gaseous losses of nitrogen on top of the general limit) [23]. These gaps leave us with the belief that, due to political reasons, individual member states or regions are avoiding or postponing actions that would lead to solving the water quality problem. On the other hand, while national or EU funding can enhance the role of science and research projects in relation to policy, they rarely contribute to actual capacity building in the legislative sector and have limited influence on problem-solving or key stakeholders. In addition to strong professional organizations inhibiting structural changes in local areas, legislators rarely provide additional money to implement measures from River Basin Management Plans (RBMPs) as they rely on money from agricultural funds to tackle pollution from agricultural sources [12,14,16,22].

Supplementary measures reported in agriculture are mainly voluntary, including advice schemes and agri-environmental measures of the Common Agriculture Policy (CAP), such as farm extensification and organic agriculture. Research and restoration efforts have been developed to recover ecosystem functions and services [19]. Several EU member states have recognized that losses of N from agriculture have been reduced significantly, especially in nitrate vulnerable zones, but further reductions are required to comply with the EU WFD [22,24–27]. As a further general reduction in nutrients may affect farm economics, a paradigm change is therefore proposed by Danish scientists, who propose severe restrictions on the application of fertilizers on land vulnerable to leaching of nitrates to the aquatic environment and a potential easing of restrictions in other areas [15,26]. A lesson learned in Denmark is that general policies can be usefully applied to control a widespread excessive application of N, but once this has been achieved, if further reductions are necessary, a switch to higher precision farming with targeted measures is required [26]. Introducing agri-environmental climate measures (AECMs) to policy can be fraught with difficulty in the form of delays and legal proceedings when the legal and regulatory complexity of adopting such measures at the national level to achieve site-specific environmental objectives is underestimated in a top-down political process [1].

On the other hand, there is growing acceptance among farmers of the environmental benefits of such policies. However, skepticism remains around the validity of specific measures, especially if their impacts are not supported by scientific evidence [28]. Science and policy should cooperate in checking the efficiency of AECMs with delivery, impact metrics, and appropriate standards for identifying trajectories associated with diffuse pollution transfer and ensuring that agri-environmental policies are given a fair and thorough evaluation and modified in the next Common Agricultural Policy cycle, 2021–2027 [24].

The EC Staff Working Document on the water–agriculture nexus [12] acknowledges the delicate balance between agriculture and water-related objectives defined in different directives (WFD, ND, DSUP, DWD) or Common Agricultural Policy (CAP) programs. The Working Document ascertains that less progress has been made than expected with respect to water quality improvements, and it shows political correctness when the EC offers to help member states to overcome this problem and support them in their quest to implement efficient measures. The approach focuses on (1) optimizing the effectiveness of the EU water and agriculture policies, (2) reviewing possibilities for supporting investments and (3) supporting knowledge and innovation transfer. Of course, more than just politically correct words are needed. The identification and implementation of efficient measures that are optimal for specific river basin spatial, climate and socioeconomic conditions is closely related to the active role of science in policy making and policies implementation [29].

An essential factor for successful implementation of voluntary agri-environmental measures for water quality improvement are the behavioral issues related to farmers' willingness to adopt science-based methods under the absence of strict regulatory control or without economically fair compensation. This fact indicates that a comprehensive understanding of the influences and extension tools that support farmers' management decisions is necessary, which can only be provided by the science and research sector [30].

Farmers' management decisions involve a compilation of unique factors including attitudes, motivations, socioeconomic circumstances, agricultural production contexts, policies and support, beliefs, pride, desire and goals, and not all of them have a rational or universal argument [31,32]. Farmers' long-term commitment to conservation measures is the result of evolution over time in which their values are "constantly modified and negotiated by social interactions" [32]. Farmers are keen to weigh the feasibility, effectiveness, profitability, and advantages of recommended management practices. Policies should remain grounded in subsidy payments, as environmental beliefs motivate only a minority of farmers [32]. However, sufficient support in terms of technical knowledge provided by agricultural extension services in the form of information sharing networks among farmers, participatory group learning, or personal communication is critical, as it increases the likelihood of conservation measures being adopted [30,31,33]. To better estimate the level and rate of adoption among farmer populations with a diverse range of practices, an adoption and diffusion outcome prediction tool was developed [34] that is able to define relative advantages of a practice, people's perceptions, ease and speed of learning about the practice, and potential adopters [34].

The authors above showed that barriers to enhancing the role of science in policy making and implementation already exist at the member state/region level or even at the individual farmer level. The majority of barriers are connected to political decisions or, better, indecisions made in revealing the ambivalent nature of daily politics in serving public needs and when taking into account sectoral socioeconomic conditions [35]. Often, science-based methods require changes in legislative documents that policy is not willing to open and update due to possible public debate and confrontations or because they require allocation of funds from other sectors [35]. This fact narrows our research question as one would ask which level of agricultural policy (EU, national, regional, local or farm level) is the most appropriate for science to enter the process in order to enhance its role and to have an actual impact on agricultural management and the improvement of drinking water quality. The literature shows that the presence of science is required at all levels with a particular emphasis on farmers, as they are the key stakeholders.

3.1.2. Evidence-Based Policy Making in the EU

Evidence-based policy is a concept that was developed in the 1970s, which received renewed strength in the late 1990s [36]. These kinds of policies can be described as science-based programs for action that guide decision making in service to the practical achievement of clearly designated outcomes [37]. Evidence-informed decision-making processes, relying on the transparent use of sound evidence and appropriate consultation, are seen as contributing to balanced policies and legitimate governance. However, the processing of expert knowledge is problematic and highly variable across policy making organizations. The potential for a close linkage between "good information" and "good policy making" is routinely undermined by two essential mechanisms—political and organizational—concerning the legitimacy of policy making processes as well as public trust in decision makers [36]. This fact leads to four approaches that describe the role of science in relation to policy: (1) knowledge shaping policy, (2) politics shaping knowledge, (3) co-production, and (4) autonomous spheres [38].

The Lisbon Strategy, adopted by the EU member states in 2000, moved the role of science into a central position for the development of a European knowledge-based economy and society and increased the involvement of scientists in science policy making (co-production) [39]. After that, European science organizations and eminent scientists initiated a common movement that led to the

creation of the European Research Council (ERC) to support basic research of the highest quality. The ERC is supported by different financial instruments such as the European Union's Research and Innovation funding program (e.g., Horizon 2020).

In 2007, the European Commission identified the connectivity of the research area with research policy and society in Europe as an important EU challenge [40]. In 2008, the EC Directorate General for Research and Innovation (DG RTD) issued a report with specific recommendations: (1) DG RTD has a pivotal role to play in ensuring that project results are disseminated across the European Commission and should ensure that supported project groups fully understand the importance of producing communication material that is useful, accessible and meaningful to policy makers; and, (2) project coordinators should be encouraged to put the usefulness of their scientific research findings in regards to policy at the forefront of their objectives and actively include partners from the world of policy making (EC) to ensure that the scope of the research responds to defined policy making priority areas [4].

After decades of intensive discussion on this topic, it was demonstrated that decision makers' behavior in the processing of information varies across policy areas. Differences in vocabulary, a lack of understanding of the counterpart's mode of operation, and a lack of interaction between decision makers and researchers may result in information that does not meet the needs of society (forming "relevance gaps") and is thus less useful, although scientifically valid and reliable [7,36,41–43]. Slow responses in funding or disinterest among policy makers in implementing new scientific developments in practice may paralyze scientific endeavors and slow down water quality improvements [44]. The practice of bringing research findings into the policy and practice arenas by publishing in peer-reviewed journals is deeply embedded within the system of science and its incentive structures.

Though often relevant for practitioners, professional scientific findings are rarely presented in a language or form that can be easily used and applied by decision makers, who primarily use governmental and internal institutional information sources [7,35,45], or by farmers, who rely on governmental institutions, extension services or the media. In the media, especially social media, skepticism is often present in regards to scientific results. They are presented as conspiracy theories regardless of whether they confirm or reject common public beliefs initiated by politics, which subsequently has an influence on groups and individuals. Policy makers need to be open-minded, have a broad view of the world and society, and take scientific results seriously, as they canvas are the ones with the tools to design solutions for economic, environmental, social and cultural problems [45,46]. A study by Radin [35] showed that scientists often have to defend their work as their methodologies or results are misinterpreted by policy makers, politicians or influencing groups. To avoid an ambivalent attitude by society, scientists argue that their work needs professional control and deserves deference [35]. The above studies show the complexity of science's role in the process of policy making and its actual implementation, which can work only if all parties involved in the process are willing to work together [46] and take advantage of knowledge sharing through the exchange of new knowledge and skills [47].

The European Union made a substantial investment in research and innovation in the past decades through its Framework Programmes for Research and Technological Development, including the current program, Horizon 2020 (2014–2020), and its subsequent program, Horizon Europe (2021–2027), in order to respond to and provide substantial scientific evidence for the numerous policies at the union level [48]. At the same time, EC DGs opened calls for tenders (service contracts) with a particular focus on underpinning policy implementation, monitoring, and evaluation. Service contracts are (a) relevant, as they address policy makers' key questions (very specific); (b) credible, as they are scientifically sound and authoritative (at least good enough); (c) legitimate, as they are developed through processes that can be trusted (competent consortium); and (d) timely, as they deliver reports on time to inform the decision-making process (timeliness is a key advantage compared to research and innovation action (RIA) projects). Improvements are observed as exploitation and dissemination

activities are under contractual grant agreement obligation for researchers participating in EU projects and are evident in service contracts [48].

Science–policy dialogues in EU projects or service contracts have many forms [9,48,49]: (1) Policy makers are invited to meetings (e.g., EIP focus groups); (2) conferences or events are organized by projects or the EC; (3) project participants are members of EU or national scientific advisory committees; (4) ministries or other national regulatory bodies or policy makers are directly involved as beneficiaries in projects; (5) projects seek input from regulatory stakeholders through surveys and inform them regularly through policy briefs; (6) representatives from policy making bodies participate in (scientific) advisory boards of projects; (7) projects involve professional scientific societies, stakeholder associations or civil society organizations; (8) the EC assists projects to ensure and facilitate the uptake of scientific results into policies by providing responses to members of the European Parliament, who often enquire about outcomes of projects; and (9) open access publications and data are available so that stakeholders, including policy makers, can get the maximum benefit from EU-funded projects and scientific research.

The organizational structure of scientific support of the EC consists of several levels. The highest is the Directorate General (DG), of which there are 31 in operation. The DGs are closely connected with the Joint Research Centre and its ten science work areas. Aimed at bringing together all relevant actors at the EU, national and regional levels, the European Innovation Partnership (EIP) works with five challenge-driven partnerships formed under the EU Horizon 2020 Innovation. The partnerships are supported by steering groups that create different task forces and work platforms. For our study, the most critical DGs are Agriculture, Environment, and Research and Innovation. The importance of the commission's DGs in regard to the redistribution of money to specific scientific fields is shown in the numerous interest groups (nongovernmental organizations (NGOs), private and public companies, multinational corporations), including the other EU bodies and the member-state governments, that are all lobbying the commission for their desired outcomes [50].

Since the establishment of the EC, there have been 180 European research projects with the word "water" in the name and 75 with the term "agri" under different funding systems (Framework funding, Horizon 2020, European Research Centre, etc.) [51]. Moreover, intergovernmental joint programming initiatives are formed to tackle major societal challenges unable to be addressed by individual countries. These are contributions to the development of the European Research Area. In 2010, the joint programming initiative (JPI) "Water challenges for a changing world" was formed. It is tackling the challenge of achieving sustainable water systems for a sustainable economy in Europe and abroad [52]. Knowledge and innovation communities bring together higher education, research, business, and entrepreneurship in order to produce practical innovations and innovation models that can inspire others to follow. They are created by the European Institute of Innovation and Technology (EIT), founded in 2008 [52].

In order to protect the quality of drinking water, the European Union, along with its scientific support services, has developed and published an extensive set of directives, policies, guidelines, research projects, websites, and literature. The EC is monitoring the implementation of EU legislation in the member states through reporting and monitoring. Based on their internal monitoring, the member states submit information and data to the EC. After these national reports are analyzed, the findings are presented in various ways (implementation reports, indicators and scoreboards, other publications). The European Commission often works in collaboration with Eurostat, the Joint Research Centre or other agencies, depending on the legislation concerned. Environmental monitoring usually leads to data collection and reporting (Figure 1).

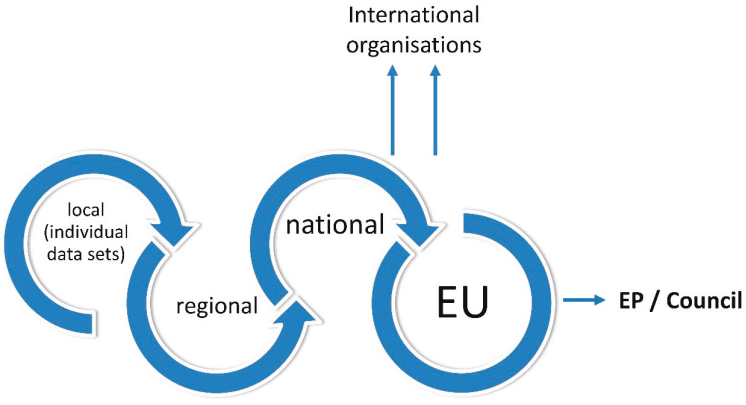

Figure 1. A data flow process for the implementation of environmental legislation in the EU. Adapted by [53].

One would think that science has many opportunities to enhance its role in transferring scientific results to the policy making and policy implementation process, with the goal of reducing the agricultural impact on drinking water quality. However, a report of the European Parliament (EP) and the European University Institute on evidence and analysis in EU policy making concluded that institutional systems have an inbuilt tendency to resist change [8,35,45]. One of the key problems of evidence-based policy making is bureaucratic inertia, which limits the potential to accept new developments and ideas [8,54]. Public administrators leading the policy making process can also influence outcomes by choosing among different theories or methods and by their attention to marginal or incremental facts and values [54,55]. Therefore, the enlightened determination of which facts are important and should be directed to the attention of analysts is required in order for policy makers to make relevant choices that broaden the range of policy options [56]. Studies show that government decision makers tend to use science and research project results somewhat more indirectly, as a source of ideas, information, and orientation [54,56]. Science has a chance to enhance its role and turn the odds of influencing the policy process in their favor by employing three overarching strategies consistently over time: developing in-depth knowledge, building networks, and engaging in active participation for an extended period [57].

The literature gives many examples of how water resource management is inherently political. It defends the dominant stance of water professionals in that "politics" should be removed, as politics compromises the accountability, transparency, and legitimacy of decisions made [35,58–60]. However, WFD brought new challenges to politics at jurisdictional scales of operation in the form of hydrological scales prescribed for water management planning. It was observed that relevant stakeholders are increasingly working across scales to advance their interests in different ways; they are redefining and reconstituting the function and significance of scales and creating new scalar hybrids at the interface between hydrological and jurisdictional domains [61]. The extent to which specific measures can be implemented (uptake, blockade) is dependent on complex politics and powerful coalitions across multilevel governance systems and scales of interest (NGOs, businesses, corporations) with an emphasis on higher governance levels [62]. The politics that mediate the use of environmental science assessments as the basis of resource management policy have an opportunity to identify the subjective ways in which scientific assessments could be interpreted so that they can be used by state water resource agencies to underpin water allocation decisions that follow their interests [59].

Scientists, as experts for certain measures, may take a role in supporting or blocking coalitions, but their evaluations of water system sustainability and security are likely to be met with competing claims based on different values and expertise [62]. The importance of the public's or voters' opinions

of politicians should not be undermined, as we can observe a daily battle for the truth to prevail between environmental and industrial groups [60] and between rigid ideologies generating contentious opinion exchanges and lenient liberal ideologies encouraging long-term solutions [35]. A recent study suggested that the tendency of political leaders to address environmental problems is primarily influenced by their aspiration to confirm an individual political status or conform to group norms. Younger politicians show a greater tendency to address environmental problems [63]. The role of science in relation to politics is inevitably subordinate as the political logic of the cost-benefit economic analysis approach usually prevails over the logic of science-based rules of reasoning [35]. This further narrows the research question, as one could ask whether it is necessary for science to enter the political decision-making process directly at the top of the system, where research work would have a significant impact, but could also be misused to achieve political goals.

3.1.3. EU WFD: Where Water Policy and Water Science Meet

The WFD is probably the most essential water-related EU directive concerning the demand for knowledge support. This has been demonstrated in its attempt to work towards a tangible water policy and research objective for achieving good water status in an integrated and sustainable manner by 2015 [10,17,64]. The knowledge support is facilitated by a participatory River Basin Management Plan (RBMP) system and implemented through water quality and ecosystem assessments, extensive monitoring, and inter- or multidisciplinary participatory and pragmatic research [65,66]. The WFD represents a shift in approach from the traditional unilateral focus on sources of pollution and disturbance to a new combined approach. It also requires the collaborative production of new scientific knowledge that is effectively adopted and communicated between policy makers, policy implementers, and the research base informing policy work [66,67].

Within the WFD Common Implementation Strategy (CIS), operational since 2001, nonbinding guidance documents on sharing good practices have been recognized for presenting and communicating results of research and demonstration projects in a readily usable form to policy makers at regional and national levels to show how to integrate the latest research developments into legislation [3,65]. The WFD has been a significant force in raising awareness of the need to restore Europe's rivers, but its application during the first management cycle was limited [68,69]. The deadline for all rivers to be in a good ecological state passed due to a lack of effective policies and an inappropriate timescale for the resilience of water systems, especially groundwater systems [14,17]. To tackle this problem, the WFD now requires member states to design and implement cost-effective programs or measures to achieve the "good status" objective by 2027 at the latest [14,21].

At the same time, policy- and decision-making arenas will require the willingness and confidence of the water sector to engage with actors from other sectors. This is essential in making progress on water challenges [9] and for positioning the role of science as an equal partner in policy making and implementation [3,7,70]. A lack of science integration at the national/regional and river basin level can be seen in the results of recent studies that finished after the first cycle in 2015 [9,17,68,71,72]. This is at least partly due to a lack of appropriate communication about the relevant research results that would be of use to policy-relevant strategies [7,70,73]. Research or policy communities themselves encompass multiple smaller expertise areas or subsectors (e.g., surface water, groundwater, irrigation, energy, drinking water, wastewater, transport, environment protection, land use planning, tourism) grouped around separate disciplines with their own practices and language, which hampers integration and weakens communication [64,74]. This indicates a multiplicity of challenges related to spatial scales and the multiple levels of governance that are central to water resource management [75]. The WFD, a complex directive, is subject to many uncertainties related to implementing institutions in member states. Surprisingly, it has been argued that they are not systematically addressed in the directive or CIS guidance document. It is further argued that interest groups and the general public participating in RBMP implementation can manage and reduce uncertainties [76,77] if authorities group participants by scope, communicate with the public, work on capacity building, define timeliness, finance participation,

and institutionalize stakeholder participation by creating organizational cultures that can facilitate processes [77,78]. Directives, legislation, and management programs are often implemented cyclically (e.g., RBMP on a six-year cycle, ND on a four-year cycle) and regularly reviewed, which provides windows of opportunity for participating actors to draw together new evidence and approaches for measure implementation [17,79].

The Science-Policy Interface (SPI) for water activity was launched in 2010, led by DG RTD and the French national agency for water and aquatic ecosystems (ONEMA). It provides an interactive forum to ensure a cooperative interface between water researchers and policy makers, managers and stakeholders at both the EU and national level [3,7,69,80,81]. Strategic use of the SPI, with specific policy milestones and effective mechanisms, should facilitate the development of innovative solutions to achieve policy goals and to create the conditions necessary for transformative change towards an exchange platform enabling both scientists and policy makers to discuss similar research and policy agendas [3,71]. SPI activities (e.g., Water Information System for Europe, WISE) also demonstrate that although networks/lobbying organizations (IAH, EGS, IGRAC, EUREAU, Eurometaux, EEB, etc.) already exist, they need stronger, even permanent, involvement [80].

The studied literature shows that the complex and dynamic nature of water governance in the EU requires flexible and reactive water policy networks that include network openness, business-like behavior, less domination by professional engineering groups, and diversity of knowledge and values [75,77,82]. One could ask if science is still needed in the process of setting RBMPs and whether public participants with knowledge of local conditions and biased groups with wide ranges of partial interest can be good substitutes to replace scientists. The literature confirms that the role of scientific knowledge should be emphasized in the process to better understand complex and dynamic hydrological, agronomic, natural and socioeconomic systems and processes as well as to evaluate the soundness of potential solutions to water quality problems [77].

3.2. Results of the Workshop and Interviews

3.2.1. Main Issues (Q1)

The participants were asked about the main issues on the EU level related to drinking water resource protection against diffuse pollution of nitrates and pesticides from agriculture in the EU. The following issues were highlighted by the participants in the workshop (Figure 2):

- Lack of knowledge about agricultural impacts on water quality.
- Harmonization of legislation needed at the EU level, with water protection currently a very local issue.
- Lack of coherence between policies.
- Synergies and trade-offs between goals and pathways of pollution.
- Lack of balance between targets and objectives of EU policies.
- A time lag between taking measures and changes in water quality.
- Fragmented and not easily available data.
- Financial questions about available budgets and allocation of the costs.

Interviewees highlighted two main issues related to drinking water resource protection in the EU: (i) There is a general lack of knowledge about the relationship between agriculture and water quality, which calls for a stronger contribution from science, and (ii) drinking water protection is a local issue with local characteristics. They also indicated that a lack of communication between water authorities, people responsible for RBMPs, the farming community, and agricultural departments is an issue. All agreed that more bottom-up, inclusive processes should be stimulated in the field of water resource protection.

One of the issues concerning nitrates is that the ND does not specify an objective by which specific results have to be achieved, unlike the WFD. There are widely differing interpretations of what

role the ND should play in the WFD in addressing nitrate pollution issues. Participants identified significant variations in how member states have addressed this issue. The predominant approach so far has been that member states take a minimum approach to implementation of the ND (only measures that are mandatory for farmers) and that they include voluntary measures as part of WFD implementation, often funded through the Rural Development Program (RDP). Another issue related to nitrate pollution is the cost of investments needed for compliance. For example, for small farmers, it can be difficult to comply with manure storage requirements. Also, as the storage norms have already been enforced for some time now, EU funds can no longer support investments for compliance.

The issue of nitrate pollution from overstocking was mentioned in the workshop, such as in regions in Germany, Flanders, the Netherlands, Brittany, and Catalonia. A significant part of the nitrate pollution comes from farms that do not have land and do not fall under the CAP. In these regions and in regions with intensively managed cropping systems, such as vegetables in Andalucía and the Netherlands, there is frequently an overuse of manure and mineral fertilizers leading to nitrate leaching into groundwater and surface water. Very few member states have set out a comprehensive approach to reducing nitrate leaching in order to meet the target goals of the WFD.

Figure 2. Key points for Questions 1, 2, 3 and 4 on the role of science in EU policy making and implementation related to drinking water resource protection against diffuse pollution of nitrates and pesticides from agriculture in the EU.

The main issue of pesticides on the EU level is the implementation of the sustainable use of pesticides directive (SUPD). Participants indicated that implementation of the SUPD had been delayed in member states; and, reports on the implementation have been delayed for two years. This report should address issues of pesticides in all areas, not just drinking water. There is a definite increase in pesticide use, so the adoption of integrated pest management across Europe is urgent. Participants stated that the main reason for the delay of the report is political and the report is no longer on the priority list of the European Commission.

The participants of the workshop agreed that there is already much legislation on the protection of drinking water and there is no need to change legislation. It just needs to be implemented well by member states. It was also indicated that the EU level of implementation of legislation is political, and not a science issue. The process of water resource protection is mainly limited by politicians who do not want to impose costs on farmers unduly.

3.2.2. Main barriers (Q2)

Sociocultural factors or differences between member state countries and regions in Europe were mentioned as primary barriers to successful implementation of EU water policies. Problems with translation and transposition of EU policies on the local level were also highlighted. The topic of a lack of funding for implementing measures was omnipresent. The main barriers are the following (Figure 2):

- Lack of political will to impose costs on farmers, and limited financial means needed to apply specific measures.
- Lack of awareness of the required actions by farmers to achieve water quality targets and a need for capacity in advisory services.
- Lack of communication or synchronization of languages between scientists and policy makers
- Site-specific aspects in taking effective measures, e.g., differences between member states and regions.
- A time lag between taking measures and subsequent changes in water quality.
- Not enough farmers involved.

There were three main barriers mentioned by the interviewees. First, the political priority is important. There is a lack of political will to impose policies and costs on farmers. It is also costly to provide good advisory services and control bodies to check what is happening or should be happening on farms. The second barrier was a need for capacity in advisory services on the implementation of measures and in regulatory bodies on monitoring measures and water quality. There should be a willingness to address these issues. More is needed besides guidelines, i.e., engagement and (auto) control of local actors. The third highlighted barrier is the lack of communication or synchronization between different instruments. The Common Agriculture Policy planning cycle is different from the WFD planning cycle. It happens that when a national RDP as part of CAP is prepared, River Basin Management Plans as part of WFD are not yet approved, etc.

Participants also highlighted that diffuse pollution is much more difficult to manage than point source pollution because it is complicated to control thousands of farmers who take individual actions. Sometimes, the lack of knowledge on good agricultural and environmental conditions in relation to cross-compliance of farming practices and EU policies as well as economic reasons is a significant barrier too. A farmer's knowledge on the objectives of EU policies, such as the need to decrease nitrate leaching to improve drinking water quality, often varies between member states and depends on the farmer's age and level of attained education. In addition, manure and fertilizers are often cheap, and from a strictly economic perspective, farmers tend to apply more than sufficient amounts of nitrogen to avoid the risk of low yields in years of optimal conditions. In regions with intensive livestock, manure is often seen as waste and is applied to soils only in the proximity of the livestock farm, because transporting to other regions is too expensive. In the Netherlands, the excess manure of livestock

farms (mainly pig farms) has a negative price, meaning that crop farmers receive money for accepting manure from pig farmers. Although manure application is strictly regulated by both nitrogen and phosphorus standards in the Netherlands, the negative manure price (an additional income for crop farmers) does not stimulate innovations to improve the nutrient management and increase the efficient nutrient use of manure.

On the other hand, participants also highlighted good, positive examples in Europe. In Scotland, there is a targeted approach for identifying catchments of higher priority (for drinking water or high-value fisheries). They put most of their resources into these areas, map all of the problems and then go back repeatedly to farmers to give them targeted advice. They also provide economic support to resolve the issues. If the problems are not resolved after the third time, fines are issued. This example stands out as a clear, targeted strategy for delivering results in a given geographic area. However, if this were not a political priority and supported by scientific knowledge, all these efforts would never be made.

3.2.3. How the Relationship between Science and Policy is Reflected in EU Policy (Q3)

First, the topic of public participation seen as part of democracy's impact on science was highlighted in the workshop in relation to the question on how the relationship between science and policy is reflected in EU legislation. Participants of the workshop agreed that public participation could be dangerous because if something is scientifically correct, we cannot discuss it and change it to suit the popular sense (populism, nationalism, corporatism). Participants debated over the fact that scientific work should be done independently because it is a methodological process (while policy or, more precisely, politics is a democratic process). The public could be involved in determining prioritizing issues for investigation and the broader topics that should be included within the scientific process (i.e., effects of sociologic factors). Once the research is finished, information should be presented to the public so that interested parties are made aware of the current status of the topic, and then the information can be used in democratic policy making processes (Figure 2).

Second, some interviewees pointed out that the formal relationship between science and policy in the EU directives is to be defined in the national transposition, but the policy text does not specify how this should be done. This is a decision of the member states. There is a clear link between science and policy in, for example, the ND and the WFD. The nitrate action plan, to be revised every four years, should be based on monitoring and the results achieved from the previous plan. If there is a feedback mechanism, we can understand what a previous plan has accomplished and can design our next set of measures based on that. In addition, the WFD has articles on different classifications and the need for a plan with the programs of measures that will be addressed. There is a link established between understanding the current situation, knowing what has been done before, and knowing what the end goal is, and then taking the most cost-effective measures to achieve it. It is clear that science and research should take a central role in this process.

One of the workshop participants mentioned an example from Ireland, an agricultural catchment program, where scientists tried many different measures in different catchments to address diffuse pollution. The best measures were then transferred to the ND action program policy making process and included in the RDP to be funded. By demonstrating the measures to the farmers, they learn how they work, which helps to get the measures incorporated into national program. Behind the agricultural catchment program in Ireland was the political will to address the issue. The link is established, and there is a good working relationship between the environmental and agricultural authorities, the agricultural advisory services and the scientists. This often does not work in many member states because there is often no agreement between the agricultural and environmental sides on what should be done.

Third, all interviewees and workshop participants pointed out that there should be more opportunities to enhance the role of scientific expertise in policy making. The entry point for the science/research community, funded by the Horizon 2020 program's call for a decision-making

procedure in the EU, is presented in Figure 3. Interviewees from DGs and certain workshop participants who were previously involved in preparing EU legislation stated that the policy cycle is often so fast that there is not enough time to consider the most valuable independent scientific advice, but rather the most available. Moreover, it was expressed that in many EU research projects, dissemination tended to be very formal and bureaucratic, not designed to maximize impact. Some workshop participants perceived that the way the commission uses the results of these projects is unclear. One of the most relevant factors is low resource availability at the European Commission. Where the highest level of technical knowledge and assessment is located within European institutions, there is limited staff available to deal with all EC essential tasks, so less necessary ones like science-to-policy interaction are often not given priority. Some participants think that the CORDIS web platform used by the commission is not always helpful; some stated that it appears that while the EU is funding projects, they are not using the information they provide. An idea was proposed to set up a functional system of disseminating summaries, by topic, to civil servants who could use the information.

Fourth, participants of the workshop pointed out the importance of numerous ongoing and available service contracts for DG Environment, e.g., implementation of the Nitrates Directive. Studies include assessments of nitrate action plans (with measures) of member states and general studies on aspects of nitrate leaching. The commission uses the results of these studies in discussions with member states. This means that it is clear how the role of science supports the implementation of the Nitrates Directive. The commission has similar service contracts for other environmental directives. So, in general, the commission uses scientific information in its policies from specific service contracts. However, it is doubtful whether the member states and farmers use this information.

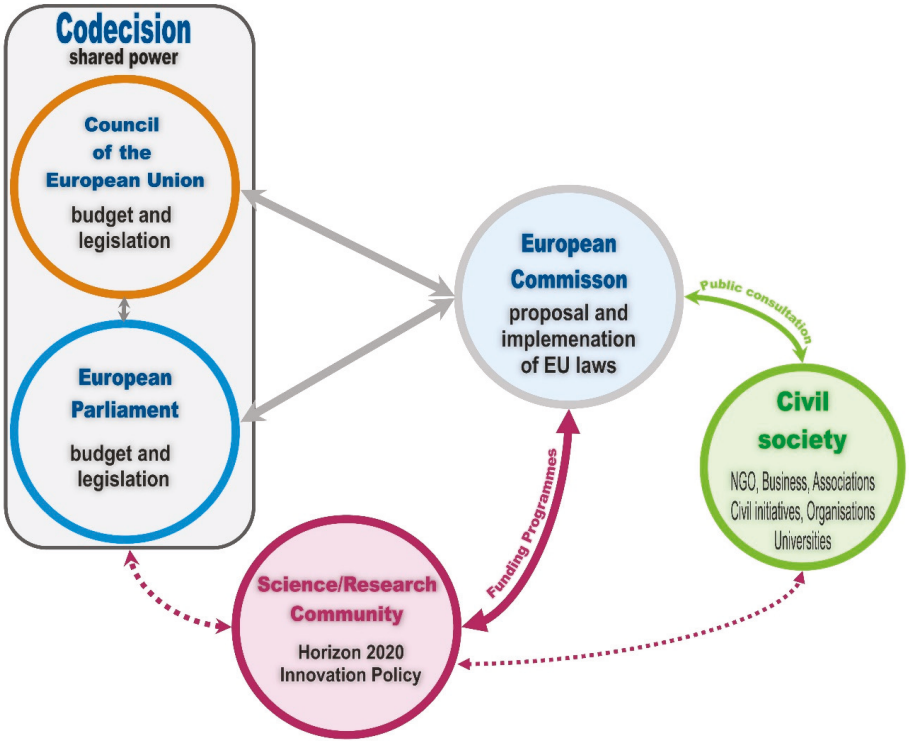

Figure 3. The entry point for the science/research community funded by the Horizon 2020 program's call for a decision making-procedure of the EU.

3.2.4. Improvements and Possible Solutions for Enhancing the Role of Integrated Scientific Support in EU Policy Decision Making (Q4)

The main debate at the workshop regarding solutions for improvement highlighted the need for the use of language that is easy for policy makers to understand and the need for physical meetings with project participants and stakeholders (Figure 2). Interviewees agreed that system improvements and possible solutions for enhancing the role of scientific support for EU policy making are an issue of national implementation.

The reform of CAP (seven-year cycles), constantly under negotiation, can enhance the role of science. For example, one proposed improvement is to make sure that there are clearly defined indicators in the monitoring and evaluation of CAP-supported efforts targeting reduced water pollution. Article VII of the WFD requires measures to be put in place at the catchment level so that the need for water companies to reduce their pollution will decrease. This measure should be reflected in agricultural legislation or in RDP to make sure that the costs are picked up by the CAP budget, farmers or consumers, and not by drinking water providers. The WFD will be reviewed in 2019, which will explicitly provide an opportunity to enhance the role of science in policy making. One of the interviewees proposed that this process could set a new attitude for policy makers and administrators regarding the current status, needs or upcoming changes, due to technological, practical or environmental changes in all connected sectors.

Workshop participants recalled that policy is now often based on indicators or data that are sometimes inconsistent, even outdated. All workshop participants agreed that with the digital revolution, with machine learning and data mining, we could and should have a real-time picture of what is happening (for example, with water quality in Europe). They added that many of the current instruments and mechanisms need to adapt and evolve. We can no longer implement a certain measure unchanged for six years. Instead, we should be monitoring and adapting in real time in order to provide more value for the public money spent. The entire relationship between data, information and decision making needs to change.

One of the proposed solutions from the participants was that the EU, as well as local actors, would need to equip themselves to make use of these new technologies, for example, to use data platforms and data mining. It was recommended to use these technologies as well as information from other fields and departments as a "feedback loop", where one does something, gets feedback, and can then make adjustments based on the feedback. The EU is now actively pushing for data reuse and open data. The same data can be used for different purposes. Participants agreed that there is a high demand for specific dissemination techniques for specific audiences and in local languages. Relevant scientific knowledge is, broadly speaking, mostly available, and it should be translated into information that farmers and stakeholders at the local level can use in practice.

Besides the service contracts mentioned in Question 3, participants proposed that civil servants of the commission should have regular involvement in projects, such as H2020 projects, so that they can obtain new knowledge over the course of the project. This could be done by giving civil servants a definite role in the project (for example, in presentations, workshops, interviews, etc.). Furthermore, some projects focus on "their business" regardless of whether the topic is on the political agenda of the EC or not, with the aim of "ticking boxes" to fulfil the grant agreement obligations. One trend to make this process easier for everyone is to establish project clusters, aimed at longer-term approaches/teams and the use of gatekeepers in the relationship/communication flows. An example of such a cluster is the Biorefine Europe cluster (https://www.biorefine.eu/about), which interconnects projects and people within the domain of bio-based resource recovery and strives to contribute to more sustainable resource management.

4. Synthesis

This research is unique because ten years after the EC DG RTD general report on the state of the dialogue between policy makers and the science community for maximizing the policy making impact

of projects [4], there is again an examination of whether the role of science has changed in relation to policy and politics. Was there a shift towards a better mutual understanding in an established iterative process of knowledge and practice exchange within a policy for integrating scientific support for EU policy?

We argue that this study shows that the status quo observed [4] 10 years ago and declared as an unsatisfactory condition was overreached at the level of EU level policy making and that much more effort at the member state/region level is needed in the policy implementation phase, where politics plays an important role. In recent years, the EC has been strengthening communication with the science community through focus groups, partnerships, meetings and web portals. However, desk studies, workshops and interviews show that the EC, despite having a substantial research and innovation budget, is not making the most of the project results. The reason for this is due to the limited staff available to deal with all of the key tasks of the EC, so less mandatory ones like science-to-policy interaction are often neglected.

Workshop participants and interviewees were well informed about the legislation, structure and information paths and about the importance of lobbying in the EU system between the European Commission, European Parliament, EU Council, corporations, NGOs and different research associations. EU legislation gives member states quite an important role in implementing EU legislation and common policies at the local level. They have the freedom to decide on the processes for addressing the issues, ways of implementing solutions, and the role of science in WFD-promoted integrated policy making. While some participants argued that legislation at the EU level should be unified and that high-level cohesion should be reached at the level of member states, other participants defended the current premise that each member state, region or local community should have the opportunity to shape its variety of general EU legislation on water protection or agriculture. Only the common goals at the EU level agreed upon by all member states (WFD, ND, CAP, SDG) should be followed. Nevertheless, science plays a vital role in supporting both types of policy making.

The Nitrates Directive does not have a set date for when the targets have to be achieved, unlike the WFD. Very few member states or regions set an exact load reduction that needs to be achieved, although border conditions (water quality, nutrient mass balance) are known and confirmed by science. Implementation of the SUPD has been delayed in some member states. There is much legislation under the implementation that still has to be fully implemented by member states. Barriers to providing the conditions necessary for enhancing the role of science in EU policy making and implementation are often connected with the political will to reach target goals, scarce instruction on the legislation implementation process, and a lack of funding opportunities for science to be included in policy making and implementation. We argue that examples from individual member states (Ireland, Scotland) show that smart policy makers can, by enhancing the role of science in the policy making and implementation process, generate positive effects on establishing links between water and agriculture policy.

Reflecting on the role of science in light of the EU legislation and decision-making process opened a discussion about public participation as part of the "democratic" impact on science. Public discussions, popular political actions relying on public opinion, and corporate interests can cause the overlooking of or even the change of scientifically correct results to suit a particular group's agenda. Science as a methodological process should be done independently, while policy making is a democratic process. Research results should be made public and available for democratic policy making. A solution for improving this issue calls on scientists to use language that is understandable by policy makers and the wider public, while avoiding oversimplification and distortion of reality when reducing the complexity of the information. That is why we argue that the role of science should be differentiated from the role of public participation. Science should be seen as a mediator in the process of understanding complex and dynamic hydrological, agronomic, natural and socioeconomic systems and processes, as well as a tool for evaluating the soundness of potential solutions to water quality problems.

However, we could argue whether the political agenda of the EU, which informed this research project, and hence whether the political agenda promoted in this manuscript, is still fully up to date. The study shows a lack of progress in certain areas when it comes to improving the input provided by science. One could wonder to what extent this is the result of the political conditions that the EU and specifically the European Commission have been facing in recent years when it comes to technocratic decision making. We made an effort to carefully distinguish the informational input of science from democratic decision making, although we cannot be sure if all EU level actors, those included in this study and those not, fully appreciate this distinction. However, this is certainly one of the reasons for anti-EU sentiments, in particular on the radical left and right in the name of more accountable/Machiavellian rather than democratic decision making. These types of sentiments could be one of the reasons for more caution, and hence a lack of progress, at all European policy levels when it comes to implementing an agenda that may quickly be interpreted as technocratic or elitist.

This study shows that, according to the views of participants, relevant RIA EU research project results are taken up by the European Commission, Parliament or Council indirectly, as a source of ideas and information. Although the process is not straightforward, it may, over time, result in distinct impacts on policy formation. Results emanating from service contract studies for DGs are used to a much more significant degree and often literally. The commission uses the results of these studies in discussions with member states, showing that science has a clear role in supporting policy making and implementation of EU legislation. Such service contracts often have a limited scope and often address member state implementation of various directives rather than new science that is produced in RIA projects. However, many of the solutions that would enhanced the role of science in the case of agricultural impacts on drinking water quality have to be found by politicians at the national or regional level. WFD, ND, DWD and other directives give member state politicians the opportunity to prepare tailor-made measures in cooperation with science and with sufficient funding, which will contribute to clean surface and groundwater drinking water resources.

Based on our study results, we argue that establishing project clusters (science, policy, stakeholders, and citizens) for up-to-date policy challenges and stakeholder needs and with citizen involvement is a viable solution to enhance the role of science in the EU integrated policy making process. The aim is to establish longer-term relationships and communication flows between scientists and policy makers, which will contribute to achieving more sustainable management of ecosystem (water, food) services.

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Participatory Water Governance and Organisational Change: Implementing the Water Framework Directive in England and Wales

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Abstract: Public participation is central to the IWRM discourse and often associated with claims of improved environmental policy outputs and their implementation. Whilst the involvement of nonstate actors in environmental decision-making has attracted scholarly attention from various angles, our knowledge is scant as to the forces that drive organisational reform towards participatory governance. This article sets out to contribute to this largely neglected research area and explores conditions under which policy-makers would be willing to attend towards more participative water governance. Its ambition is twofold: first, to explore the conditions under which public officials attempt to institutionalise more participatory modes of water governance. To this end, I analyse the implementation of the Directive's active involvement provision in England and Wales. For many decades, water management in England and Wales had a reputation for being a technocratic exercise. In the past 15 years, however, the Environment Agency has made considerable efforts to lay the foundation for enhanced stakeholder participation. Second, with reference to the case of England and Wales, this study contributes to understanding the difficulties that reformers may meet when it comes to building support within an organisation and to implementing reforms towards participatory governance.

Keywords: integrated water resources management; IWRM; Water Framework Directive; WFD; participation; United Kingdom; England; water governance

1. Introduction

Promoted by the Global Water Partnership and international heavyweights such as the United Nations, integrated water resources management (IWRM) brings together a number of principles to encourage "the coordinated development and management of water, land and related resources in order to maximise economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems" [1]. Arguably, the involvement of a wide range of state and nonstate actors in water policy and management decisions is key to achieving such coordination [2–5].

The Water Framework Directive (WFD, 2000/60/EC), adopted in 2000, is the most prominent piece of legislation to embody IWRM principles in the European Union [6]. It is also one of the most important policies to promote participatory water management in Europe. According to Article 14(1) WFD, "Member States shall encourage the active involvement of all interested parties in the implementation of this Directive, in particular the production, review and updating of the river basin management plans". The provision raises a number of legal, political and practical questions. On the one hand, its legal status is somewhat unclear. While water managers are obliged to make policy documents publicly available and to invite comments from third parties, active involvement is merely 'encouraged'. Not surprisingly, legal experts conclude that, "the obligation to encourage involvement falls short of a duty to ensure that this actually occurs" [7] (p. 404). On the other hand,

terms such as 'active', 'involvement' and 'public' remain undefined. According to the WFD's public participation guideline, developed within the context of the EU's Common Implementation Strategy, active involvement "implies that stakeholders are invited to contribute actively to the planning process by discussing issues and contributing to their solution" [8] (p. 11). Apparently, 'active involvement' requires a closer interaction between water managers and stakeholders than public hearings and consultation exercises.

Almost 20 years after the adoption of the Directive, assessments indicate that many European countries have established new forums for participation in water management or have broadened existing ones, and now manage their water bodies in a more participatory way than they did ten years ago [9,10]. This invites the question under which conditions are state actors willing to attend to participatory decision-making, or to change political structures such that participation can be ensured on a sustained basis. With a focus on England and Wales, this article explores why participatory forms of water management were adopted and why the attempts made were only partially successful.

In doing so, this article contributes to the already vast literature on public participation in water management and environmental management more broadly. This literature includes studies to showcase how participatory arrangements operate across countries and policy areas as well as evaluations using normative criteria from political theory or policy practice [11–16], comparisons of participatory and nonparticipatory governance arrangements with a view to policy delivery and outcomes [17–19], and many others. However, we know much less about the causal factors behind the transition from less participatory to more participatory policy making. Previous research has studied both European and non-European cases and largely focuses on combinations of contextual factors [20–22]. Although participatory requirements challenge existing policy networks, historically grown administrative cultures and predominant views on the merits of participation held by organisations, intraorganisational considerations have not received much scholarly attention in explaining the adoption of participatory management principles.

The ambition of this article is therefore twofold: first, to explore the conditions under which public officials attempt to institutionalise more participatory modes of water governance. To this end, I analyse the implementation of the WFD's active involvement provision in England and Wales. The United Kingdom (UK), and specifically England and Wales, is an exciting case to study; for many decades, water management in England and Wales had a reputation for being a technocratic exercise. In the past 15 years, however, the Environment Agency (EA) has made considerable efforts to lay the foundation for enhanced stakeholder participation. With reference to the case of England and Wales, this study contributes to understanding, secondly, the difficulties that reformers may meet when it comes to building support within an organisation and to implementing reforms towards participatory governance.

The article is organised as follows: the next section offers a brief overview of theoretical accounts related to organisational change and reform. Section 3 introduces the methods and data that inform this study. Section 4 analyses pre- and post-WFD water management in England and Wales and offers an in-depth case study of a reform initiative towards more participatory modes of water governance. The last section concludes.

2. Theory and Concepts

Many studies exploring the impact of the EU identify the pressure of legal adaptation as a key driver for domestic policy change [23–25]. This line of thinking, however, yields, little explanatory power with regard to EU policy initiatives with weak or no legal binding such as the WFD's active involvement provision. It is therefore plausible to prioritise, in the absence of any legal adaptation pressure, domestic factors over European factors in order to understand the adoption of participatory modes of water governance [26].

March & Olsen [27], Pierson [28] and Héritier [29] have conceptualised (domestic) institutional change from various theoretical angles. In the context of this study I mainly rely on Brunsson &

Olsen [30,31], who apply the propositions made by March & Olsen on public sector organisations. Accordingly, government agencies and departments operate in an institutional environment that makes various, sometimes contradictory demands on an organisation. Consequently, organisations create two versions of themselves. The first one coordinates internal actions and produces services that are related to the tasks assigned to an organisation. The second one represents the organisation to the outside and is mainly concerned with building and maintaining an organisation's legitimacy and reputation. Organisations tend to keep these versions separate and therefore contribute to a decoupling of organisational components [30] (pp. 8–9). Public bodies are well aware of their double identity and, in fact, behave hypocritically when they present a set of values to the outside that they do not use internally because it is incompatible with their overall organisational mission [30] (pp. 8–9).

According to macro-theories of organisational change, reforms are responses to external demands which, in one way or the other, seem to threaten an organisation's legitimacy and reputation [32,33]. Organisations therefore tend to reform the version of themselves that is visible from the outside. They present strategies, goals and techniques that seem to be in tune with those demands, and offer procedures that appear to achieve these goals more legitimately. More often than not, these reforms are just a façade, without internal counterparts and demonstrate a loose coupling between external representation and internal operations [30].

Micro-theories, in contrast, assume a genuine intraorganisational interest to initiate reforms. This interest is typically motivated by insights from within the organisation that current practices fail, partly or fully, to deliver successfully whatever an organisation is supposed to deliver. Performance deficits threaten the identity and self-image of an organisation, and reforms are then attempts to realign practices, performance and identity. However, organisations may fail to fully implement those reforms. This is for two reasons: Paradoxically, practices themselves may have become part of an organisation's identity, and path dependency then makes it hard to depart from those established habits and routines. On the other hand, the suitability of a specific reform proposal may internally be disputed, resulting in intraorganisational opposition [34].

It is plausible to assume that these two approaches complement rather than exclude each other. As organisations are indeed subjected to external demands, one may expect them to be resistant and to engage in half-hearted efforts that are essentially window dressing. For example, we may expect an organisation, which operates in a nonparticipatory fashion and is confronted with external demands promoting more participatory modes of governance, to initiate reforms reluctantly. These reforms would appear to represent a move towards participation, but do not touch upon internal routines. Consequently, the key rationale here is to maintain or restore legitimacy whilst preserving organisational identity. In these situations, public sector organisations engage in political learning [35] (p. 339).

However, this description seems to capture only part of the reality. To illustrate, it is perfectly possible to imagine a situation in which an organisation has come to understand (or better, believe) that its performance is seriously undermined by nonparticipatory modes of governance. Plausibly, the organisation would then display a greater degree of openness to implement rigorous reforms which emphasise collective learning, deliberation and participation. The key rationale here is to lay the foundations for continued service delivery and performance. To this end, public sector bodies would take recourse to instrumental learning which includes the acquisition of knowledge about governance techniques, policy design, processes and instruments [35] (p. 335). However, for the reasons outlined above, these internally supported reforms are difficult to implement.

To sum up, organisational reforms may come in two forms. They may be initiated in response to external demands threatening an organisation's legitimacy and reputation. The typical response would be window dressing. Alternatively, organisations may realise that their practices and routines compromise their organisational goals. They would then reflect upon promising alternatives with a view to realigning practices and performance. This has implications: a mere call for more participatory modes of governance is unlike to trigger genuine change within an organisation. What is required

is the insight that current practices jeopardise the achievement of an organisation's mission and that public participation may be the best solution here. These two conditions are rarely fulfilled. I will use these propositions to analyse the implementation of the WFD in England and Wales.

3. Data and Methods

This study focuses on participatory water governance in England and Wales. In order to demonstrate that water is indeed managed in more participatory ways, I compare pre- and post-WFD water management. The UK environment is regulated nationally, which means that specific authorities are in place for England and Wales (up until 2013, afterwards regulated separately), Northern Ireland and Scotland. For this paper, I have studied one English river basin district, the Humber, in detail, and the other nine basins in England and Wales on a more general level, thereby not examining the basins in Northern Ireland and Scotland.

I rely on process tracing in order to explore the causal factors that contributed to the above reform initiative and its achievements. This method describes "the minute tracing of the explanatory narrative to the point where the events to be explained are microscopic and the covering laws correspondingly more certain" [36] (p. 66). Causal-process observations are the analytical tools employed in tracing that explanatory narrative. They describe "data that provides information about context, process or mechanism and that contributes distinctive leverage to causal inference" [37] (p. 353). However, causal process observations refer to a logic of causality that does not directly rely on covariation of variables taken from a specifically defined sample and comparable to each other because they belong into the same column of a rectangular data set. In the contrary, causal-process observations "are not different examples of the same thing; they are different things ('apples and oranges')" [38] (p. 179). They describe multiple types of evidence taken from very different units of analysis and unique populations. Accordingly, a causal path will be split up into subvariables: "The logic model deliberately stipulates a complex chain of events over an extended period of time. The events are staged in repeated cause-effect-cause-effect patterns, whereby a dependent variable (event) at an earlier stage becomes the independent variable (causal event) for the next stage" [39] (p. 149).

Process tracing requires the collection of different types of evidence, the above-mentioned causal-process observations. Between 2001 and 2006, a core group of people at the EA, the WFD Team, made decisions on the future course of water policy in England and Wales. In a first step, I used the snowballing technique in order to talk to members of this group, external consultants and EA staff holding leadership positions back then. This includes the EA's former Head of Water Quality (within the Agency responsible for the overall implementation of the WFD and chairing the WFD Team), one member of the Social Policy Group within the EA (the relevance of which will be explained later), one external consultant to the Social Policy Group, the EA's former Head of Stakeholder Relations as well as EA staff at the Agency's head office and at the regional level. I also talked to actors involved in drafting the WFD and related guidance documents. Further, I consulted legal acts, implementation guidelines, action plans, strategy papers and other materials prepared by the Department for Environment, Food and Rural Affairs (DEFRA) and the EA, some of them publicly available and some of them unpublished.

In a second step, I focused on the Humber basin. The purpose was to understand in detail how the newly established system of participatory water planning worked on the ground. I interviewed EA staff involved in organising the Humber River Basin District Liaison Panel, nine out of 15 stakeholders participating in the Panel, all of them representing industry sectors, public authorities and societal groups. I also interviewed seven stakeholders who had previously collaborated with the EA, but were not invited to join the panel. In order to ensure that my findings on the Humber river basin were representative for England and Wales, I interviewed four (out of seven) lead officials in river basin districts other than the Humber. These interviews also provided additional information about water management and stakeholder relations prior to the implementation of the WFD.

The total number of interviewees is ~40. Approximately 20 interviewees informed the first step of this research. These interviews were mainly carried out between 2009 and 2011; however, I interviewed

some informants again in later years (up until 2017) to obtain additional information or documentary sources. Another 20 interviews contributed to the second step of this project; these interviews were conducted between 2009 and 2018, and quite a few people were interviewed multiple times to follow up on latest developments. I talked to a vast majority of my interviewees in person, but I also carried out telephone interviews. All interviews were semi-structured.

4. Results

This study explores the transition towards more participatory water governance in England and Wales during the implementation of the WFD. Before I analyse the reform process and its achievements, I offer a comparison of pre- and post-WFD water management and the role that public and stakeholder participation played therein in order to substantiate the claim that there was, in fact, a paradigm shift that requires explanation.

4.1. Anglo–Welsh Water Management and Public Participation from a Historical Perspective

For many decades, secretive relations between inspectors and polluters were a key characteristic of British environmental policy and management [40–45]. Cooperation mainly followed functional imperatives; inspectors required additional information from polluters that they were unable to collect themselves due to low staff numbers. Transgressions were extremely difficult to prove so that informal negotiation was the most effective way to achieve behavioural change. Inspectors therefore relied on quasi-voluntary action and preferred to negotiate with, rather than impose measures on, polluters (see Ayres & Braithwaite [46] for a conceptual discussion of the underlying logic). "British pollution control policy is basically made and enforced in private" and "precludes opportunity for effective participation by other political constituencies" [47] (pp. 91–92).

This style came under fire through the Thatcherite reforms of the mid-1980s, which emphasised the privatisation of public services, the introduction of market mechanisms in the public sector and, most importantly in the context of this study, the creation of more or less independent regulatory agencies. Government agencies in the 'British regulatory state' [48] did not only begin to oversee privatised industries, but also to regulate sectors that were characterised by a high degree of specialism, including the environment and water. Agency operations, therefore, required expert knowledge and technical skills that elected politicians or bureaucratic generalists rarely possessed [49]. Consequently, the legitimacy of agency decisions relied less and less on democratic elections and competence delegation but on expert judgments made independently from the politics of the day [50,51].

Unlike similar developments in the US [52,53], however, endeavours in the UK to formalise the relationship between regulators and the regulated were not paralleled by public involvement programmes which compensated for the loss of democratic legitimacy. Supported by domestic legislation such as the 1990 Environmental Protection Act and the 1999 Pollution Prevention and Control Act, the EA and other regulatory agencies saw a window of opportunity to develop a more adversarial style towards regulatees, to enforce environmental rules more thoroughly and, despite industry-friendly rulings, to take polluters to the courts in cases of noncompliance [51] (p. 131).

Consequently, environmental regulators showed little commitment to participation in water management. Instead, these agencies put a high premium on the technical and scientific expertise within their organisations [51]. Nevertheless, the EA and their predecessors engaged in a number of participatory exercises, for instance during the preparation of Local Environment Agency Plans, Flood Alleviation Schemes, Catchment Management Plans and through various advisory committees. However, only a few of these opportunities for involvement went beyond note and comment procedures, none of them were applied consistently across the country, and only advisory committees were based on statutory obligations [54] (pp. 39–54).

To recap, the emergence of an expert-based, managerial regulatory style in the late 1980s marked a new approach to pollution prevention in England and Wales. However, neither the classic British regulatory style—cooperative yet secretive—nor the one adopted after the Thatcherite reforms were

particularly compatible with the emerging paradigm that emphasised the involvement of nonstate actors in water management.

4.2. Implementing the WFD in England and Wales

The WFD was transposed into English and Welsh law through the Water Environment Regulations of 2003 (Water Framework Directive) (England and Wales). According to Article 10 (2ai), it is within the discretion of the competent authority to decide whether it provides "opportunities for the general public and those persons likely to be interested in or affected by its proposals to participate in discussion and the exchange of information or views in relation to the preparation of those proposals". Active involvement in England and Wales is, therefore, not a legal requirement set by the British legislator, but a voluntary decision made by the EA.

At the time of transposition, the Agency had sole responsibility for managing nine river basin districts in England and Wales and two jointly with the Scottish authorities. Regional water authorities other than the EA regulated river basins in Scotland, Northern Ireland and Gibraltar. Things have changed slightly since 2013 when the EA Wales, as part of the EA for England and Wales, was dissolved and a new statutory body, Natural Resources Wales, assumed responsibility for water resources management in Wales.

Up until 2012, nonstate actor involvement took first and foremost place in so-called River Basin District Liaison Panels. Operating at the river basin district level, Liaison Panels discuss the content of river basin management plans and the measures needed to achieve the plan's objectives. Furthermore, they are involved in the monitoring and enforcement of various management activities.

Liaison Panels operate with templates developed by the EA's head office, in particular templates for three consultation rounds and the draft management plans. These templates considerably restricted ambitions developed at the regional level and the measures envisaged to achieve specific objectives (interviews, EA officials 22 and 23). EA river basin managers justified this procedure with reference to saving resources and, more importantly, to ensuring consistency across all river basins in England and Wales (interviews, EA officials 22 and 23). Further, regional offices were requested to use a list of statutory governmental bodies and organised interests which were to be approached for membership of the Liaison Panels.

Interview evidence suggests that the organisers of the panel seemed to restrict discussions about the ambition of water management goals as compared to economic and social concerns. Instead, the panel focused entirely on measures to achieve the goals that the EA had identified beforehand. Accordingly, the EA structured Liaison Panel meetings in a way that only reflected the technical challenges of WFD implementation. While EA staff deny one-sidedness and claim that there was scope for discussions about procedures and objectives (interviews, EA officials 19, 22 and 25), Humber panel members tend to disagree (interviews, stakeholders 15 and 16).

Top-down framing through the EA's head office and a technocratic way of handling the panels resulted in disappointment among stakeholders and a lack of ownership for the final management plans. In the Humber basin, stakeholders comments ranged from "worthwhile" and "reasonably pleased with it" to judgments which suggested that panel members found "the whole process difficult to understand", "slightly frustrating" and "of not much use" (interviews, stakeholders 12, 14, 16, 17 and 21). In particular, an environmental nongovernmental organisation held that they had been "hijacked" by the EA and had been exposed to a process of "acceptance management" (interview, stakeholder 12).

In the past seven years, however, the UK has begun to experiment with a catchment-based approach to water management [55]. The idea is to utilise existing catchment partnerships and to promote the creation of new ones, during the implementation of the WFD with a view to bringing water management activities closer to affected communities. However, catchment-based arrangements did not replace public participation at river basin district level, and while it is plausible to assume that

the catchment-based approach has relaxed the degree of control held by the EA, published research suggests (and my own fieldwork confirms) that a final judgment is still due [56–59].

In brief, the regulatory style that Anglo–Welsh authorities have adopted indicates a new emphasis on stakeholder involvement. However, while these developments could be construed as the institutional basis for more participatory modes of water management, there is little evidence that the cognitive disposition with regard to using these new possibilities has been fundamentally altered. Both state and nonstate actors report instances of exchange and mutual learning in these newly created participatory arenas yet the templates and guidance provided by the EA's head office seem to restrict these spaces for deliberation. The observations above suggest that the hopes of advocates of participation have certainly not been completely fulfilled as yet. Nevertheless, it is fair to conclude that the authorities in England and Wales have taken steps towards managing water more participatory. So, how can this reform initiative be explained?

4.3. Understanding Administrative Reform in England and Wales

Since the election victory of New Labour in 1997, participation and network governance have become mantras that have further developed the regulatory changes which started in the late 1980s. While certainly none of these efforts marked a revolutionary turn towards participatory democracy, New Labour's agenda had a profound impact on the political landscape in Britain and put the EA under considerable pressure from governmental bodies and nonstate actors. These organisations were consultees in various contexts and became potential stakeholders of the EA (interviews, stakeholders 16 and 21). As a result, the more participatory modes of governance reflected the societal mainstream, and at the same time were less compatible with the EA's technocratic regulatory style. This style was in part inherited from its predecessor organisations and implied, as I will show in the following, a potential barrier in terms of legitimacy and performance.

4.3.1. Challenging the EA's Legitimacy

After New Labour assumed power in 1997, the EA's regulatory style was subject to an investigation by the Royal Commission on Environmental Pollution in 1998 [60] and two House of Commons Select Committees in 2000 and 2003 [61,62]. The findings of all three reviews were remarkably negative.

The Royal Commission report analysed the ethos and practices of British inspectors and concluded that environmental decision-making was a closed process in Britain. It suggested that the values of citizens, rather than of standard setters and scientists, should guide the definition and analysis of problems as well as the development of policy proposals. In order to resolve current shortcomings, the Royal Commission called for a public debate on values and preferences related to environmental problems, and recommended the establishment of participatory arenas, which would enable the involvement of various stakeholders [60].

While the Royal Commission's study was an attack from a body of academic experts, the two reports published by the House of Commons Select Committee [61,62] came from the centre of political life in Britain. Based on evidence which reflected the day-to-day experiences of stakeholders, EA staff and regulated industries, the Select Committee revealed that Agency operations suffered from a legitimacy deficit [61] (oral evidence 42). This was not the least because the EA showed great reluctance when it came to providing information to affected parties and to including stakeholders in environmental decision-making [61].

Carpenter [63] studies the reputation of government agencies and distinguishes the following ideal types: 'performative', achieved through service delivery; 'technical', achieved through the scientific soundness of decisions; 'moral', achieved through the satisfaction of public interests; and finally, 'legal-procedural', achieved through fair and transparent procedures. The three investigations discussed above seemed to indicate that citizens, stakeholders and experts were increasingly developing a notion of organisational reputation that was at great variance with perceptions held by the EA. The Agency's regulatory style was, after all, a consequence of the function which it and many other

science-based regulators in the UK had been given. Many stakeholders, however, have come to believe that the Agency's managerial approach has caused a serious legitimacy deficit. The challenge for the EA was to process these insights.

The theoretical observations made earlier suggest that external demands which are not directly related to organisational performance will fail to trigger rigorous and durable reforms towards participatory governance. Instead, agencies will engage in half-hearted efforts of window dressing whereby internal operations remain intact.

EA actions taken in response to the Royal Commission's report and the Select Committee's inquiries do indeed support this expectation: in October 1999, EA board meetings were made public in order to increase transparency and openness; in June 2000, the EA agreed to collaborate closer with local communities. Further, acknowledging that "public expectations of public bodies are also changing, with increasing demands for accountability and transparency in how they operate" [64] (p. 8), the Agency published 'An Environmental Vision' that was supposed to outline organisational key values. However, these three initiatives were the only measures taken to respond to the above-mentioned criticisms. They were therefore nothing more than a footnote on the EA's path toward more participatory policy making.

4.3.2. The EA's Regulatory Performance

In 2002, the EA published a 'General Quality Assessment of Rivers and Classification of Estuaries in England and Wales' [65] with a view to identifying challenges related to the forthcoming implementation of the WFD. The Agency claimed to look back on 'a Decade of Improvement', and reported significant advancements with regard to the biological and chemical quality of water bodies since 1990. The assessment suggested that the EA would not face any major difficulties in achieving the WFD's ambitious water quality goals. However, the 2003 Select Committee was not convinced.

First, the 2003 Select Committee expressed serious doubts regarding the EA's quality assessment. Based on oral and written evidence, the Select Committee criticised the methods used to assess biological and chemical status and disputed the validity of the findings. It claimed that "there are in fact a number of factors which adversely affect the quality when it is assessed against the criteria set out in the Water Framework Directive" [62] (item 33) and implied that the indicators developed by the EA were not in line with the criteria suggested in the WFD. Therefore, according to the Select Committee, the EA's report painted an erroneous picture of the degree of anticipated compliance with the Directive [62].

Second, the Select Committee established that the EA's working relationship with agriculture was unlikely to resolve problems related to nonpoint source pollution, which would make the achievement of the WFD's water quality goals unlikely. The Select Committee acknowledged that pollution through agricultural nonpoint sources was a result of practices that were, in the view of many, necessary and desirable in order to ensure supply of various agricultural products. However, at the same time, the enforcement of any legislation related to pollution through farming was extremely difficult. In order to tackle the environmental problems that result from farming, "wholesale changes in such practices" were required [62] (item 47). The Select Committee went on to say that the agency would therefore "have to work with the farming communities on getting them to put in place positive environmental management systems that will reduce their impact on rivers in a way that fits in with their farm business" [62] (item 47). When the Select Committee investigated the EA's management practices, such collaboration was nonexistent and was unlikely to be achieved as long as the EA maintained its predominant regulatory style.

Third, the Select Committee found that the WFD required a high degree of policy integration. During the inquiry, stakeholders and experts pointed out that, in order to achieve the ecological goals of the WFD, the EA must collaborate with a plurality of statutory authorities involved in land use planning, development planning and pollution control, and to exert influence on a number of policy fields outside the EA's area of competence [62] (item 67). Tunstall and Green [54] (pp. 23–24) map the degree of cooperation required between the EA and other statutory or private actors. The authors

list 26 activities related to water planning that the EA or any other competent authority designated in England and Wales has to undertake or supervise during the implementation of the Directive. The overview suggests that, under the then legal and administrative framework, the EA neither possessed the political competences to regulate all these activities, nor was in control of all funds necessary for their implementation. After all, only three of the 26 activities could have been carried out without interaction with other statutory organisations or regulatees [54], thereby suggesting once again that the EA was, thanks to its regulatory style, ill-prepared for the coordinative and communicative tasks set by the WFD.

Theory suggests that evidence of current or anticipated underperformance constitutes a powerful trigger for organisational reform that would go beyond window dressing. Accordingly, reformers will attempt to implement more participatory modes of policy making if they identify instances of underperformance and relate these instances to the nonparticipatory approach taken by their organisation. In 2003, only one of these two conditions was fulfilled: the Select Committee's report provided ample evidence that the EA's regulatory style was unsuitable for tackling the challenges posed by the WFD. During the investigation, the EA's Chief Executive openly conceded to be in panic: "First of all, if I can say we are not complacent. We are a bit like swans, we may look very serene on the surface, but we are paddling like hell underneath the water" [62] (oral evidence 221).

However, while the Agency slowly came to realise that its regulatory approach was the source of many shortcomings, it had difficulties identifying the lack of participation as the heart of the problem. As a consequence, the EA decided to create a specific subunit, the WFD Team, in order to deal with the upcoming challenges. This response stands in stark contrast to the reaction shown when the Agency was confronted with concerns related to legitimacy. In line with theory, the Agency was much more willing to engage in an open-ended endeavour of self-reflection and analysis and to go, potentially, beyond mere window dressing once organisational performance, rather than legitimacy, was at stake.

4.3.3. Intraorganisational Learning

Right after the Directive had been adopted, the EA established a team to analyse the implications of WFD transposition and to design proposals for implementation. The WFD Team consisted of experts who represented a variety of disciplines, including hydrology, ecology and toxicology (interview, EA official 9). In the context of this study, the Social Policy Group is of particular relevance. The establishment of this group in 2002 reflected the insight gained during the Select Committee's inquiry that the WFD posed a number of organisational challenges to the core competences of the EA, i.e., hydrological and ecological science (interviews, EA officials 9 and 10). During the parliamentary investigation, stakeholders and experts suggested that these competences might not play out very well unless supported by organisational development towards improved cooperation with nonstate actors and statutory agencies [62]. For many EA staff, this meant a journey into the previously unknown realms of the social; hence the somewhat curious name, the Social Policy Group (interview, EA official 10).

The Social Policy Group decided to work with external consultants from academia to develop an understanding that would be compatible with the spirit of the WFD and with the way the Agency worked (or could realistically be expected to change). These consultants would provide the necessary outsider perspective, ensure a high level of analytical sophistication, and carry the image of objectivity and science that is sometimes required to implement unwelcome reforms in a defensive organisation. To this end, scientists affiliated to WRc plc were contracted in late 2002 (interviews, consultant 5, EA officials 9 and 10).

The Social Policy Group and their consultants introduced the concept of 'social learning' to initiate an internal process of reflection and to communicate the insight that the WFD would require permanent institutional arrangements enabling self-reflection and critical examination of management practices (interviews, consultant 5, EA officials 9 and 10). This concept, which is closely related to participatory governance [66], provided the intellectual device through which the idea of stakeholder involvement

could be explained and made acceptable. However, while the Social Policy Group successfully used the concept to introduce the idea of public involvement, they failed to translate the core idea of fair and open-ended deliberation typically associated with social learning. In particular, the physical scientists in the WFD Team found it hard to accept that stakeholders should be involved in the definition of policy goals (interviews, consultant 5, EA officials 9 and 10).

In an attempt to showcase the merits of their ideas, the Social Policy Group, therefore, tested in March 2003 a first draft of what would later become the 'Framework for Stakeholder Engagement' [67] in the Ribble basin. Project design, involvement opportunities and the outcomes of the pilot have been described extensively elsewhere [68,69]. The Ribble pilot will go into the history books as a gold-plated exercise, i.e., an overfulfilment of Article 14 WFD. The pilot project successfully demonstrated that well-designed stakeholder involvement improves accountability and legitimacy and promises better environmental outcomes. On this score, the pilot strengthened those in the Agency who favoured participation over hierarchical approaches to water management. However, the Ribble Pilot still assumed that the EA should take a leadership role in WFD implementation. This implies that decision-making powers were not to be shared with other participants who would instead become 'codeliverers'. The project also revealed that active involvement is expensive in terms of staff, time and money. It appears that the EA was neither in possession of such resources nor willing to acquire them through private donors (interviews, EA officials 10 and 24). This provided ammunition for those in the Agency who favoured lower levels of involvement or no involvement at all. In the absence of anything that resembles a cost report, the members of the Social Policy Group were reluctant to draw such conclusions (interview, EA official 10). Nevertheless, with reference to budgetary considerations, the pilot project did not receive the support from DEFRA.

At the same time, the EA's directorate and members of the WFD Team vetoed a proposal based on the Ribble pilot because it conflicted considerably with the EA's traditional regulatory philosophy. Relying on an instrumental understanding of participation, the concept of social learning was radically reinterpreted. For the Head of Water Quality, social learning in participatory arrangements implied that stakeholders get to know about government imperatives while the competent authority extracts information required for effective policy implementation from state and nonstate actors: "Scientists determine good ecological quality; the social thing is how you optimise that" (interview, EA official 9).

Nevertheless, the EA generally bought into the participatory agenda, recognising that it represented a new way of management: "The Environment Agency's role in river basin planning will be distinct from its role of enforcing environmental regulation ... the Environment Agency should see itself as the chair or co-ordinator of a group of key decision makers and deliverers which is responsible for investigating a set of collective problems and devising and negotiating solutions to them" [70] (Section 11.2).

This episode of intraorganisational learning confirms two theoretical observations made earlier. First, public officials tend to initiate more rigorous reforms if compliance with long-standing modes of operation jeopardises the fulfilment of tasks with which an organisation is entrusted (in the absence of legal or hierarchical pressure of course). The way members of the WFD Team reinterpreted and contextualised the concept of social learning demonstrates an instrumental understanding of participation typically associated with notions of policy delivery and effectiveness. The prehistory of this episode, i.e., the unsuccessful attempts of the Royal Commission and the Select Committee to revise the EA's position, suggests that concerns related to organisational legitimacy (would) have failed to trigger such a reform.

Second, policy-makers need to be fully convinced of the merits of participation in order to implement respective modes of governance. This implies that advocates of participatory governance must frame their arguments such that they are compatible with the political environment in which public officials operate and that they may meaningfully be linked to their sociolegal context and task assignments. In England and Wales, some EA staff considerably changed their way of thinking. However, as they were operating within an organisation which was concerned with environmental

protection and pollution reduction, members of staff reframed the advice given by the Social Policy Group and its consultants, resulting in a very incomplete adoption of more ambitious participatory governance principles.

Organisational learning does not necessarily imply that the entire organisation is involved in a process of reformulating established beliefs. This was definitely not the case here, and perhaps rarely is in general. During the early 2000s, the EA had some 13,000 staff, and it is fair to argue that initially, the analysed organisational learning process did not involve more than 30 individuals. Crucial for the relative success of this learning episode, however, was that key individuals who were in charge of implementing the WFD in England and Wales were among the learners. Hence, the Social Policy Group, as part of the WFD Team, received the support required in order to propose a framework for stakeholder involvement that would be applicable to all river basins and would imply a major change in how the EA interacts with nonstate actors and other statutory organisations (interviews, EA officials 9 and 10).

4.3.4. A Framework for Stakeholder Engagement

Supported by the WFD Team, the 'Framework for Stakeholder Relations' had to overcome its final hurdle: to receive approval from the Agency's directorate. Previously, the EA's managing director held a sceptical position vis-à-vis public participation. This is not the least because opportunities for involvement were considered to be a deviation from the EA's core activities: "The touchstone for us will be whether the environment gets better or not, it has to be outcome-based" [62] (oral evidence 248). Even years later, when the Liaison Panel system was already up and running, the EA's director remained sceptical about any activities that might distract the Agency from its true mission: "I would like to put a nail through the heart of this public participation thing right from the start . . . To spend a lot of public money trying to get the intricacies of the Water Framework Directive over to the man in the street, when he has already told us that he does not want to know that, seems to me to be not what we are about. I want action. I do not want discussion. I want doing. I want outcome. I want river basins to get better" [71] (oral evidence 24). In this sense, the EA's directorate was a perfect representative of the Agency's technocratic approach to managing the environment.

In the summer of 2004, however, the EA's Chief Executive had finally given the green light to make the Agency (appear) more participatory. This change of face was mainly a result of pressure exerted by DEFRA which, even though it has no direct influence on the EA's decisions, controls the Agency's budget, appoints the Chief Executive and management board and can, upon request, review regulatory decisions. Although such influence is rare in practice, it constitutes a shadow of hierarchy that the EA cannot ignore. Apparently, DEFRA had been receiving more and more stakeholder complaints with regard to the Agency's closed-shop approach: "They wanted industry to be friend of government, New Labour, you know. Labour in the old days has never gotten on particularly well with industry... And they didn't want to get into conflict with virtually all the big green organisations. It wasn't so much the more radical ones like Friends of the Earth or Greenpeace. It was much more the mild ones, RSPB, most of these organisations with huge membership bases. So they told me the problem had to be resolved" (interview, EA official 7). DEFRA proposed a swift and sustainable improvement in relations between the EA and its stakeholders.

In response, the EA established a Stakeholder Relations Team in 2004, which implemented improvements to the Agency's external communication with stakeholders and other interested parties (interview, EA official 7). Further, the EA's Chief Executive finally endorsed the WFD Team's proposal for stakeholder engagement (interviews, consultant 5, EA official 9). The final document, which outlined the planned structure for the involvement of nonstate actors during the implementation of the WFD, reflected the instrumental understanding of participation and was made public in 2005 [67].

4.3.5. Improving Internal Compliance

In light of the EA's prevalent managerial style, the reformers expected many middle managers and on-the-ground inspectors to be unwilling or unable to collaborate effectively with stakeholders and other government agencies. In order to improve internal compliance, the Agency employed multiple strategies.

First, the EA engaged in an intraorganisational marketing and promotion process, offered training to regional directors and river basin district managers and initiated a countrywide information campaign for state and nonstate actors. The Stakeholder Relations Team coordinated this process together with the Social Policy Group (interviews, EA officials 7, 9 and 10). Second, the Head of Water Quality successfully approached DEFRA to publish the template for stakeholder engagement as an official departmental guideline [70] (interview, EA official 9). Finally, the EA used the EU as a lightning rod. In order to improve internal compliance, the Stakeholder Relations Team constantly claimed that active involvement was a legally binding EU requirement. This claim was presented in meetings with regional directors, during the road show and in training modules: "We did tell people that it was a European requirement, yeah it is true. You know because they have a regulatory mindset" (interview, EA official 7). Utilising the WFD in this context was an effective strategy "to break resistance" and to shift the blame (interview, EA official 7).

Interviews suggest that this strategy was successful. In the view of most EA staff at the regional level, public participation and active stakeholder engagement is a legally binding EU requirement (interviews, EA officials 19, 20, 22, 23, 24 and 25).

5. Conclusions

While the concept of participation has attracted scholarly attention from various angles, our knowledge is scant with regards to the forces that drive organisational reform towards participatory governance. Studying the implementation of the WFD and its public involvement provision in England and Wales, this article set out to contribute to this largely neglected research area and explored under which conditions policy-makers make attempts towards more participative water governance.

The findings of this study suggest that public sector organisations begin to reflect on their standard modes of operation and to develop more participatory policy arrangements when they are challenged either with regards to their legitimacy and reputation or in relation to their current or future performance. The former typically results in window dressing. In the case studied in this article, widespread criticisms as to the EA's technocratic management style, increasingly undermining the Agency's legitimacy and reputation, did not receive much attention. The EA nonetheless began to release minutes of their board meetings, published a vision statement and promised closer bonds with communities, yet none of these measures responded to the nature of the criticisms or were effectively followed up. Underperformance, in contrast, motivates organisations to engage in learning exercises and to reflect on the tools they apply when fulfilling the tasks they are entrusted with. On the basis of the Anglo–Welsh case, I propose that organisations add participatory modes of governance to their regulatory canon if they conclude, rightfully or not, that the lack of involvement opportunities was a major cause for previous instances of underperformance. This supports findings in organisational studies and research on public sector reforms [30,32].

It is up to future research to test an alternative explanation according to which the EA's WFD Team developed their participatory agenda not, or not only, in direct response to performance considerations. Failure to successfully implement the WFD and to deliver the WFD's ambitious water policy goals was then a concern for the EA only insofar as this would have had negative implications for the agency's reputation as a science-based regulator. Both hypotheses centre on the notion of performance. The explanation offered in this article, however, focuses on potential underperformance in WFD implementation. The alternative explanation, in contrast, emphasises reputational effects of potential underperformance as a driving force for organisational reform within the EA. The two explanations are not in contradiction to each other and could well form the basis for a more nuanced interpretation

of the events. However, this calls for further research, in particular with regards to the relationship between DEFRA and the EA.

Likewise, the long-term effects of the reform examined in this article, and their causes, require further scholarly attention. I have argued that the implementation of the WFD has enhanced in quality, quantity and opportunities for involvement. However, these measures were not as far-reaching as optimists back in the time hoped they would be, not as creative and innovative as the legally nonbinding guidelines published by the European Commission [8] suggest, and not as thorough as others think is necessary. This confirms findings published elsewhere [4,14,59,72]. However, while I am confident to explain why public participation was adopted and why specific governance arrangements were chosen back in the time, I am less confident to link current practices solely to the events described here. The reasons are, essentially, methodological. The 2008 financial crisis had a major effect on the resources available to WFD implementation, the incoming 2010 Tory government left their own trace on environmental policy making in the UK, the 2013 devolution of environmental competencies to authorities in Wales distracted the Agency and, most importantly, the implementation of the catchment-based approach in the same year brought about fundamental changes, in particular as to the relations between actors at different policy levels. While first assessments of the catchment-based approach are available [56–59], we know too little about its prehistory, and relevant considerations within central government and the EA about it, to fully assess the causal effect that the new approach and the other events had on the way public participation operates. This reflects a typical challenge in implementation and evaluation research: external factors influence the implementation of a programme and make it harder to isolate its effect on the ground [73].

Now, returning to the overall contribution of this article, I claim that a current or future performance deficit in conjunction with the insight that the active involvement on on-state actors may be an effective way out, are two necessary conditions [74] for the adoption of public participation. Their absence would constitute a major obstacle. This may sound like common sense, but nevertheless flies in the face of many academic works and policy documents promoting public participation. We are informed that participation represents a superior way to organise our democracy, empowers and educates communities, inputs local information into decision-making processes, enables reflexive deliberation, enhances acceptance of policy decisions, resolves conflicts between stakeholders and so on [75,76]. This may all be true under certain conditions. However, the beneficiary of public participation is, in many of those rationales, society as a whole. While some rationales for public participation may well be compatible with the narrow and pragmatic perspective often taken by government bodies operating on clearly defined legal mandates [77], other rationales may be largely irrelevant from an agency perspective or even contradict the values and interests held and organisational mission pursued by agency staff. Given that active involvement and other ambitious forms of participation are no legal requirement in many jurisdictions across the globe, the ability to link rationales for participation to the constraints experienced by regulatory agencies is a major factor that deserves further consideration.

That said, the above-mentioned factors may be necessary but not sufficient [74]. The case study presented here suggests that two additional factors are conducive at the intraorganisational decision-making stage: first, a general willingness to be open-minded regarding new practices and procedures; this was facilitated by committed individuals in leadership positions. The importance of leadership in public sector reforms is undisputed [78], and future research may benefit from studying its role in more depth in a public participation context. Second, the presence of norm entrepreneurs, here in the form of external consultants with established industry experience, surely aided this process of reflection and reform. The consultants were very effective in analysing the EA and its internal operations and suggested a perhaps overly ambitious, but generally appropriate, set of measures—public participation—which seemed to reflect well the needs of the organisation. Again, the field may benefit from targeted studies exploring the role of norm entrepreneurs when it comes to reforming public sector organisations. In their book on water policy entrepreneurs, Huitema &

Meijerink [79] discuss leading approaches in the water sector, but the country-specific focus leaves little room for in-depth studies of public participation.

Keeping in mind that the societal mainstream in the UK back at that time, as well as discourse at EU level, were very much in favour of public participation in environmental management, planning and policy making, this study identified two intraorganisational factors as the key obstacles to implementing public participation within the EA. The first one refers to the well-known concept of path dependency. Procedures may become an important part of organisational identity, reflecting professional values and best practices, and agency staff are not always waiting for the latest fad in town to irritate their day-to-day practices. This is not a new insight, but it nevertheless remains important. The second obstacle refers to well-founded arguments presented from within the organisation according to which public participation simply did not represent a viable solution to the problems that the Agency faced. Although staff acknowledged that the EA did not always perform well, the question remained whether more and better and, perhaps most importantly, better funded technocratic regulation would not be the preferable alternative. Provided that the empirical evidence for improved environmental outcomes, a term that lies at the heart of the EA's identity, through participation are still inconclusive [17,19], this scepticism was not entirely unsubstantiated. More than ten years ago, McMahon [51] has published a fantastic study about the organisational identity of the EA and the US Environmental Protection Agency and the technocratic mindset of many agency staff. My research has identified a transition period in which many long-term members of staff defended views that have characterised the EA in the mid-1990s already, whereas new appointments and a few top management people have opened up to new discourses brought in from academia, other industry sectors and overseas. At the time of completing this research, it was certainly too early to carry out a follow-up study to McMahon, but it in a few years it would be worthwhile to analyse the degree to which technocracy, participation and deliberation characterise the Agency; ideally in a comparative setting as this question is of global relevance.

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Between Emulation and Assemblage: Analysing WFD Policy Transfer Outcomes in Turkey

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Abstract: Turkey's protracted European Union (EU) accession process has resulted in the transfer of environmental policy, primarily the water acquis. Despite a recent reversal in accession negotiations, this process is continuing and has thereby resulted in the active Europeanisation of Turkish water policy. However, the resultant pattern of Europeanisation remains poorly understood with questions arising as to whether policy transfer is leading to significant convergence with EU policy, or if a uniquely Turkish hybrid system of water governance is emerging. The paper therefore provides an analysis of transfer outcomes from the EU Water Framework Directive (WFD), using eight core institutional features: identification of river basins; transboundary cooperation; environmental objectives setting; characterisation of river basins; monitoring; cost recovery and water pricing; river basin management planning; and public participation. While analysis of legal frameworks and their implementation shows many areas of emulation, some features of the WFD in Turkey are an amalgam of pre-existing water institutions, the mimetic influence of integrated water resources management (IWRM) norms, EU policy and changing national water policy priorities: what we call assembled emulation. This observation has implications for future studies on policy transfer, Europeanisation, IWRM and Turkish accession.

Keywords: European Union; Turkey; Europeanisation; institutions; policy transfer; Water Framework Directive

1. Introduction

Integrated water resources management (IWRM) is a global paradigm for hierarchical water governance, with multiple variants visible according to national context [1]. Practical conceptualisations vary widely but IWRM essentially encompasses the integrated management of water and related resources at the river basin scale, in conjunction with multiple stakeholders, to ensure their equitable and sustainable use [1]. In the European Union (EU), IWRM is primarily implemented through the Water Framework Directive (or WFD). Introduced in 2000, the WFD has fundamentally transformed water governance across Europe through compelling the transfer of EU institutions for, inter alia, river basin management and planning, public participation and economic valuation of water resources into national policy structures, thereby contributing to a wider Europeanisation of environmental policy. Here, drawing upon rational choice institutional theory, 'institutions are conceptualized as collections of rules and incentives that establish the parameters on the behavior of individuals' [2]. 'Europeanisation' refers to the interaction between the EU and its Member States as well as externally with non-EU states, with this typically measured through formal, rule-based institutional change and its effects in domestic political contexts resulting from European level influence [3]. In particular, rational institutionalism explanations of Europeanisation interpret such domestic adaptation as stemming from the transfer of EU rules [3]. As a result of this process in

the water policy sector, different national implementation approaches for the WFD exist across the EU, prompting development of a significant academic literature examining its effects [4–6].

Europeanisation of water governance under the WFD is not restricted to EU countries. The EU has actively transferred WFD institutions to non-EU states, either through a process of policy transfer via network influence [7], or more coercive forms of transfer [8] whereby these states are incentivised to adopt them through accession conditionality. One such country is Turkey, which initially transferred WFD institutions in response to its 1999 EU accession agreement [9]. A critical requirement of the Copenhagen Criteria for accession to the EU is the obligation on candidate countries to adopt the environmental acquis; the body of EU laws and policy norms concerning the environment. Despite a declining accession process in recent years, as is due to a changed domestic policy context, Turkey has conversely continued to implement the WFD as part of the water acquis, leading to significant institutional change to its pre-existing policy structures, although a detailed analysis of the effects of this transfer is lacking. A critical question to emerge from this transfer process therefore concerns the extent to which external Europeanisation has led to convergence around WFD institutions in Turkish water policy.

As discussed further below, answering this question involves consideration of three dimensions of policy transfer. Firstly, determining the 'object' [10,11] of transfer, in this case the element of WFD policy, is of central importance for measuring convergence. Here, we focus on WFD institutions, or formal rules [2], as a measure of policy change. Secondly, the degree of transfer in institutional outcomes is a critical factor. Convergence is compatible with the complete adoption of EU water institutions in national policy frameworks. Thirdly, while transfer of WFD institutions to Turkey provides a key measure of convergence [9], consideration of their influence on the governance of water is also required. For this reason, this paper examines institutional transfer across the policy process in Turkey.

Our analysis is structured in the following way. We initially set out our methods, which involve developing an analytical framework for measuring the effects of external Europeanisation in the transfer of WFD institutions to Turkey, based upon its key implementing requirements. A brief context to the transfer of the WFD to Turkey is presented before this framework is applied to examine the integration of these institutions into Turkish water policy, in order to assess the degree of convergence. Finally, the analysis is used to discuss the future development of IWRM in Turkey along with the implications of the study for wider IWRM research.

2. Developing an Analytical Framework for Policy Transfer under Europeanisation

Policy transfer is understood to be an important mechanism within Europeanisation for ensuring convergence with EU institutions [12,13]. This process has been studied with regards to convergence within EU states [14], but also to non-EU states via political enlargement, including in respect of Turkey [15,16]. A rich literature has also evolved to provide analysis of how the WFD has been implemented in EU states [6]. However, the transfer of EU environmental institutions, particularly for water management, to non-EU states has only received limited theoretical attention in the academic literature [17]. For example, Fritsch et al. [7] examine the role of the EU Water Initiative (EU-WI) in facilitating transfer of the WFD to African and Central Asian states, but they do not explicitly use a policy transfer framework. Studies on EU water policy in Turkey are similarly descriptive [18–20], suggesting the need for more theoretically-informed research. Utilising a policy transfer approach for assessing WFD convergence requires consideration of several factors: the actual focus or 'object' [10] of transfer; policy outcomes and the degree of convergence; and qualitative indicators of transfer. This section therefore examines these factors to develop an analytical framework that is then applied to qualitative data on Turkish water policy, as is drawn from semi-structured interviews and documentary analysis.

2.1. Object of Analysis

The policy transfer literature identifies several objects for analysis. In his studies of lesson-drawing, Rose [21,22] primarily refers to programmes as objects for public policy learning. However, this conceptual emphasis is rather limiting. Dolowitz and Marsh [10], in their classic review of this literature, therefore identify six objects of policy transfer: 'policy goals, structure and content; policy instruments or administrative techniques; institutions; ideology; ideas, attitudes and concepts; and negative lessons.' They later return to this typology to add 'policy programs' to the list [8]. While by no means exhaustive, these features provide an analytical focus for policy transfer research [11]. For the WFD, we propose an emphasis on rule-based institutions [2] as the EU primarily focuses on transferring this element to states through the Europeanisation of environmental policy [23]. Here, directives, the most common EU environmental policy instrument, specify the general institutional requirements of policy to be achieved but provide some implementation flexibility through their legal transposition in national contexts [24].

2.2. Measuring Outcomes

Having established the object of transfer to be measured, the notion of policy outcomes must be considered. In other words, the actual results of policy transfer as a reflection of convergence. Again, the academic literature provides significant discussion of this subject, allowing the construction of an analytical framework. Outcomes can be placed along a continuum depending on the degree of transfer. Rose [21] argues that lesson-drawing by policy-makers can result in five outcomes: copying; emulation; hybridisation; synthesis; and inspiration. Copying equates to direct transfer of policy 'using practice elsewhere literally as a blueprint' [21]. Emulation, meanwhile, refers to 'adoption, with adjustment for different circumstances, of a programme already in effect in another jurisdiction' [21]. Hybridisation and synthesis encompass the combination of different programmes from other countries, while inspiration refers to external programmes merely providing an 'intellectual stimulus' for domestic action [21]. Reflecting back on this earlier study, Dolowitz and Marsh [10] support this categorisation, although state that '[w]e prefer to combine the two related categories of hybridization and synthesis'. By 2000, they still used this approach but only referred to the emulation category to denote combinations of policy transfer [8]. More latterly, Bulmer et al. [14] understand emulation as 'entailing the 'borrowing' of a policy model more or less intact from another jurisdiction' thereby allowing for 'adaptation to accommodate contextual differences', but otherwise they use Rose's original concepts.

The literature on policy transfer has since adopted other concepts to measure the degree of transfer occurring [11]. Recent research has focused on the notion of 'policy assemblage' [25–28]. Definitions are diverse, but for Prince [25] an 'implemented policy is an assemblage of texts, actors, agencies, institutions, and networks [. . .] at particular policy-making locales that are constituted by a complex of relations, including the increasingly spatially stretched relations constitutive of globalisation'. Although often associated with critical theoretical studies of policy translation and mutation [28], assemblage also recognises that policies which 'travel' can be drawn from multiple sources, both domestic and external, and therefore includes elements of influence as well, often reflecting global neoliberal agendas. While methodological questions arise over empirically researching the translational nature of policy assemblages [29], the concept can provide a useful heuristic device—in a positivist sense—for examining transfer outcomes that complements earlier, more rational conceptualisations.

For WFD transfer, copying would equate to the direct transfer of EU institutions by Turkey, i.e., the policy would be the same, resulting in complete convergence. If emulation is evident, WFD institutions would be transferred essentially intact but modified to fit existing practice during this process, equating to high levels of convergence. Partial convergence would be apparent where transfer of institutions has resulted in an amalgam of policy, combining elements of pre-existing domestic practice with the WFD and other external sources, i.e., assemblage. Convergence would be limited where the WFD has provided only superficial institutional influence for Turkish water policy.

For analytical purposes, a distinction should also be made between adopted policy and its implementation. The policy process can be divided into sequential stages that equate to the decisional and post-decisional phases of policy-making [30]. In WFD transfer it is therefore important to not only examine how institutions have been formally interpreted in Turkish policy, but also their implementation on the ground. Given the multi-level nature of the WFD, analysis should also focus on river basin management planning: the core procedural outcome of the Directive.

2.3. Indicators of Policy Transfer

In assessing the degree of policy transfer occurring in such outcomes, it is necessary to outline the key institutions of the WFD in order to provide qualitative indicators for assessing implementation in Turkey. Under the legal framework of the WFD, Member States are required to implement several rule-based institutions or 'articles' relating to specific implementing features (Table 1). For example, Article 3, 1. stipulates that they should initially 'identify [. . .] individual river basins' in order to create so-called 'river basin districts' (RBDs) as a fundamental unit of implementation [31]. Since the adoption of the WFD, 124 river basin districts have been established, although they vary in basin size, population, land use and water pollution issues. For example, the Danube River Basin covers over 800,000 km^2 and 19 countries [32], while Cyprus only has one RBD which extends across a total area of 9250 km^2 [33]. River basin districts can also encompass non-EU states (Article 3, 5.) and therefore requires that 'appropriate coordination' is undertaken 'with the relevant non-Member States' in order to achieve harmonisation in management throughout the basin [31]. Implementation has witnessed the development of transboundary coordinating institutions between EU and non-EU states, in addition to bodies for cross-border management. For example, implementation of the WFD in the Danube River Basin is coordinated by the International Commission for the Protection of the Danube River (ICPDR), to which 14 countries and the EU are contracting parties [32]. Environmental objectives must be set and a programme of measures adopted for each river basin district in order to prevent deterioration of water quality and achieve 'good surface water status' [31]. A characterisation analysis of the basin should be undertaken that reviews human impacts on water resources and provides 'an economic analysis of water use' (Article 5, 1.) [31]. Once established, the programme of measures for each district should be monitored against water quality objectives (Article 8). Member States are also obliged to impose cost recovery and water pricing to ensure that efficient use of water resources is made (Article 9). All of these measures should then be incorporated into a river basin management plan for each district, which is periodically reviewed (Article 13, 1.) [31]. Finally, development of the plan should be conducted in conjunction with public participation (Article 14, 1.). The 'active involvement of all interested parties' should be encouraged, particularly in producing, reviewing and updating the plan, while plan information should be made publicly available in this process to facilitate consultation [31]. Key institutional features and institutions of the WFD are summarised in Table 1 in order to provide a set of indicators for comparative analysis.

Table 1. Institutional features and institutions of the Water Framework Directive (WFD) [31].

Institutional Features	Institutions
1. Identification of river basins	Article 3, 1.—'Member States shall identify the individual river basins lying within their national territory and [. . .] shall assign them to individual river basin districts'
2. Transboundary cooperation	Article 3, 5.—'Where a river basin extends beyond the Community, the Member State [. . .] shall endeavour to establish appropriate coordination with the relevant non-Member State, with the aim of achieving the objectives of this Directive throughout the river basin district'
3. Environmental objectives setting	Article 4, 1.—'Member States shall implement the necessary measures to prevent deterioration of the status of all bodies of surface water'. 'Member States shall protect, enhance and restore all bodies of surface water [. . .] with the aim of achieving good surface water status'

Table 1. *Cont.*

Institutional Features	Institutions
4. Characterisation	Article 5, 1.—Member States are required to undertake the following for each river basin district: 'an analysis of its characteristics, a review of the impact of human activity on the status of surface waters and groundwater, and an economic analysis of water use'. Art. 7.—Member States must identify waters used for abstraction.
5. Monitoring	Article 8, 1.—'Member States shall ensure the establishment of programmes for the monitoring of water status'
6. Cost recovery and water pricing	Article 9, 1.—'Member States shall take account of the principle of the recovery of costs of water services, having regard to the economic analysis . . . and in accordance [. . .] with the polluter pays principle' and 'that water-pricing policies provide adequate incentives for water users to use water resources efficiently'
7. River basin management planning	Article 13, 1.—'Member States shall ensure that a river basin management plan is produced for each river basin district'
8. Public participation	Article 14, 1.—'Member States shall ensure that, for each river basin district, they publish and make available to the public, including users,' relevant plan information.

3. Methods

These 8 institutional indicators were then used to analyse the degree of WFD transfer that has occurred in Turkey. Qualitative data comprising primary, secondary and tertiary documentary sources were combined with policy-maker interviews to assess the extent to which these key institutional features of the WFD are integrated into Turkish water governance. Legal analysis was conducted on national water policy, primarily the current draft Water Law (discussed further below) and associated national by-laws for implementing the EU water acquis. Further documentary analysis was undertaken of national and river basin district WFD implementation reports, official implementation data and published academic studies. Interview data was derived from questioning Turkish national officials, EU representatives and policy actors in two case river basin studies: the Konya and Büyük Menderes. Both river basins are significant since they have served as pilots for the WFD implementation process (see below).

In total, 48 interviews were conducted between 2017 and 2018. This total included 3 interviews with European Commission officials (DG NEAR (Directorate-General for Neighbourhood and Enlargement Negotiations) and DG Environment) in Brussels. The main body of interviewing was undertaken with Turkish government officials in Ankara, with 19 participants from the Ministry of Forest and Water Affairs (MoFWA), 2 from the Delegation of the European Union to Turkey and 7 from the Ministry of Environment and Urbanisation (MoEU). Interviews completed in river basins included 11 in the Konya (Closed) Basin and 6 in the Büyük Menderes Basin. Interviewing followed a semi-structured approach of asking standardised questions around how transfer of the WFD was occurring and the extent to which it has been achieved in Turkey. Interviews typically lasted one hour and were recorded for later transcription and analysis.

The analysis of documentary sources and interview transcripts centred on whether WFD institutions have been directly transferred ('copied') into Turkish policy at national and river basin levels. From this analysis an assessment could then be made as to whether policy transfer has led to convergence. Conversely, the analysis also considered whether these institutions have been modified in the policy process or are absent, in which case policy transfer can be considered less effective and hence subject to emulation, assemblage or inspiration.

4. Results

To what extent has the WFD transferred to Turkey under the Europeanisation process? In considering this question, this section first goes back in time to consider the context to Turkish water policy in order to track the adoption of the Directive: a process which is still ongoing. Unlike the adoption process in EU Member States, transfer has not followed from initial transposition of the Directive into Turkish national legislation and policy, leading to implementation at the river basin

level. Rather, a twin-track approach has evolved via incremental national level institutional change alongside river basin level transfer of WFD institutions through various EU-supported initiatives known as 'projects'. Therefore, national (legal) and river basin (planning implementation) processes are considered together.

4.1. A Short History of Turkish Water Policy: From Localism to Europeanisation

Prior to 2002, Turkish water policy had accumulated into a body of uncoordinated water-related legislation with no single overarching water law. This situation occurred through the incremental development of a dense set of national and local legislation and national level implementing bodies in response to several discursive waves or 'paradigms' of policy development [9]. Such institutional 'layering' [34] began soon after the creation of the Turkish Republic with the adoption of national water legislation [35,36]. Prior to this point, reflecting the governance system established by the Ottoman Empire, water was essentially a local responsibility [37]. Centralisation of Turkish water policy continued in 1934 with the establishment of the national Ministry of Public Works, whose primary function was to support municipal drinking water provision. An era of centralised integrated water planning then proceeded under a national five-year development plan adopted in the same year [38]. Further centralisation occurred in the post-war period, primarily through the creation of the General Directorate of State Hydraulic Works (DSI in the Turkish acronym) in 1954. Water infrastructure for hydropower, flood control and irrigation became national economic planning priorities, alongside significant development of drinking water supply systems. Large integrated water management projects, influenced by practice in countries such as the USA and funded by international donors, became prevalent. By the 1980s, neoliberalism had exerted greater influence on the direction of policy. In 1981, municipal water and sanitation bodies were established to operate with independent budgets and the capacity to receive loans from foreign sources such as the World Bank, underwritten by government guarantees [39]. Privatisation has informed the direction of Turkish water policy in the intervening period, with the growing influence of foreign development loans becoming apparent.

Turkish water policy has more recently been informed by the Europeanisation agenda [9]. A central component of Turkey's EU water policy transfer strategy has involved adopting WFD institutions. This process started in 2002 through the EU-sponsored MATRA 'Implementation of the WFD in Turkey' (2002–2004) (MATO1/TR/9/3) project [40]. As a result, 25 river basin districts were identified nationally, with technical and financial assistance for implementation provided by the EU [9]. Turkey has since adopted several national by-laws and other legal measures to support this process, for example, the By-Law on the Determination of Sensitive Water Bodies in 2016. Several other by-laws are currently under development regarding, for instance, drinking water basin protection and water loss leakage control [9]. However, the most significant policy innovation for WFD implementation, a new national Water Law (WL), is still awaiting adoption [9,41]. Although discussed further below, the Water Law is designed to integrate Turkish policy with the WFD by endorsing the principles of river basin management and planning [41,42]. In parallel to national legal policy changes, Turkey has pursued implementation 'on the ground' through a series of additional EU-funded projects. The 'Strengthening the Capacity of Sustainable Groundwater Management in Turkey' (2006–2008) project was funded by the Dutch government to support implementation of the EU Groundwater Directive and WFD in river basins under the MATRA programme. It was followed by the EU Twinning Project 'Capacity Building Support to the Water Sector in Turkey' (2007–2009) which was intended to facilitate transposition of the WFD, using the Büyük Menderes river basin district as a pilot to develop a river basin plan [9]. Further Twinning Projects were then undertaken for assessing surface water bodies and water quality monitoring in line with the WFD (2010–2014), plus the parallel Floods Directive (2010–2014). Finally, the period since has involved preparation of River Basin Action Plans (RBAPs) and River Basin Management Plans (RBMPs).

This process was initiated in 2010 when RBAPs were prepared for 11 basins (Marmara, Susurluk, Kuzey Ege, Kücük Menderes, Büyük Menderes, Burdur, Konya Kapalı, Ceyhan, Seyhan, Kızılırmak,

Yeşilırmak) [9]. Plans for the remaining 14 basins were subsequently produced between 2011 and 2013. The RBAPs consist of several elements: a general description of the river basin district; field surveys and determinations of the environmental context; water quality classification; a calculation of pollutant loads; identification of prominent environmental problems in the basin and potential solutions; the planning of urban wastewater treatment plants; an overview of the preparation of the RBAP; and GIS data. By 2023, it is anticipated that the process of converting RBAPs to RBMPs will be completed. To support this aim, the Draft Büyük Menderes River Basin Management Plan was prepared under the MATRA programme. Currently, RBMPs are being developed for four other basins: the Meriç–Ergene, Konya and Susurluk RBDs under the Conversion of River Basin Action Plans into River Basin Management Plans (2015–2018) (TR2011/0327.21.05) project in collaboration with the Spanish Ministry of Forestry and Water Affairs [42]. To support conversion, stakeholder meetings have been staged to inform the public of plan development and invite responses.

4.2. Similarities with the WFD Model

As a result of this twin-track Europeanisation approach, implementation of the WFD in Turkey bears many similarities with the EU model. Although policy changes have been introduced to transfer the broader EU water acquis [9], national institutional innovations are best understood through examination of the draft Water Law [41], still under consideration by Turkish government ministries, adopted by-laws and implementation in river basins. These de jure institutional changes can therefore be considered sequentially alongside de facto implementation at the river basin scale.

Kibaroglu and Sumer, in their preliminary analysis [43], show that the draft WL broadly integrates with key WFD institutional requirements. The Turkish Draft Law will, once it is completed and adopted, recognise the concept of the river basin district, i.e., Article 3, 1. WFD (see Table 1). Water resources will therefore be legally organised around regional scale basin management [41]. Article 1, 1. (see also Article 4, 1.) of the draft WL thereby refers to the purpose of the Law as ensuring sustainable use of water resources using planning based on the watershed [41]. Although 'watershed' is most commonly employed in the USA to mean both catchment or river basin scales [44], the WL then states that waters should be assessed 'primarily in the basin' (Article 4, 1(a)) [41]. Watershed and basin are terms used seemingly interchangeably throughout the text, but application suggests that the WFD term is favoured for implementation. This obligation is already implemented through a national by-law, adopted in 2012 and revised in 2017 (By-Law on the Protection of Water Basins and Preparation of Management Plans 2012) [9]. The identification and assignment of river basin districts, as required under Art. 3 WFD, has also occurred under the MATRA project (see above) with the establishment of the 25 RBDs: the national Water Law will therefore effectively provide legal endorsement for their creation once fully adopted. The recent shift towards adopting RBMPs for all river basin districts also supports implementation of Article 13 WFD (see Table 1). The draft WL specifies a requirement, under Article 7 (1), that a 'management plan' is prepared by the Ministry of Forestry and Water Affairs (now the Ministry of Agriculture and Forestry) for Cabinet approval [41]. This plan should be compatible with the National Water Plan (Article 6 of the WL) and consider stakeholder participation, the impacts of climate change, water management at basin level and water allocation [41]. Water transfer can occur by considering basin needs and usage priorities where adequate water is available to transfer. For the Konya basin, this is an essential obligation due to the serious drought conditions currently being experienced.

Additionally, the WL prioritises the WFD notion of achieving environmental objectives for 'good' water quality (implementing Art. 4 WFD—see Table 1) through river basin management [41]. Article 4 of the WL covers the reuse of waste waters, good water status for surface and groundwaters, participatory approaches and eliminating the factors which negatively affect water quality and quantity [41,45]. Kibaroglu and Sumer [43] show how the draft WL 'establishes a hierarchy of uses [. . .] which seems to confirm the centrality of environmental objectives'. Article 5, 1. WL states that in establishing the right to use water resources, 'water needs for natural life' is prioritised above,

inter alia, drinking water, agricultural irrigation, energy, industrial uses, trade tourism, recreation and transport [41,45]. A national by-law for protecting water resources now supports this hierarchy [9]. Draft RBMPs also set out environmental objectives for water resources at the river basin scale [46]. For example, the Draft Version of the Konya Basin Management Plan closely follows Art. 4 WFD by adopting 'good status' objectives for surface and ground waters plus protected areas [47], a feature replicated in other RBMPs [48].

Both national legal measures and practical implementation shows that the WFD requirement for monitoring water resources has also been transferred to the Turkish system. The draft WL states that water monitoring should be conducted by government ministries [41], reflecting the requirements of Art. 8 WFD (see Table 1). Article 8 WL determines that water monitoring is conducted by the Ministry of Forestry of Water Affairs. However, if necessary, it can delegate this duty to the DSI and municipalities [41,45]. Few specific details of monitoring procedures are specified in the draft WL, but they are outlined in a supporting national by-law (By-Law on the Monitoring of Surface Waters and Groundwaters 2014) for WFD implementation [9]. In practice, monitoring systems are now being established in river basins [47]. In depth monitoring of water bodies has been undertaken for the production of the RBAPs and RBMPs [46–48]. The Draft Büyük Menderes RBMP shows that a network of 79 monitoring stations for 75 water bodies is now established to test biological, hydromorphological and physical–chemical elements of waters [48]. Interviews also showed that national and local policy actors were successfully learning monitoring approaches from EU technical experts.

Full cost recovery, central to the WFD (Art. 9—see Table 1), is also a key WL principle. Article 4, 1(e,f) WL thereby refers to '[p]ricing for water management services' and requires that '[p]ollution prevention costs are paid by the polluters; water supply costs are paid for water users' [41]. Article 23 (1,2) WL moreover specifies how water management services should be charged by the relevant ministry and managed by the DSI [41,45]. To an extent, this requirement should support implementation of WFD Article 9 which emphasises full cost recovery for water services to increase use efficiency. Indeed, Article 23 of the draft WL thereby refers to 'the principle of full cost' as a means of financing water provision [41,45]. Evidence from the interviews and draft RBMPs shows that cost recovery is now being considered in the development of programmes for implementing measures [46].

Public participation has, in addition, formed an important component of RBMP development, with stakeholder engagement mechanisms established at the river basin scale. Although the draft WL does not include public participation under its core Article 4 principles, when specifying watershed plan development Article 7 (1) does nonetheless require that this should occur through 'a participatory approach' [41]. As public participation is fundamental to the WFD (see Table 1), this aspect could be seen as positive when considering the effective transfer of EU institutions. Data from the river basin planning process interviews and documentary analysis would underline this requirement, with stakeholder meetings held during RMBP development [46]. For example, planning information and consultations were provided for the public in the Büyük Menderes process, the latter taking place through stakeholder meetings [48].

4.3. Differences with the WFD Model

However, there are some significant differences between Turkey's transfer of the WFD and the EU model. Again, we can start by analysing de jure institutional change. Divergence is most apparent when considering Article 3, 5. of the WFD (see Table 1). This Article compels Member States to engage in transboundary cooperation for interstate waters, but Turkey has not fully implemented this institutional requirement. Five main transboundary basins are found in Turkey: the Maritza (Meric); Euphrates-Tigris; Aras; Coruh; and Asi. According to the DSI, Turkey has historically sought to promote cooperation through bilateral agreements with its riparian neighbours [49]. Limited cooperation has subsequently occurred in the Maritza basin between Turkey, Greece and Bulgaria, with bilateral agreements signed with Greece for flood protection, erosion control, water diversion and environmental protection [50]. For example, Greece and Turkey signed a Memorandum of

Understanding Concerning Cooperation on Environmental Protection in 2001 [50]. But multi-lateral, interstate river basin institutions of the type established in the EU for WFD implementation are not evident, particularly with Middle East states and Georgia. After construction of the Atatürk, Keban and Karakaya dams on the Euphrates in the 1960s, Turkey became embroiled in disputes over water use with downstream Syria and Iraq. A Joint Technical Committee was created by Turkey and Iraq in 1981, followed by the signing of a Protocol between Turkey and Syria regarding the supply of water in 1987 [51]. Following further disagreements, a Joint Declaration of the High-Level Strategic Cooperation Council was signed between Turkey and Iraq in 2008 that resulted in a Memorandum of Understanding on water use in 2009. Despite some cooperation then occurring, ongoing conflicts in Syria and Iraq have significantly reduced transboundary coordination [52].

The setting of environmental objectives is broadly encompassed by the draft WL, and ecologically 'good' water status is considered in RBMP development. However, Turkey arguably has a different emphasis in objectives setting than that anticipated by the WFD, where the latter has explicitly targeted improving water quality and preventing its deterioration alongside other water uses. Despite the hierarchy of uses in the WL (Article 5) [41], drinking water provision is still considered as pre-eminent by the Government in its strategic development priorities, above water for 'natural life'. Moreover, water allocation for non-environmental (i.e., economic) uses underpins the language of national policy in the WL, forming a significant part of its legal requirements [41]. In practice, in the RBDs, agricultural, industrial and energy water provision is still prioritised over water for environmental services, reflecting the past development of water resources through large-scale engineering projects.

As identified above, characterisation of Turkey's river basins has been undertaken in line with Article 5 WFD, but full cost recovery remains a problem area [46]. The draft WL does explicitly identify this principle as a means of financing water provision but, as Kibaroglu and Sumer [43] point out, 'setting up a robust implementation scheme is another issue'. For this reason, the Ribamap project [46] in its review of Turkish WFD implementation stresses the need to establish 'an economic financial regime for the use of water in a new Water Act' that brings together measures currently dispersed across the legal system in Turkey. Economic analyses of river basins conducted, it argues, should provide sufficient information to allow assessment of the levels of cost recovery but also estimations of potential costs of measures for achieving environmental objectives, both of which appear lacking in the Turkish system [46].

In the same vein, Article 4 WFD (see Table 1) sets times for meeting objectives by 'achieving good ecological potential and good surface water chemical status at latest 15 years' after the adoption of the Directive [31]. However, the WL (Article 4) does not specify timelines, primarily because of potential difficulties faced in meeting objectives [41,53]. In addition, Article 7 of the draft WL [41], which provides details about preparation of the management plans, does not specify a schedule to renew them whereas Article 13 WFD mandates that RBMPs shall be reviewed and updated at the latest 15 years after the Directive's adoption, and every six years thereafter. The draft WL therefore has more general requirements for meeting objectives than the WFD.

Other differences exist in how public participation is interpreted. While the public was encouraged to comment on the draft Water Law preparation in 2012, they were subsequently excluded from its revisions after criticisms were submitted [43]. The Water Law itself does not set out public consultation procedures [41] but this aspect has nonetheless become an integral part of the RBMP development through implementation of the national by-law, with stakeholder meetings staged in the river basin districts [46]. That said, the WFD's prescriptive definition of what public participation should entail, under Article 14 (see Table 1), is not replicated in Turkey: interviews suggested that stakeholder meetings have lacked citizen engagement and often followed a more technocratic model of including institutional, academic and business actors to the exclusion of local people (see also [46–48]). In Büyük Menderes, for example, information was made available via websites and newspaper reports yet only three stakeholder meetings and local consultations were held, each featuring little public engagement [48]. As the Ribamap [46] concludes:

> 'Public participation is a prerequisite for the approval of the Action Plans in the River Basin Management Plans that comply with the WFD. The law must answer to this challenge. Initial solutions of indirect participation have also been suggested (through organizations and institutions representing different interests and sectors) integrated in each of the suggested organizational models.'

5. Discussion

In theoretically analysing the degree of institutional transfer occurring, we can return to our continuum of transfer outcomes. Analysis would show that Rose's [21] notion of direct copying, and indeed complete convergence, can be discounted since there is no exact replication of WFD institutions in Turkish legal frameworks or implementation practices. However, this is not unexpected since, as a directive and not a regulation (regulations are directly applicable in Member State law and hence do not require transposition), the WFD only requires transposition thereby allowing, as across the EU, some degree of flexibility in application. For example, river basin district establishment in some EU states has been interpreted to mean developing planning that maps onto specific hydrological units, while in others RBDs are essentially regional scale reporting devices that encompass several river basins. Public participation has also been interpreted in multiple ways according to national context, leading to a patchwork of practices and degrees of effectiveness [5,6]. In fact, there are widespread differences in institutional implementation across European states [54,55], suggesting that complete convergence is not a feature of the WFD generally.

At the other end of the continuum, we can also discount the EU WFD as merely providing policy 'influence' [8,10,21] for Turkey's IWRM programme. This transfer outcome would imply Europeanisation is merely incidental as an intervening variable to the WFD transfer process. Clearly this assumption is not credible for the situation in Turkey, given the degree of similarity with the EU approach in terms of river basin planning and other WFD features. Additionally, Turkey was compelled to adopt the water acquis in its entirety as a Copenhagen conditionality requirement: the former process continuing even though the latter has stalled. Turkey's continued production of WFD implementation reports and cooperation with the EU [46] would underline this point.

We could then understand transfer of WFD institutions under Europeanisation as more indicative of emulation rather than hybridisation, i.e., significant convergence. While hybridisation, according to Dolowitz and Marsh [10] refers to combining programmes from two or more external sources, which would not be appropriate in the case of Turkey, emulation implies transfer of key WFD institutions but with some minor allowance for contextual conditions. This feature is visible in the adoption of WFD institutional requirements in the WL and implementation of the Directive on the ground. If we take the example of establishing river basin districts and developing river basin planning, Turkey has taken significant steps to fulfilling both requirements. Characterisation of water resources has also been undertaken, along with the adoption of WFD principles of 'polluter pays', 'full cost recovery' and monitoring. Public participation, meanwhile, is also an accepted norm in the RBMP process in Turkey. Yet, rather than pure emulation, some elements of the WFD in Turkey are manifestly not derived directly from EU policy after marginal adjustment for context. Here, they could be described as an assemblage of EU institutions, pre-existing water norms and practices plus learning from other states around integrated water resources management, i.e., only partial convergence. A case in point is Article 3, 5. of the WFD, which has not been entirely adopted by Turkey. Although Turkey undertakes some minor bilateral cooperation with Greece and Bulgaria, for geo-political reasons—partly historical and partly pragmatic—it does not fully coordinate its actions with Georgia, Syria or other southern neighbours. The reasons are complex, reflecting long-standing disagreements with bordering states and the fractious political situation in the region [51,52]. Also, although Turkey does implement the WFD requirement for 'full cost recovery', it has a significantly different meaning in this context. In their view, Kibaroglu and Sumer [43] argue that the WL is primarily a vehicle for continuing the neoliberal privatisation process initiated in the 1990s. Finally, the WFD has been

'layered' [34] over a pre-existing institutional structure of water governance that drew on integrated water resources management practices, primarily from the World Bank, which were adopted from the 1980s onwards (See Mukhtarov for an analysis of policy translation and IWRM in Turkey [56]). Pierson's concept of 'path dependence' [57] or the institutional inertia of past interventions is helpful in explaining the current situation. As a consequence of previous IWRM transfer supported by foreign donors, management of water resources in Turkey still reflects a top-down, engineering development 'paradigm' [1] which emphasises the quantitative aspects of water provision for agricultural, energy or industrial use rather than the environmental quality objectives explicitly prioritised by the WFD (Article 4). Indeed, evidence from the RBMPs shows that similar derogations to those allowable under the WFD could be used by Turkish policy-makers to offset any substantial investments in improving the 'good' ecological status of waters [47]. Significant arguments have already developed in the EU over the application of such derogations for cost recovery in WFD implementation, thereby illustrating the widespread problem of interpreting this institutional requirement due to domestic political contexts [58]. This feature additionally reflects the way in which de jure WFD institutions generally have been redefined by EU national governments to satisfy de facto political considerations in implementing the Directive [59].

6. Conclusions

Turkey's adoption of the WFD raises an interesting contradiction whereby implementation of key institutions continues despite declining EU accession imperatives [9]. At face value, when considering policy transfer outcomes under this Europeanisation process, it is possible to show that emulation is evident, i.e., partial convergence. Turkey has largely transferred WFD institutions into its national legal frameworks and implementing structures at the river basin scale, with the essential DNA of the EU model visible in the system now evolving. Critically, however, significant differences remain. Most notably, the WFD compels transboundary cooperation for water resources, but Turkey's application of this institutional requirement is limited due to an assemblage of historical and geo-political factors. In addition, features such as full cost recovery, environmental objectives attainment and public participation are interpreted differently. As a result, we could speak of an 'assembled' emulation which, as Turkey moves along the continuum of policy transfer, may one day equate to fuller correlation and hence convergence with the EU approach. An alternative hypothesis is that, if accession incentives decline further due to domestic political conditions, IWRM in Turkey may evolve to become a quasi-WFD model, which cherry-picks principal institutional elements of the EU approach but is tailored for the Turkish context. This type of approach may also provide a model for other non-EU states who aim to implement a system of IWRM governance but lack the political desire or technical capacity to follow the WFD in its entirety. It may also provide lessons for the EU itself in revising the WFD in response to implementation issues, particularly in the Mediterranean region, that highlight the need for institutional innovation [60] and better institutional 'fit' with contextual conditions [61,62].

Such research also has implications for academic investigations into policy transfer, the WFD and IWRM more generally. Firstly, research is required into how WFD transfer is impacting water governance transformations in Turkish river basins, and particularly how individual actors are socially constructing its institutions through learning and socialisation [9]. Secondly, this research can help inform debates on EU policy transfer under conditions of declining accession incentives or even 'de-Europeanisation'. Further investigations into these dynamics will contribute to an emerging literature on this subject [63–65]. Thirdly, some reflection on how institutional implementation issues in Turkey compare to practice in existing EU states could be considered, particularly in areas such as public participation and cost recovery. Finally, the EU is now actively promoting WFD institutions globally through its regional Water Initiatives: multi-lateral policy transfer networks comprising EU bodies, governments and epistemic communities [7]. New forms of IWRM governance are consequently emerging but research is required into how EU transfer is affecting governance outcomes

in non-EU states [7]. Of interest is whether WFD institutions are transferring directly, partially or merely providing influence due to contextual constraints in state receiving environments. In addition, consideration is required as to whether wholesale 'packaging' [66] of WFD institutions is occurring or if transfer involves individual policy components, i.e., a pick-and-mix approach. Viewing such processes through the related explanatory lenses of policy transfer, lesson-drawing and translation theory [10,11,21,26,56] could therefore inform future investigations.

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Abbreviations

WFD	Water Framework Directive
EU	European Union
IWRM	Integrated water resources management
RBAPs	River Basin Action Plans
RBMPs	River Basin Management Plans
WL	(Draft) Water Law

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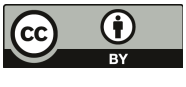

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Governance for Sustainability of Estuarine Areas—Assessing Alternative Models Using the Case of Ria de Aveiro, Portugal

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Abstract: Estuaries are one of the most productive and complex types of ecosystems supporting a wide range of economic activities. Departing from a set of governance problems and emergent goals, such as sustainability or climate change adaptation faced by an estuarine case study area, Ria de Aveiro, in Portugal, this article assesses the adequacy of alternative governance models under the existing water resources legal framework and traditional political culture. It shows that apart from the centrally-based compliance model, all other alternatives require high degrees of institutional reforms. Moreover, although the model based on a dedicated new agency, long preferred by many users of Ria de Aveiro, is the most understandable and focused, it does not assure the pursuance of adaptability or collaboration, which are considered essential for estuary governance. As it relies on collective action and multi-level and multi-agent contexts, estuarine governance may require a new institutional design. Where one begins a process of institutional change, however, is not a simple issue to address and demands a deeper analysis, particularly on the types of required institutional changes, as well as on their impacts on policy and decision-making outcomes over estuarine environments and associated socio-ecological networks.

Keywords: estuaries; governance; sustainability; governance models

1. Introduction

Estuaries are one of the most productive and complex types of ecosystems where coastal and fluvial waters converge. They provide rich habitats for people, flora, and fauna [1], and support a wide range of economic activities because of their strategic location [2,3]. Irrespective of decades of estuarine studies and subsequent knowledge [4], development approaches continue to put pressure on local resources and cause extensive changes across associated social and ecological systems [2]. In addition, overlapping responsibilities and multiple-jurisdictions [5–7], spatial-sector conflicts [8], and their complex socio-cultural environment [9] have intensified the complexity of the governance of estuaries. In this context, governance is understood as the set of means by which society determines and acts on goals, priorities, and chains of rules, policies, and institutions related to the management of the natural environment [10,11].

Given the persistent estuarine problems and challenges, without significant changes in governance, there is a risk that estuarine ecosystems will further deteriorate, causing serious social and economic

impacts [12]. Governance of estuaries has been questioned by many scholars [7,13–17]. Mono-level governance approaches (community-based or government-based) got strongly criticized in the estuary contexts [14,18]. New designs of estuary governance are increasingly associated with collective action and integrated planning [19–22], and also co-operative and collaborative approaches [23,24]. The complexity of estuarine governance, where water resources assume a vital role, and its interdependence with many different policy sectors and users, raises two major concerns. One has to do with the integrated water resource management concept. This is understood as a process that promotes the coordinated development and management of water, land, and related resources in order to maximize the resultant economic and social welfare in an equitable manner, without compromising the sustainability of vital ecosystems [25]. The other concern has to do with the challenges associated with governance approaches, i.e., the organizational settings established to accommodate the different policy priorities existing in an estuary, their decision-making tools and processes, responsibility boundaries, stakeholder involvement schemes, and the means to face the challenges of a dynamic and vulnerable system [26–28]. This paper is mostly concerned with this last challenge.

This article undertakes a critical analysis of the governance of Ria de Aveiro, a coastal lagoon and estuarine area in central Portugal, shown to be inadequate to face the persistent problems and emergent challenges brought by, among others, sustainable development and climate change [29–32]. Despite the numerous publications on particular management problems of Ria de Aveiro, very few bring to the fore overall approaches of the governance settings applied to it. This article further extends the policy paper elaborated by a group of researchers affiliated with the University of Aveiro to assess the governance of Ria de Aveiro [33]. It focuses on the existing water resources legal regime, which foresees different governance approaches, namely the centralized plan and the delegation of powers to municipalities or to the associations of water users. This paper addresses the following main research questions. RQ1: What are the main weaknesses of the current governance model of Ria de Aveiro? RQ2: What prospects can be associated with the alternative governance models foreseen by the National Water Act? This research, qualitative in essence and from a social sciences perspective, was based on literature review, as well as on legal documents and focus group analysis.

The next section proceeds with a literature review on concepts and challenges of governance of estuaries, based on a selection of papers referenced by the Scopus platform, covering estuaries, water resources, and governance. Then, Section 3 introduces the main features of typical governance models usually referred to in the specific literature in order to support the assessment exercise undertaken further ahead. Section 4 presents the method and type of information used in the case study analysis and assessment. After outlining the main features and the current governance problems of Ria de Aveiro, Section 5 exposes the results of the assessment exercise, displaying the prospects offered by each government model. The paper is concluded with the discussion (Section 6) of the results and with final notes and recommendations for further research (Section 7).

2. A Literature Review on Estuary Governance

Although the management of estuaries has long been a concern in the dedicated literature, the recognized socio-ecological complexity associated with estuaries has justified the increasing use of the term governance. In fact, the protection of estuaries is commonly associated with the challenges of governing collective action and the management of common goods alongside private interests and values. In the scientific literature the term governance associated with estuaries can either be found as an explanation to the existing problems [2,34–36] or as a source of hope to solve the problems by enabling the improvement of the ways communities and related institutions organize themselves in order to better protect and use estuarine resources and values [21,22,37]. These concerns emerge either associated with particular estuarine challenges, such as fisheries and other estuarine resources [8,15,34], water management [3,35,36,38] or climate change and ecosystem services [2,39], or associated with transversal issues, such as adaptive management, integrated planning and policy approaches [20–23],

co-operative and collaborative governance approaches enabling stakeholder engagement [24,38], or appropriate legal frameworks [35,40,41] able to incorporate estuary values and protection means.

Governance in estuaries is not a recent subject in the scientific community. During the 1990s, governance in the realm of estuaries was already being discussed by Imperial [1], who stated the importance of the design of "governance institutions" for estuarine ecosystems, including flexibility, adaptability, and capacity to learn. Later Schneider [42] added the relevance of new forms of "cooperative governance" able to nurture stronger ties and articulation between estuarine stakeholders and national and local policies. Focusing on the planning issues, Dorcey [24] stressed the relevance of a plan to improve estuarine governance and the inclusion of collaboration between government agencies and non-governmental stakeholders in order to ensure public understanding and political commitment to achieve sustainability of estuaries. Since then governance has been approached through diversified purposes and lenses.

Gibbs [19] uses a different lens by analysing the new modes of "spatial governance" at different scales brought by the European Union Habitats Directive (92/43/EEC of 21.6) and shows that the environmental regulations are able to reshape political–economic landscapes and absorb conflicts around estuaries. Also inserted within the estuaries in the European context, Ballinger and Stojanovic [20] focus on the new approaches to "environmental governance" brought by the European policy, the stimulus they bring towards more integrated approaches, and the need to overcome institutional and policy fragmentation alongside under-investment in integrated estuary planning. Focused on spatial planning approaches but with the concern of floods and risk management, Dawson [21] added the relevance of "governance arrangements" in the process of designing and adopting new structural risk prevention measures. The consideration of estuaries as planning units, while integrating sectoral policy approaches and related rules, may reduce boundary tensions and facilitate integrative governance approaches [31]. Moreover, besides the relevance of estuary plans to improve estuary management, robust "governance models" for plan preparation and implementation are also mentioned [37]. In this context, estuary governance arises as opposed to the command-and-control decision-making models [21,24], due to the need to react against the dispersion of power between public and private interests [38]. This may facilitate the conciliation of interests between agencies and users under a framework of "collaborative governance".

The focus on stakeholder engagement is also stressed by authors [15] when emphasizing that stakeholder participation must be pursued through "new governance regimes" with an embodied participatory logic. Others [43] add the theme of "risk governance" to the scientific estuary context and highlight the benefits of an approach aiming to disseminate knowledge to enable action and to promote awareness and analysis by local stakeholders and officials who face such emerging problems. Community-based and co-management governance is also mentioned in the literature. Some authors criticize the community-based view [14] because of its weak linkage between government and local people, because it is not capable of benefiting from government participation and support, as the state can threaten to impose a solution [44]. Others [14] highlight the merits of community-based management and co-management of estuarine resources. Co-management is understood as the sharing power between government agencies and non-government groups to enable effective collaboration among them [20]. Strong public policies and agencies are considered critical to face estuarine problems [34]. The need to articulate complex ecological (generally public) interests and proprietary (generally private) interests, numerous laws, and associated plans and policies [7,41] is also highlighted as a relevant factor to improve estuary governance.

Under the perspective of water resources management and the Water Framework Directive (2000/60/CE, 23.10), various contributions on estuarine governance have also emerged. Mendez [35] showed that the historical persistence of command-and-control approaches has been a path-dependent process leading to the emergence of "rigid institutions for governance" and, thus, argue that there is a need for flexible and adaptive institutions and practices. Taylor [36], however, mentions that estuary problems can also be associated with changing governance approaches, and therefore, name them as "problems of governance". Kotzé [3] add the relevance of "cooperative governance" to ensure

the protection of health benefits and ecosystem services supplied by aquatic ecosystems against the threats caused by frequent freshwater abstraction for human activities in estuaries. Despite the debate, it is usually concluded that "governance through bottom-up collaborative processes" is among the attributes of successful action addition [38].

In spite of the prolific literature on estuaries, recent contributions keep emphasizing the challenges raised by Imperial [1] in the 1990s. Some studies focus on the need to integrate new values within the traditional governance structures and communities to minimize conflicts [45]. Others focus on climate change concerns and on the need to integrate social-ecological systems to allow transformative adaptation to climate change among stakeholders, uses and values, public and private property concerns, public infrastructure, and human communities [39]. The need for "innovative adaptive approaches" to confront uncertainty, engage stakeholders, "improve governance", prioritize actions, centralize the role of science, and for holistic management have been referred to in many estuaries [46]. The need for multilevel approaches, means for effective collaboration of stakeholders [18], the building of common goals, "well-understood governance and decision-making structures", routine coordination and communication activities, and sharing of data are among the main recommendations for estuary governance [23].

Adaptation and integration are considered as key-words for estuary governance and related institutions [1,46–48]. Adaptive management is the way in which the most effective series of actions can be chosen across the linked estuary, river, and watershed system [46]. Despite the development of the country, estuaries require strong governance structures, stakeholder participation, monitoring, and feedback in the adaptive management cycle [47]. Moreover, estuarine institutions are capable of learning how to incorporate uncertainty, innovation, multiple stakeholder perspectives, and priorities [2,46]. It is also evident in the literature that the word "collaboration" has become an essential part of estuary governance for sustainability [24,38] and is seen as the heart of adaptive governance [49,50]. The creation of linkages for cooperation and mutual accountability at both local and higher levels can support achieving appropriate governance models [12]. Leadership by a dedicated management agency and a bottom-up collaborative process are also seen as important factors [38,51].

Sustainability is also considered a key-word in estuary governance literature, as it requires norms and collective action, long-term strategic approaches, compensation and funding for schemes, resource use regulations, planning and permitting, as well as consultation and public participation [52,53]. The design of effective governance institutions, however, faces the divergence of principles of resource management and sustainability among the different sectors usually present in estuaries [48].

In summary, the main integrative requisites are systematized by Carvalho and Fidelis [37] in their literature review on estuarine governance, which also mentions several other perspectives, as represented in Figure 1.

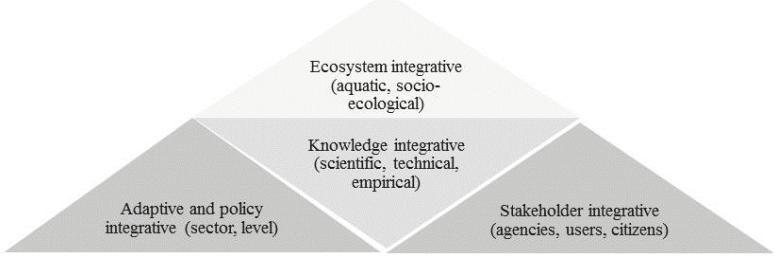

Figure 1. Requisites for estuary governance (adapted from [37].)

Effective approaches to decision making in estuaries should rely on (i) focused and dedicated agencies, (ii) goals and rules adopted after interactive processes, (iii) should be stable but adaptable, understandable, and accountable, and (iv) be supported by robust leadership, where traditional

command-and-control and top-down approaches give room to bottom-up collaboration governance schemes [32]. Having considered the requirements mentioned above, research on how the governance of estuaries has been equated deserves further attention.

3. Theoretical Assumptions of Governance Models

The concept of governance deals with a set of conditions that allow for an ordered rule and collective action [11]. It encompasses a series of interrelated phenomena including: (i) the dispersal of policy-making powers amongst a wide range of public and private actors, which often coordinate their actions in policy networks; (ii) the increasing importance of multi-level governance decision-making structures due to the loss of powers by the state; and (iii) the rise of new governance arrangements that rely significantly on horizontal decision-making or self-steering, as opposed to the conventional state-led command-and-control approach that traditionally governed the environment [11,54]. Kooiman [55] distinguish three methods of governance: the hierarchical one, where top-down directives from public authorities shape public policy; the self-governance mode, which is a collective-based approach to bottom-up policy building; and co-governance, in which several stakeholders cooperate in a mutual shaping process of partnerships. Co-governance presents greater potential to explain how state and non-state agents participate with legitimacy in policy building and service delivery. It tends to produce an equal arena for engagement, as hierarchical modes of governance tend to be dominated by state actors, whereas self-government is usually preferred by non-state actors.

The term governance implies that the interest of the analysis goes beyond the functioning of formal public institutions and stands on a wider notion of public policy, which includes the provision of services through non-state actors. It considers new ways of achieving collective action in the realm of public affairs, in conditions where it is not possible to rest (exclusively) on the authority of the state [56]. Consequently, a series of developments over the past decades have put pressure on the resulting multi-level governance performance. The flexibility and fragmentation of policy delivery instruments and the impact of scale and agencies' autonomy and scope demand particular attention. As stated before by Stoker [57], governance is moving into a new era "populated by a more diverse and varied set of institutions and processes". Studies [58] have pointed out several contextual reasons responsible for the emergence of this model, and identified different manifestations of this shift from hierarchical methods of provision: the proliferation of institutions at different tiers of government, involving private and public actors; the increasing complexity of policy networks; the emergence of innovation strategies and new capacity building demands; and novel mechanisms of accountability and leadership. As an example, the inter-municipal approach is understood as an available strategy to address problems of scale [59], often implemented in a top-down approach or encouraged by central governments [60]. It also aims at the improvement of planning capacities and the availability or quality of services to overcome fragmented territorial structures and cost reduction. However, even though economies of scale are seen as a clear advantage, cooperation between local authorities may bring new problems related to the democracy, efficiency, and stability of these governance arrangements [53]. Regarding Hendriks' [61] definition of governance, the system will be more effective (efficient, valuable, innovative, effective at solving problems) by involving all actors efficiently.

Over the last decades, many different approaches to governance have been put forward and have provided a relatively fair map of governance arrangements, but have failed to fully develop the practical implications for the agents involved and policy aims achieved. They have also failed in providing sufficient guidance on how to create adequate institutional design for effective governance. Consequently, scant attention has been paid to developing the necessary tools to assess the real extent of these different models. In this context, the delivery of public services and policy networking has resulted in unresolved problems related to the differentiation and integration of multiple private and public agents. The generic terms of collaborative governance, actually just an add-on to the concept of governance, or of co-governance, depict, in essence, very complex systems and not just shared rules between agents and a voluntary urge to engage in public policy decisions and

delivery. Institutional collaboration, particularly the collaboration this article addresses, results from an intentional strategy to involve multiple stakeholders. The institutional collaboration addresses the means to foster communication and collaboration between different government agencies with specific goals, responsibilities, and actions over a particular territory [1]. This entails an assemblage of processes to ensure coordination, shared power, resources, and information. Such a system does not need to be a replica of the way governments work, and is, in fact, most of the time, a new way of connecting the public and private spheres.

4. Methods and Information

The analysis and assessment of governance models in Ria de Aveiro has been structured along the following steps:

a. Introduction to the main setting features of the case study area based on published literature and legislation on water resources governance in place;
b. Identification of the main weaknesses of the current governance approach based on the legislation and focus group context;
c. Identification and broad description of the alternative governance models based on the literature mentioned in Section 3 and on the analysis of the Portuguese legislation; and
d. Assessment of the models, first, by identifying their major pros and cons, and second, by classifying them according to a set of governance factors obtained from the literature review [62], namely:

    i. if they require major institutional reforms, i.e., new rearrangements or tiers of government, competences, and scope of responsibilities;
    ii. if they require new practices, i.e., learning new skills and improving the pursuance of current responsibilities and related processes;
    iii. if they are easily understandable by communities and likely to reinforce trust relationships;
    iv. if they are adaptable and open to uncertainty, risk, and new decision-making processes;
    v. if they are focused on the estuary as a spatial unit; and
    vi. if they are capable of ensuring collaborative practices with all stakeholders.

A focus group is a research technique that tries to improve the information by using interactional discussion, which can have a multi-disciplinary potential [57,58,63,64]. The focus group used for the purpose of this research comprised a set of experts on Ria de Aveiro, including a political scientist, a spatial planner, a water resources expert, an environmental economist, a biologist, and a law specialist, and focused on the viability of the alternative governance models under the existing legal and political framework features and cultures, as well as their associated benefits and constraints. The prospects associated with each model were classified on a three-point Likert-like scale [65] according to likelihood of being pursued (i.e., certain, possible, or unlikely). The Likert scale rating system is widely used in social science questionnaires to broadly capture and measure the central tendency of people's opinions or perceptions regarding a particular theme.

5. Assessing Alternative Governance Models for Ria de Aveiro

5.1. Background Features

Ria de Aveiro is a coastal lagoon and estuarine area located in the northwest coast of Portugal where the sea and four rivers (Vouga, Antuã, Boco, and Caster) meet. It is a complex wetland and hydrodynamic system [66], separated from the sea by a fragile dune barrier 45 km long. It covers approximately 80 km^2 and has a lagoon shoreline of more than 150 km [67]. The lagoon forms four main channels (Mira, S. Jacinto, Ílhavo, and Espinheiro) with several branches, islands, inner basins, and mudflats, and connects to the sea through a single artificial inlet built in 1808 (see Figure 2).

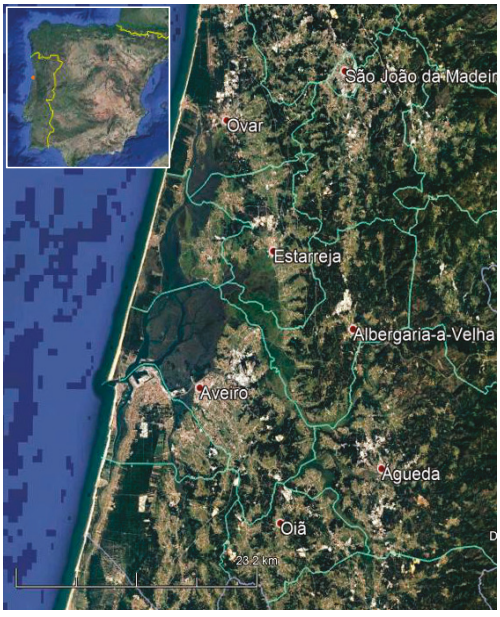

Figure 2. Ria de Aveiro, Portugal (source: Google Earth).

The Ria de Aveiro includes a hierarchy of environmental protection statutes, including "nature reserve", "national ecological reserve", and "Natura 2000 network" under the Birds (2009/147/EC, 30.11) and Habitats Directives (92/43/EEC, 25.5). Due to its low altitude and the flat topography of its marginal lands, the Ria de Aveiro is prone to large sedimentary deposition supplied from rivers, especially in flood seasons [68], as well as to tides, floods, storm surges, and upstream extreme events [69]. The estuarine natural capital and ecosystem services have considerable regional and national economic importance (port, aquaculture, salt production, fishing, etc.).

The Ria de Aveiro has been shaped by the communities around it over centuries, mainly through the harvest of the lagoon's seagrasses, the construction of salt ponds, the draining of salt marshes, the opening of inlets and the dredging of canals, and the agricultural smallholdings, named "bocage", which has enhanced biodiversity. The traditional activities that have shaped the ecosystem have declined and the estuary is now facing pressure from other diversified activities, such as urban, industrial, fisheries, aquaculture, agriculture, tourism, navigation, and ports, with different social and economic dimensions and cultural and historical roots. This has increased and threatened the ecosystem services and values of the estuarine system [29,70]. The expansion of the port and related interventions [71], such as the dredging operations of its main channels performed in the 1990s and the regular dredging of the entrance channel that access the port of Aveiro, have also contributed to changes in the tidal range, velocity, advance of the salt wedge, and sediment dynamics. These have aggravated flooding events on its margins [67], disturbing the estuarine ecosystems. Moreover, several problems related to extreme sea levels [72], precipitation, and river flow have affected the lagoon and its banks [73].

The area is surrounded by a scattered urban structure of small and medium-sized cities, summing-up to approximately 370,000 inhabitants and a population density of 219 inhabitants per km^2. Population pressure and industrialization have increased over the past decades, impacting the system's ecohydrology, habitats, and associated human activities. Water pollution issues include those associated with diffuse source pollution land use and agricultural activities [74,75], sewage treatment systems [66,76] and industrial activities [77], contamination of aquaculture resources [78], and sediment

contamination [79], especially with heavy metals, such as mercury [80]. Over-exploitation of species in the intertidal areas [81], habitat destruction [82,83], and abandoned salt marshes call for measures to protect natural values and biodiversity [84,85]. In addition, flood risks aggravated by the shoreline retreat [86,87] and oil spills from nautic activities [88] are also increased causes of concern.

The majority of the management problems faced by the Ria de Aveiro require further conciliation between the ecosystem services and vulnerability to the impacts of the human activities involved. This goal requires an integrated, or at least an articulated system of planning, permitting, and monitoring, as well as of economic instruments to support maintenance measures, such as dredging, banks protection, habitats recovery, water treatment, and pollution prevention. For this, the articulation between policy objectives, measures, and rules adopted by water, nature conservation, and many other sectors relevant in the estuary is crucial [22,31]. This articulation calls for collaborative schemes to identify and reduce conflicts [30,89].

5.2. Current Major Governance Problems

Ria de Aveiro encompasses ten different municipalities (Ovar, Murtosa, Estarreja Albergaria-a-Velha, Agueda, Aveiro, Ílhavo, Sever do Vouga, Vagos, and Mira), alongside a complex framework of public agencies with different types and levels of responsibilities. For a long time, port authorities managed the estuary in combination with local actors. In 2002, however, except for the port's immediate vicinity, most of the estuary came under the jurisdiction of the central administration via the Ministry of Environment. However, the transition did not include the allocation of adequate means or knowledge, and moved the locus of decision-making further away from the Ria de Aveiro, reducing institutional accountability and contributing to a period of inaction and disintegration of effective management. Since then, the management of Ria de Aveiro has undergone several metamorphoses and thwarted attempts to create a dedicated agency. The most recent of these have resulted in setbacks to ongoing attempts to bring decision-making closer to local stakeholders [30]. The successive institutional configurations [31], together with insufficient human, technical, and financial resources, have contributed to aggravating the overuse and degradation of the estuary resources and to weakening trust between management agencies and users.

The governance tasks of the Ria de Aveiro related to water resource management comprise components such as planning (frame of reference for decision and investment, setting priorities, rules, guidance, articulation of uses), actions and investments (promotion of measures for recovery, rehabilitation, upgrading and maintenance), permits (rules and guides to control the type and intensity of uses articulation), surveillance (verification of compliance with conditions of licensing or usage rules), and monitoring (monitoring the status and the impact of quality, improvement measures). All these activities are implemented with the collaboration of many different government agencies from various sectors, such as environment, nature conservation, economy, health, public works and ports, finances, maritime authorities, water utilities, estuary users, universities, and research centers [31]. The main weaknesses of the current governance model identified under the focus group analysis [33] stand out as follows:

i. It is materialized in a complex, and often poorly articulated, network of policy objectives, plans, standards, and actions, dispersed by multiple entities with different affinities and closeness to the Ria de Aveiro.

ii. The responsibilities for the management of the water and wetland area, one of the most important management components in the Ria de Aveiro, are currently assigned to the Portuguese Agency of Environment, IP, based in Lisbon, putting into question the principle of subsidiarity. The implementation of tasks through decentralized services is carried out with insufficient human, technical, and financial resources. In addition, successive institutional metamorphoses of public agencies responsible for water resources management, in particular at the regional level, have contributed to degrading trust levels between public administration and water resources users.

iii. There are other relevant public agencies related to agriculture, fisheries, aquaculture, industry, spatial planning, navigation, or civil protection, which in the absence of an integrated reference framework to guide decision-making, lack coordination and cooperation and fail to deliver the necessary integrated governance approach.

iv. Stakeholders' dissatisfaction with public administration has been quite evident. It also conveys a public perception that the lack of adequate management worsens the loss of value, not only environmental but also social and economic. In addition, the existing institutional mechanisms that would allow for more accountability and public participation are spread out in multiple procedures with few opportunities for a collective vision to be discussed and built in a consistent manner.

The current model is globally poorly understood, complex, inefficient, and with very weak accountability mechanisms. It has been also recognized as inadequate to address the persistent problems and emerging challenges in the area [31]. Environmental protection and economic development of this extensive and rich estuarine and lagoon area are considered key issues in the Integrated Territorial Development Strategy of Aveiro Region 2014–2020 [32]. Nevertheless, in spite of the emerging discourses for efficient use of resources and nature conservation [30], conflicting expectations between water users, government agencies, and non-governmental organizations (NGO) still prevail. Increased attention is required from different levels of government, namely the establishment of priorities and the adoption of measures able to secure their sustainable development and to improve resilience.

5.3. Assessment of Alternative Models

Considering the main features of the Ria de Aveiro, strongly related to water resource management and to the Portuguese Water Act and respective regulations that foresee diverse approaches to water governance, the following four alternative models have been considered for our analysis:

i. The "centrally based compliance model" relies on the current governance framework, with the allocation of responsibilities to the various existing government agencies and associated procedures, but is enriched with an estuary plan, where goals and rules for the protection and use of the estuarine area are to be established.

ii. The "municipal community-based compliance model" is based on the delegation of the current powers from the central government agencies to the Inter-municipal Community of Aveiro Region (CIRA). It would also be supported by a decision-making reference framework, i.e., an estuary plan (as mentioned in the previous model).

iii. The "collaborative model" is based on a system of governance through the main users of Ria de Aveiro, equated by the creation of an association of water users. This model would require a decision framework plan built out of a collective building process.

iv. The "multi-sector government agency model" is based on the creation of a new multilevel government agency with its own resources and autonomy, merging the different expertise and government responsibilities with particular relevance to the Ria into a single organisation. A decision-making framework plan would also be needed.

The broad benefits and constraints associated with each of the above-mentioned models are summarized in Table 1. The "centrally based compliance model" is based on maintaining the existing institutional status but is enriched with a decision-making framework based on a type of plan already foreseen by law, i.e., the Estuary Management Plan. The current legislation provides for the development of the plan for the Vouga Estuary (created by Law 58/2005 of 29 December 2005, with the regime established in Decree-Law No. 129/2008 of 21 July 2008, and with Order No. 22550/2009 of 13 October 2009). These documents establish the content, drafting process, and monitoring committee for the plan. This type of plan seeks the protection of the waters of river beds and banks and associated ecosystems, their integrated management, and the environmental, social, economic, and cultural improvement of the estuarine waterfront. Its main objectives include: (a) the protection and

enhancement of environmental features, ensuring the sustainable use of water resources and natural values; (b) the integrated management of transitional waters with inland and coastal waters, and the respective sediments; (c) the sustainable functioning of estuarine ecosystems; (d) the preservation and restoration of aquatic and riparian species and their habitats; and (e) the coordination with other relevant sectors or spatial plans and programs applicable in the area. Under this model, the different agencies, together with other stakeholders, can enable a coherent, decision-making framework. However, the model has a set of relevant constraints. The first stems from the expectation that institutional practices may change with the rules of a plan, even if resulting from a wide institutional participation process. The adoption of such an ambitious and complex plan does not guarantee the articulation and harmonization of the various responsibilities, powers, and specific autonomies constitutionally assigned to the existing government agencies. Even with a planning process built out of a long-term integrated vision by the relevant agencies (water, nature conservation, port administration, and municipalities), this model is prone to gaps. The typical rigidity problems associated with centralized and bureaucratic models may hinder the necessary adaptive management required in the very dynamic estuarine contexts. It also requires the efforts of public authorities to adequately involve stakeholders in decision-making processes. The existence of a decision-making framework based on a solid and representative public participation process and materialized in the estuary plan is seen as essential in guiding the activities in Ria de Aveiro.

Table 1. Pros and cons associated with the four alternative governance models.

	The Centrally-Based Compliance Model	**The Municipal Community-Based Compliance Model**	**The Collaborative Model**	**The Multi-Sector Government Agency Model**
Pros	- It facilitates the link to European and national water and nature conservation programs - It has fewer drawbacks on legal grounds, as it is the state defining the principles and rules to guide the decision-making	- It earns from the experience of inter-municipal collaboration - It is close to the lagoon, its problems, and challenges - It is close to the local users and to the regional authorities	- It responds to the conveyed willingness of users to participate in decision-making - It may be less sensitive to political cycles - It may address adaptive resource management	- It may simplify permitting procedures of uses in the estuary - It may join the best procedures from different agencies into the new institutional framework - It facilitates institutional cooperation
Cons	- It is unlikely to significantly change current rules in use - It is prone to gaps and rigidity problems which may hinder the necessary adaptive management required for strong environmental and economic dynamic contexts	- The delegation of powers from all the relevant agencies into Inter-municipal Community of Aveiro Region (CIRA) is unlikely - It does not assure effective institutional consultation - It requires a significant institutional capacity - It is vulnerable to political cycles - It requires significant supporting political	- It would not guarantee the inclusion of all relevant stakeholders - It would lead to a very complex collaboration process due to the wide variety of users - There is no experience with such collaborative practices	- It is unlikely under the political and administrative circumstances - It would raise legal and institutional difficulties - It would not guarantee, per se, the involvement of stakeholders - It would require high organizational resources

The "municipal community-based compliance model" is based on an update of the current governance practice by the delegation of responsibilities to the inter-municipal community (based on the terms of the provisions of Law No. 75/2013 of September 12, 2013), and hence can be understood as an incremental step. The fact that it is based in the region of Aveiro, with a meritorious learning process of inter-municipal collaboration, strong regional dynamism, and closeness to the lagoon and its users, offers CIRA the potential to take over its management. The proximity to users as well as to local and regional authorities also makes stakeholders receptive to this model. The experience gained within the institutional model of Polis Litoral Ria de Aveiro (a public company created to implement a set of water resources recovery projects, mainly from the responsibility of central government and from the municipalities), where CIRA had a relevant role in articulating central and local perspectives, may also offer good prospects for the performance of CIRA in leading the management of Ria de

Aveiro. The unlikelihood of a delegation of powers to CIRA from all entities, however, hinders the enforcement of an effective, efficient, and participatory governance system. Additionally, this model requires significant institutional capacity from CIRA and a process of knowledge transfer from the delegating agencies. Although it may be legally possible, it will surely require significant political will to support it. In addition, it could be considered as an exceptional example if compared to other estuarine and lagoon areas in the country, where water management faces similar problems and challenges. Governance may also become more vulnerable to political cycles. If implemented gradually, after small steps under a pilot program, for example, it could, however, allow a learning process that, if successful, can be extended to other policy areas in the estuary and possibly to other similar estuarine and lagoon areas.

The "collaborative model", created under an association of users of water resources (as foreseen in the previously mentioned Water Law and in the legal regime established by Decree-Law No. 348/2007 of 19 October 2007, and Ordinance No. 702/2009 of 6 July 2009) would allow users and organizations to manage the Ria through a collaborative platform. This could allow a more efficient management approach from a social, economic, and environmental point of view. This model would also respond to the frequently conveyed willingness of users to participate more actively in decision-making processes. It could also result in a more sustainable management system, based on the interests of the users and less sensitive to political cycles. Issues such as flexibility, adaptability, and ownership could be enhanced through this model. Formally, its operationalization could be based, for example, on the creation of an association of water users, foreseen in the Portuguese law. Although focused primarily on water management, it could equate the extension to other fields of use in Ria de Aveiro. This model, however, also has a set of weaknesses. On the one hand, not all the relevant stakeholders associated with the Ria are covered by water resource permits (a condition to be integrated into an association of users according to the law). On the other hand, the quantity and variety of existing users would turn the management into a very complex process of collaboration, for which there is still no institutional maturity related to such collaborative practices.

Finally, there is the "multi-sector government agency model" (created at sub-regional level, by incorporating and merging responsibilities over Ria de Aveiro that are currently spread over different government agencies from central and regional levels, including water management, nature conservation, and economic development). This model arises out of an old expectation of the region and an aborted attempt in 2005 to create the so-called "Integrated Management Agency of Ria de Aveiro", whose decree was never promulgated. It aims to bring together in a single entity the diversity of dispersed responsibilities and to simplify permitting procedures of activities and uses of the lagoon. Notably, users often manifest the importance of concentrating the responsibilities of permitting and surveillance on a single agency. This model, as built from scratch, would bring together the best of what currently exists across different agencies and would set up an institutional framework for integrated environmental governance. The political and administrative circumstances, however, are not very favourable for the creation of new public agencies. From the legal and institutional perspectives, the transfer of powers into a single agency would also raise relevant questions and obstacles. In addition, this model would not guarantee, per se, efficient and sustainable management, nor the involvement of stakeholders. Finally, and not less important, the organizational resources required for such a model could be particularly high. The creation of a public company, such as the one created for the implementation of Polis Litoral Ria de Aveiro S.A., is often cited as a potential example. Despite its relative success, this example has very specific aims and extrapolation and extension to other circumstances, responsibilities, and resources is difficult. Polis Litoral Ria de Aveiro S.A, is a public company with a restricted mandate in time, integrating a limited number of entities to perform a specific set of recovery actions and a set of constrained financial resources.

The comparative assessment of the four models crossed a set of six factors extracted from the estuarine governance literature (Section 2) and from the governance theoretical assumptions (Section 3) with a three-point Likert-based scale. The factors questioned if the models (i) require the adoption of

new institutional reforms to be operationalized or (ii) require the adoption of new procedures and practices, (iii) if purpose and policy outlines can be easily understood by all stakeholders, (iv) are easily adaptable to sudden problems (such as global change risks), (v) are focused on the specific challenges of Ria de Aveiro and, finally, (iv) allow the adoption of collaborative schemes (i.e., if they easily accommodate the participation of all stakeholders in decision-making). The scale was centred only on three points: unlikely (1), possible (2), and certain (3), so as to foster consistency and avoid subjectivity. The results are represented in Figure 3.

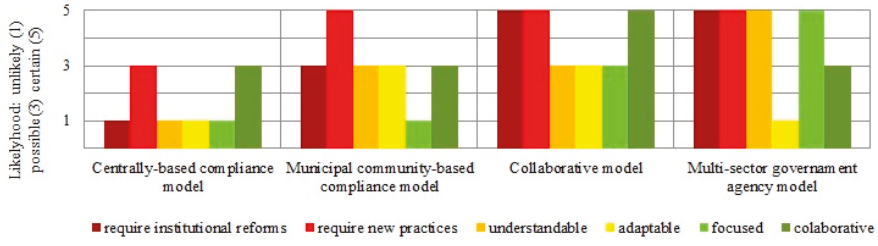

Figure 3. Comparative assessment of the alternative governance models.

All models except the "centrally-based compliance model", and the "municipal community-based model" were considered to require high levels of institutional reforms and new practices. Moreover, although the "multi-sector government agency model" is the most understandable and focused, the expected added value does not assure the improvement of factors such as adaptability or collaboration, considered as essential features of estuary governance. Basically, independently of the model, new practices have to be fostered. In addition, it may not be as adaptive or as collaborative as desired.

6. Discussion

The management of estuarine areas, where environmental, social, and economic challenges converge, and where institutional and government structures are complex, has been intensively discussed in the scientific literature [1,20,23,37,46–48,52]. They first seek to identify appropriate governance processes that overcome institutional barriers and "silos" of public policy, based on integrated learning, rethinking, and evaluation [46,63]. Secondly, they seek to understand the mechanisms by which society determines priorities, policies, instruments, and agencies under complex institutional and environmental contexts. Finally, they seek the articulation of multi-level decision-making and governance structures, based on the sharing of responsibilities and decision-making processes with users.

The complex problems and challenges faced by Ria de Aveiro require adaptive and interactive governance processes, with institutions and decision-making processes able to ensure coordination, both horizontally between economic sectors, and vertically between local, regional, and central levels of administration. They also require more agile mechanisms to improve the sharing of scientific and empirical knowledge among the public administration, users, and other interested stakeholders. This is essential for better decision-making processes in such a socially, economically, and environmentally rich ecosystem that is simultaneously vulnerable to the effects of human intervention, coastal erosion, and climate change. The surrounding society needs to be more responsive to the mutability of socio-economic and environmental conditions and able to interconnect people, places, and knowledge more robustly in order to preserve the values of Ria de Aveiro. It also needs adaptive and interactive governance, with institutions and decision-making processes capable of bringing together technical knowledge, users, decision-makers, and scientists in a collaborative platform, where values, expectations, rules, and resources converge. Ideally, given the complexity and diversity of sectors and stakeholders, the "collaborative model" brings together a set of characteristics with significant potential, but the current legal framework and the limited experience of both public administration and users themselves,

could cause obstacles to its operationalization in the case of Ria de Aveiro. The creation of a "multi-sector government agency model", in view of the difficulties already experienced in previous attempts and the associated financial and legal requirements, also raises concerns. In view of the above-stated constraints, updating the current model into the "municipal community-based model" might be seen as a viable alternative and can significantly enrich the current practice. It requires, nevertheless, the provision of a decision framework and the delegation of competencies to a lower level of government, following the principle of the subsidiary but without losing sight of the necessary regional framework. Thus, the delegation of powers to the CIRA, recognizing the historical relevance of inter-municipal collaborative learning, regional dynamism, proximity to the territory, and the agents concerned, can be justified as a more viable process for improving the integrated governance of Ria de Aveiro. We emphasize, however, that in addition to the necessary implementation of a decision-making reference framework translated in a plan, this model will require, on the one hand, the identification of the possible and desirable competencies need to be transferred, and on the other hand, their legal, political, and financial impact, as well as the required institutional capacity. This process will also demand the transfer of knowledge from the delegating entities.

Despite the advanced character of the Water Law in foreseeing various governance models, the assessment revealed that their implementation may require significant institutional efforts and new organizational steps, for which government agencies and stakeholders may not be fully prepared. It is true that in Portugal, multilevel and networked governance is pushing forward a more decentralized administration, reshaping institutional procedures. This paradigm shift has been emphasised through a gradual and recent delegation of competences to local and inter-municipal authorities. As networked governance demands a complex set of relationships and stronger ties between different stakeholders, in this article we argue that it also relies on the suggested institutional design. However, the process of institutional change is not a simple one to address, and, in fact, the focus on collective action in multi-level and multi-agent contexts implies recognizing that it demands a serious analysis, particularly of its impacts on organizational settings, policy delivery, costs, and efficiency.

The evaluation of the governance models undertaken in this paper was based on a set of comparative factors and qualitative analysis of the Portuguese legal and institutional setting, and consequently, is very context dependent. Nevertheless, the approach developed to analyze the models could be comparatively applied and tested to other cases and countries. The narrowness of the focus group is a well-known limitation of the analysis, as other areas of expertise, such as geology, aquaculture, tourism, administration, sociology, and finances would certainly enrich the results. Considering this is a qualitative analysis, the results provide coherent and relevant insights into the advantages and disadvantages of the governance models. Further research would have to be developed to identify and formulate the preferred model, as well as the distribution of responsibilities among government agencies and stakeholders able to reduce the specific estuarine problems.

7. Conclusions

The diversity of entities and often divergent policy objectives, plans and actions, successive institutional metamorphoses of public agencies, degradation of trust levels between administration and water resources users, and also the dissatisfaction of stakeholders with the role of public administration have called for a new governance approach to the Ria de Aveiro estuarine area in Portugal. This article assessed the potential viability and added value of alternative governance models of this estuarine area under the existing water resources legal framework and traditional political culture. It concluded that apart from the "centrally-based compliance model", all the other alternative governance models require high levels of institutional reforms. Moreover, although the model based on a dedicated new agency (i.e., "multi-sector government agency model") can be considered most acceptable and focused, the expected added value does not assure the improvement of factors, such as adaptability or collaboration, that are considered essential features of estuary governance. Inevitably, any new chosen alternative would require high levels of institutional reforms and the adoption of new practices.

Regardless of the model adopted, it is crucial to derive a stable collaborative framework of decision-making in order to integrate action plans and policies for integrated water resource management in estuarine areas. Multilevel and networked governance is pushing forward more decentralized administrations, reshaping institutional procedures, and searching for more effective and efficient public services. This paradigm shift has been accentuated through a gradual delegation of competences over the past few years. As networked governance demands a complex set of relationships and stronger ties between stakeholders, this article claims that its viability relies significantly on institutional design, with a focus on collective action in multi-level and multi-agents contexts. It recognizes that these new arrangements demand an in-depth analysis of their impacts on policy and decision-making processes, as well as on the outcomes and benefits to estuarine environments, resources, and associated socio-ecological networks. The success of the relevant political and technical approaches, either to improve the current model or to implement a new one, will strongly depend on the ability to integrate the various stakeholders in response to the challenges identified above. The apparent gaps of knowledge regarding the requisites and potential implications of different governance models for estuaries, however, underline the relevance of future research in this field.

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Article

Global IWRM Ideas and Local Context: Studying Narratives in Rural Cambodia

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Abstract: This article investigates how the "constructivist turn" in public policy and international political economy informs the interaction of global ideas and local practice in water governance. We use the implementation of ideas associated with Integrated Water Resources Management (IWRM) in the Lower Mekong river basin. This article provides some explanation of the attitudes in the villages in Cambodia due to the Sesan 2 Dam, which would see the relocation of thousands of people, damage fisheries, and inflict high coping costs on villagers. Based on 24 in-depth interviews with villagers, commune heads and local community leaders, we find diverse narratives which transcend the "pro or anti" dam narrative. We find four narrative types—myths, stories, noise and informed opinion, which relate to each other in degrees of social meaning and ideational force. Of these, the first two are more likely to be useful in terms of mobilization and policy-making. This typology provides a framework for analysis of social change in the studied villages and other contexts of policy translation. We should state that these four types are not separate from each other but are linked along two axis which together conscribe the four types of narratives outlined.

Keywords: dam; local communities; lived experiences; environmental narratives; Cambodia

1. Introduction

A prominent paradox in global water resources governance is the dichotomy between two concepts of "integrated water resources management" (IWRM) [1]. One way to view IWRM is to prioritize integration through planning and infrastructure projects across various sectors that influence water resources, such as irrigation, hydro-power production, recreation and drinking water provision and sanitation [2]. The birthplace of this reading of IWRM can be traced to the conservation movement in the United States of America in the early 20th century and the introduction and spread of multi-purpose dam construction, such as the Hoover Dam [3,4]. The conservation movement was rooted in the comprehensive rational planning approach that spread across many countries in the 20th century, including USA, USSR, Germany, China, and Tanzania, and resulted in large dams, irrigation channels and other big scale infrastructural projects [5–7]. A political scientist of development, James Scott (1998) [5], dubbed this approach as "high modernism ideology", based on state confidence in the ability of science and technology to manage natural resources and social welfare. This approach still continues to inspire political leaders and water practitioners who view IWRM as a largely technocratic tool to integrate water, land, ecosystem, energy and economic development related issues [4,8,9].

Another conception of IWRM, however, is that it builds on many failures of comprehensive rational planning and attempts of humans to master nature, and thus, strives to take into consideration ecosystem protection, long-term adaptation to and mitigation of climate change, and social justice of marginalized groups affected by water policy [2,10]. This is a more social and ecological reading of IWRM where the possibility of a "win-win-win" among the economic, the social and

the environmental is taken for granted. However, the issue of big dams shows that the holy grail of IWRM, the "win-win-win" scenario, is much more problematic in practice than in the theory [4,11,12]. Such big dam projects require large numbers of citizens to be moved, often have disastrous ecological consequences, and do not always favor local populations, who, for example, may see electricity generated by dams transferred to other regions [1,8,13]. This dichotomy is especially pronounced in the Mekong River Basin, where on one hand, large dams are proposed and being built, often in the name of integrated management of water, land and energy. This results in people being evicted from their ancestral land and resettled within a developmental discourse; on the other, the Mekong River Commission as well as individual member-states have worked to emphasize the need for water and food security, which are threatened by the dams, and to promote IWRM in the region [14,15].

This schizophrenic nature of IWRM presents empirical dilemmas to researchers striving to understand how the contradictory visions of IWRM may co-exist in the same space. Many riparian countries have drawn up IWRM plans, with commitments to the protection of the environment [16]. At the same time, they continue to regard economic development and the prosperity of their peoples as being vital. There is a need therefore to understand how these two discourses, and the practices they sanction, co-exist in the Mekong region at the national and local levels. With this paper, we do so at the local level in the case of a dam site in rural Cambodia where the global discourses of development and environmental preservation meet the local realities. Our goal is to understand which of these two interpretations of IWRM is most supported or opposed in our research site, and why.

Theoretically, we build on the idea of "contact zones" as used in post-colonial studies [17,18]. Pratt [17] defines "contact zones" as "social spaces where cultures meet, clash, and grapple with each other, often in contexts of highly asymmetrical relations of power, such as colonialism, slavery, or their aftermaths . . . ". According to her, the asymmetries of power and crude force do not explain fully the variegated experiences of the interaction between various ways of knowing and being, and are not determinant of the ensuing social order. For us, various sites where international discourses, ideas, and capital come in contact with national and local discourses, values, and ways of being to constitute the "contact zones" and the body of literature which studies policy mobility and translations can be of use in making sense of these "contact zones" and the nature of interaction in certain sites [19–21]. What is special in such a relationship is the "interactive, improvisational character of colonial encounters so easily ignored or suppressed by diffusionist accounts of conquest and domination" [17] (p. 4). The contingent, often unexpected and variegated ways in which the global meets the local in the context of IWRM is what interests us in this article.

As Benson and Jordan [22] mentioned, such an emergent and fluid view of "policy in the making" is at odds with more conventional and formulaic approaches of policy design, policy implementation or theories of policy diffusion, policy transfer and learning [22–24]. Instead, "policy mobility and translation" as an approach in policy studies, looks at policy movement in a manner that resists attempts to theorize it through various macro-level structures and explanations, and views the ensuing policy process as a micro-political process which is context specific, interactive, improvisational and contingent [21,25,26]. The ideas of policy translation and "contact zones" provide us with the conceptual tools to make sense of how the global and the local interact, and to argue that narratives may be a well-suited tool to understand such interactions.

We draw from a constructivist view of international political economy (IPE), especially in the form offered by Abdelal, Blyth and Parsons [27]. As they contend, "(t) he central insight of constructivism is that collectively held ideas shape the social, economic, and political world in which we live" [27]. In charting their notion of a constructivist IPE, the authors propose four paths to consider. These are (a) the path of meaning; (b) the path of cognition; (c) the path of subjectivity; and (d) the path of uncertainty. We build on these four categories of a constructivist IPE in order to offer an account of how international policy discourses and material interests manifest themselves on the ground and make impact in the Mekong region. More specifically, we bring in a case study of the Sesan 2 Dam in

Cambodia in order to illustrate our key points and offer a view on how IPE may relate to public policy in the case of the environment.

Our paper is organized as follows, Section 2 presents our treatment of approaches to study how the global and the local intersect, and introduces a discussion of policy translation, "contact zones" and a significant modification of the four paths of a constructivist IPE advanced by Abdelal et al. [27]—from four distinct types into a two-by-two matrix, which sees each type in relation to the others, as well as a continuum of pairs. Here, we present our framework for studying the "contact zones", and a discussion of our methodological choices of ethnographically informed "lived experiences". In Section 3 we introduce our case study in rural Cambodia where the Sesan 2 Dam has been proposed. Section 4 presents our analysis and discussion of data from interviews with the villagers on the way they experience the global ideas on the ground. Finally, Section 5 summarizes and concludes the paper.

2. The March of Constructivism in Politics

In this section we discuss how constructivist ideas have shaped both public policy studies and IPE in the recent decades. Our goal is to provide some similarities in the way one may approach these two disciplines which are usually discussed separately and have conventionally been homes to communities which rarely intersect. We first discuss interpretive policy analysis and especially the role of narrative analysis in it, and then move on to discuss the constructivist notions of IPE.

2.1. Interpretive Policy Studies and Narratives

The interaction between constructivism and policy studies have been growing over the past decade [28–32]. In empirical investigations, these have ranged from regulation [33], to poverty [34], the role of science in public policy [35] and water management [36–40]. Since the early 2000s, there are also a number of key volumes which define and clearly distinguish interpretive policy analysis from other forms of policy analysis, such as Deborah Stone's "Policy Paradox: The Art of Political Decision-Making" [41], Frank Fischer's "Reframing Public Policy: Discursive Politics and Deliberative Practices" [42], and Peregrine Schwartz-Shea and Dvora Yanow's "Interpretive Research Design: Concepts and Processes" [43].

Arguments for constructivism within policy studies can be examined in two broad strands. First, the epistemological critique which takes issue with the fact that the only legitimate units of analyses in the production of knowledge are limited to observable behavior [44–47]. For these scholars, the positivist, empirical-scientific conception of the policy sciences fails to give a good account of what goes on in government and public policy more broadly [48]. For example, Dryzek observes that "generalization in social science is a chimera, as all situations are different" [48] (p. 310). He and other advocates of interpretive policy analysis suggest that we should look instead to interpretation and perceptions of a constructed reality in the process of policy making [43]. The "interpretive turn" in social sciences in the late 1970s and 1980s [49] was soon joined by others who argue for a hermeneutic approach to social sciences [50].

This approach prioritizes attention that an analyst gives to a policy narrative. Proponents of the narrative approach recognize that information is transformed both in its production and its use, that is to say, how people construct and communicate reality [50–52]. A field of narrative policy analysis has indeed been in formation since the publication of Roe's book [53] on the subject. Furthermore, Feldman et al. [28] speak about how narrative analysis benefits the study of public administration by allowing researchers to examine the "unstated, implicit understandings that underlie the stories people tell" (p. 147).

From the lens of these scholars of narratives, reality is a composite of empirical facts, values and other factors such as history, emotions and social context; all coalescing into a policy story. From this, we infer that a change in narrative would be a push towards policy change, or at least accompanies such a change.

The second strand of scholarly attention concerns itself with the notion of objectivity in constructivism. Ricouer [54] says that a narrative has an objective meaning that can be "constructed in various ways". He notes that, in a public discourse, the problems of right understanding can no longer be solved by a simple return to the alleged intention of the author [54] but must be construed by a process. "A text has to be construed because it is not a mere sequence of sentences, all on an equal footing, and separately understandable. A text is a whole, a totality" [54] (p. 158).

For Fisher, a collection of such understandings qualifies as "knowledge" which he thinks ought to be expanded "beyond the narrow confines of observational statements and logical proof to include an understanding of the ways people are embedded in the wider social contexts of situation and society" [55] (p. 179). Understanding policy change therefore requires us to take a thick description approach to depicting reality [56]. Fisher [55] (p. 108) furthermore writes: "(t) he key to explaining how change comes about has to be grounded in a detailed contextual examination of the circumstances at play in specific cases. For this purpose, quantitative methods have to take a back seat to qualitative research." This follows the broad field of "interpretative policy analysis" advocated by such thinkers as Yanow [32] and Schwartz-Shea and Yanow [43].

Further to this epistemological thread, Lejano and Ingram [57] argued that narratives form new knowledge, which is different from the objective, value-neutral paradigm of scientific knowledge, but not divorced from it. Such "narrative knowledge" [57] (p. 62) is produced whenever we translate complex, technical or scientific knowledge into everyday ways of knowing—integrated with our beliefs, emotions, history and identities into a coherent and meaningful whole [58,59].

2.2. Interpretive Turn and International Political Economy

The interpretive turn has also reached IPE which concerns itself with global issues. The constructivist notion of IPE has been developed to oppose material interests and political power as the major, non-exclusive, explanatory frameworks for international politics and global world order. Among many proponents of taking ideas, norms and discourses seriously in IPE, Barnett and Finnemore [60–62], and more recently Blyth [63] and Abdelal et al. [27] have argued for change in theoretical approaches.

Abdelal et al. [27] outlined four paths that such scholars may follow—the path of meaning, cognition, subjectivity and uncertainty. First, the path of meaning which calls attention to the politics of knowledge, and how policy actors construct meaning in the process of appropriating international discourses within a particular geographic or political locale. Notably, the view of international norms has emerged as key to this approach to political economy as "international norms define the boundaries of choice and thereby affect how societies, policymakers, and market participants discern the meaning of various policy stances" [27] (p. 9).

This type of research looks into how international organizations set norms to member-states and by this means define the boundaries of what is legitimate [60]. It also looks at how international organizations become "norms entrepreneurs" by pushing particular meanings on states and non-state actors, most notably, Transparency International and Freedom House rankings in pressuring states to fight corruption and institute "good governance" [64]. Framing the politics of norms and discursive contestations around the notion of legitimacy are all parts of this type of analysis [27] (p. 16).

The second is path of cognition which calls attention to the taken-for-granted assumptions in policy design and implementation, but also challenges the dominant role of rational choice and technocratic measures in decision-making [65]. Here, scholars are interested in extra-cognitive influences on the way humans construct their worlds, assign meanings to social processes and make polices as a result. This literature looks at the role of emotions, values, affect, and performativity [1,66], and is a growing strand in interpretive policy analysis, which may also be applied to IPE in this regard.

The third is the path of subjectivity, which stresses the importance of the structures and forms that allow for pluralism and multiple ways of knowing in discussing what counts for "reality" and "truth". Here, the major attention is drawn to how international discourses are created to constitute

actors and define what is "thinkable" or not [27] (p. 14). A good example is Epstein's [67] analysis of the anti-whaling regime, which managed to persist in the presence of scientific data that whales are not endangered and could be safely hunted. Thus, there is a dialectic relationship between agency and structure in this type of work, agents work on defining norms and discourses, which once they become dominant, constitute agents and their preferences, which in turn "reproduce or incrementally shift structures" [27] (p. 14).

Finally, the fourth is the path of uncertainty and unpredictability of policy, and the basic dilemma it poses—how can institutional design happen in the face of inherent unpredictability and contextual sensitivity of social practices? In this strand, the very notion of social reality is cast as emergent and contingent. In economic research, Keynes [68] was among the first to argue that the world is too complex for economic models to have the predictive power, and in IPE such scholars as Blyth [69,70] have taken these ideas further. As we will see in the next subsection, this is one of the key tenets of the "policy mobility and translation" school of public policy.

Drawing on these four paths, researchers of constructivist IPE reconceive how international developments take place [27,43]. Here, neither structure nor agency are privileged, but the dialectical relationship between the two illuminates the on-going process of contestation and fixings of ontologies (or reality). The result of our theoretical expositions is a typological modification of Abdelal et al. [27] in relation to the "contact zones" to fit it to our field explorations.

2.3. Analytical Matrix for Exploring the Global and the Local

In this, we conceive of the four paths of constructivism as two pairs along two continuums rather than four isolated types. First, within our narrative framework, one pair of contrast is between meaning and subjectivity. Meaning, we conceive of as essentially social, where the meaning is established by its relationship to others. This idea takes bearing from Saussure [71] where language is the result of a link between a signifier (words or images) with a signified (i.e., the concept). There is no "value" or specific meaning resulting from the mere linking of signifier and signified; instead meaning only emerges in relationships with other signs in the language-system. Hence, narratives are said to be meaningful in relationship to other narratives held by people in the community [57]. This stands in contrast to a subjective, a solipsistic conception of what the person feels without reference to social conditions, or others in the community.

Statements in the latter tend to be self-referential. The other pair of paths is an uncertainty and cognition continuum—high cognition means informative statements that weave different empirical facts together in a coherent whole and display high understanding of state of affairs. Uncertainty is the opposite—characterized by many doubts, gaps in knowledge, fears, or emotional reactions that may not be warranted by the objective state of affairs.

With this, we construct a simple matrix—on the horizontal axis, an ideational force with which the "reality" is constructed through the prominent discourses, and where narratives have either strong or weak power of persuasion. On the vertical axis, the degree of social meanings, of how subjects make sense of the changing role of water, hydropower and the impact of dams. Here, "meaning" captures the collective nature of social meanings or ways of knowing, and "subjectivity" captures the phenomenological aspect of our interest—the lived experience of farmers and local communities.

In attempting to understand how various agents construct the narratives around the dam, we will tease out the differences among those two axes. In the next section, we discuss the case study site in rural Cambodia, the policy proposal to build a dam on the tributary to the Mekong River, and our methodological choices in this study. The conceptual framework we have suggested above would come together with the empirical data outlined in Section 3 and inform our major discussion below in Section 4.

3. Case Study and Methodological Choices: Sesan 2 Dam in Cambodia

Cambodia's Gross Domestic Product (GDP) per capita has tripled between 1999 and 2013. Along with this growth, comes rising demand for electricity—at the rate of 17.9% annually from 2012 to 2020. Cambodia is projected to grow to nearly 16 million within the next few years, with 80% of the population living in rural areas. The country's capital Phnom Penh consumes 90% of its total electricity [72].

Currently, most of Cambodia's electricity demand is met by imported electricity from Vietnam, Thailand and Laos, as well as locally-produced oil generators. High reliance on imported fossil fuels and electricity, lack of electricity in rural regions, and escalating energy demands are challenges being faced by the Cambodian government. Against such a backdrop, hydropower projects appear attractive as a means of producing clean energy while catering to the overall economic development of the region. About 80% of over 60 million people living along the Lower Mekong Basin rely on the river for livelihood, food, socio-economic activities and other ecological services. The lower Mekong River includes Sesan and Srepok, two tributaries of the Mekong.

Our research site is along the Sesan River which flows through Central Vietnam and northeast Cambodia, in the province of Stueng Treng. In November 2012, a 400-megawatt dam, the Lower Sesan 2 (LS2) dam project, was started with an investment of US $816 million. The company is formed with a majority stake from China's Hydrolancang International Energy and Cambodia's Royal Group. Most of the electricity will be sold to state energy provider Electricite Du Cambodge (EDC) or exported to Vietnam under a 40-year contract [73].

A 2012 study [74] by US and Cambodian researchers estimated that the dam, once constructed, will deplete fish biomass (due to fish migration blockage) in both Sesan and Sreypok, by more than 9%. Experts have also warned that the LS2 dam might significantly change the hydrology of Mekong River and Cambodia's Tonle Sap Lake, while diminishing sediment flows to the Mekong Delta.

The Rivers Coalition in Cambodia, a group of non-governmental organizations (NGOs), have reported the dam reservoir is set to flood more than 30,000 ha, most of which is forest area including some 1200 ha of community farmland and housings. As a result, illegal logging in the affected forests has significantly gone up. A few active NGOs in Cambodia have challenged the government's evaluations of the complications arising from the LS2. They have argued for more open discussions between the government and civil society groups, including non-government organizations and civic leaders [72].

The 2009 Environmental Impact Assessment (EIA) shows that the dam project will displace nearly 5000 villagers in about 1100 households from seven villages in four communes. However, the 2009 report points out that the impacts might be much worse than predicted in the EIA. Villagers who live along the Sesan and Srepok Rivers upstream of the LS2 as well as 87 villages of the tributaries of the two rivers, will lose access to migratory fish. The same research also found that over 22,000 villagers living downstream from LS2 would be negatively impacted as a result of changes in river hydrology and water quality [73]. The 24 villagers interviewed come from three affected villages (Sreh Kor 2, Plork, and Kbal Romeas, where Sreh Kor 2 is upstream and Kbal Romeas is downstream). The location of these villages is indicated in Figure 1 below. The interviews were conducted over three days, from 11–13 August 2015. The three villages shared the following characteristics—there were many medium income households (except for Sreh Kor village where households appear to be more well off than the rest of the villages). All the villagers were highly dependent on river water for both drinking and daily usage. The villagers typically worked as rice farmers, non-rice farmers, and fishermen. Importantly, for our study of constructivism and narratives, the households are situated near to one another so that the flow of information is good and community meetings are frequent. We have not pursued a comparison across villages and did not therefore code utterances by interviewees in accordance with the village they come from. While the names of the interviewees are known to authors, because of requested anonymity we do not provide any references to the authors of

quotes. Instead, we categorize these quotes in the four categories we have devised and count these in order to understand the comparative spread of these types in our sample.

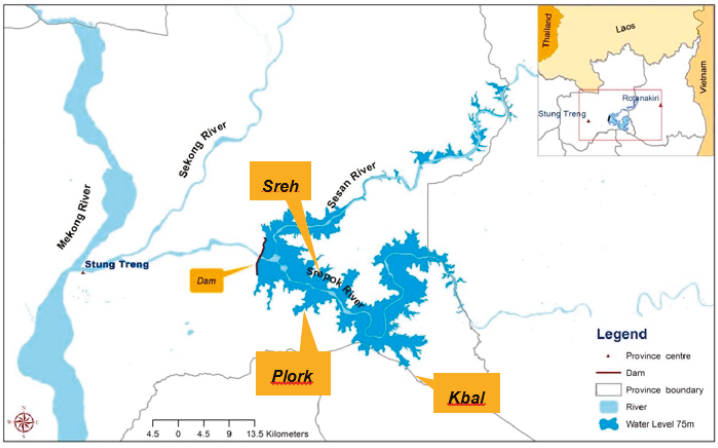

Figure 1. Map and location where fieldwork took place. Source: The map was retrieved from CDRI (Cambodia Development Resource Institute), Theavy Chom.

The lived experience method was operationalized with an interview guide (see Appendix A) along three themes, namely (1) Everyday Use of Mekong River, (2) Hydropower Dam and (3) Perceived Participation. The breakdown of interviews in Sreh Kor 2 (11 August 2015), Plork (12 August 2015), and Kbal Romeas (13 August 2015) is as in Table 1. The interview guide is presented in Appendix A.

Table 1. The matrix of social construction of international political economy (IPE). Based on Abdelal et al. [14].

		Ideational Force	
		Uncertainty	**Cognition**
Degrees of Social Meaning	**Meaning**	I feel afraid, that life will be more difficult. When they construct the dam, they will close the big river and they will create the new small one. I forgot how I got this information.	I worry a lot. I am afraid that when we go to new land, it won't be as good as the old place. Second, I am afraid that the land cannot be farmed. I do not know that kind of land. We grow rice, we harvest rice. We plant fruits, we collect fruits. We worry. New land is not the same as old land.
		Q1 (Myths)	Q2 (Stories)
	Subjectivity	The river gives us fish and water. As water is unclear, we have to adapt to that.	Yes, there are benefits. I think we cannot win (to stop the dam). They (NGOs) can just explain things to us. We understand but we cannot do anything. We protested several times, but they do not care about us. They do not "take their ear" to listen and they walk away.
		Q3 (Noise)	Q4 (Informed Opinions)

We base our research on the method of "lived experiences", which has its roots in ethnographic methodology and phenomenology [75]. We are interested in the storylines that local residents have with regard to resettlement (e.g., Rousseau [76]). Here, we are not interested in gaining information from our research subjects based on the concepts or codes which we have designed a priori, but allow for those ideas to emerge from the fieldwork, in terms and meanings experienced and formed by the researched themselves [57]. This is closely related to ethnography as a research methodology [77]. Ethnography can be defined as "a family of methods involving direct and sustained social contact with

agents, and of richly writing up the encounter, respecting, recording, and representing at least partly in its own terms, the irreducibility of human experience" [78] (p. 5). Narrative is a unit of analysis in this research as it allows to understand the reasoning of people which may otherwise appear senseless or difficult to explain [79].

The contemporary forms of ethnography have been called "ethnography-lite" as the world is increasingly inter-related and on the move [20,80]. Kubik [81] speaks of "ethnographic sensitivities" where ethnography is global and multi-sited. We follow in the steps of these scholars, but limit ourselves to the "lived experiences" at the local level for this study. As our major point with this article is to discuss how IPE and public policy inform each other through the use of narratives and "contact zones", our case has an illustrative power.

With regard to how we operationalized this method, we do not claim that each statement constitutes a "narrative" but rather how such a statement, together with other similar, stands for a certain narrative type. Of course, individuals can hold beliefs across different narrative types, and such beliefs can change over time; and indeed, the momentum and pervasiveness of such beliefs have great impact on how local narratives regarding development and dams are constructed.

A more detailed multi-sited ethnography and policy interviews with other actors involved in the construction of Sesan 2 Dam as well as the stakeholders at the national and transnational levels would be useful for an extensive "political ethnography" of this project. This, unfortunately, is beyond the scope of this article.

4. Discussion: Narrative Types

As a result of coding the interview transcripts, we identified four categories present in the field: "Myths", "stories", "informed opinions", and "noise". Each category has attributes which vary across two scales: The extent to which a narrative is shared among community members, and the extent to which it is consistent and coherent as well as powerful in making a point. We discuss each of these categories below with quotes from the transcripts.

4.1. Noise

On the weaker end, noise is what we call fragmented narratives, uncertain in factual origin and not embedded in any social norm or view. They are often transient and uncertain in origin and emotional in content. Narratives here are often not fully formed. Here are a few examples of noise from our fieldwork site:

> "This is because, I also don't know, but I heard from others that it is because they construct a dam at the end of the river."
> "I don't know what to do next. I don't really have experience what to do besides doing farming and raising fish."
> "We have no fish anymore, so what should we do? That's why we should raise the fish. I have no experience, but I have to learn. If everyone raises, I will follow them."
> "So, we do not dare to say if their suggestion (proposing compensation) is cheap or expensive. We do not want to leave our home. Our house is not cheap to build. Who wants to leave? Even if you have a boat, do you think you can take me and my husband? No, you cannot take us. We cannot live on the river. Only Yuon (Vietnamese) build houseboats to live on water. We cannot. Khmer and minority do not build house on water (river, lake)."

These quotations indicate much confusion and fragmentation in terms of bits and pieces of information, often invalidated, which are not yet well shaped into a narrative, of such a narrative is, these are fragmented and poorly articulated.

4.2. Myths

Myths are powerful, but they may lack full grounding in fact. They tend to appear in situations when information is scarce, and no clear communication is provided. In our case, they occur in a number of areas, such as resettlement, water quality for drinking, fishing and the possibility of markets opening up in places with hitherto available water. Below are some quotes from our interviews which indicate that such myths lack clarity and are shared among multiple actors. Here, it is important to note that we use the term "myth" in order to signify a story which does not rely on factual information but is told in a cohesive manner nevertheless. We realize that the study of myths in social sciences is rich in various approaches (e.g., de Guevara [82]), and qualify our use of the term "myth" in that particular fashion.

> "Water is public use since it is available all the time so there is no complaint about the shortage of water and we also do not have to buy it. But the quality of water from the river is not good because there is Yali dam construction in Vietnam. The quality of water has changed since 2001. In the beginning, I didn't know the dam project but just noticed that during dry season water levels had suddenly dropped and boats disappeared. Before 1999, people could use water for direct drinking but now we have to boil it."

The passage above shows that the resident has made sense of the change and has a cause-effect model to link the dam with adverse effects on water quality and quantity. However, there is much uncertainty about the future and possible ways to deal with the situation.

Another example of a myth-like statement is this: "I am afraid that life will be more difficult. When they construct the dam, they will close the big river and they will create only the new small one. I forgot how I got this information".

This quotation from an interview with a farmer indicates that there is little clarity, and gaps in information in terms of the future plans of the government and possible impacts of these on the river. In such uncertainty, multiple narratives and myths appear.

The following two passages further illustrate little certainty about the future, and thus confusion among people who are not sure whom to believe or what to expect. Such uncertainty is unsettling and does not contribute to trust in government or between citizens.

> "According to them (government officials), not much land will be flooded. But those who campaign against the dam says there will be a big flood. It is hard to decide. People say that the waters will reach a height of 5 m. If so, it will flood the house. Others say water will not reach 5 m."
>
> "I don't know. I'm just worried that water will be contaminated and there will be lack of water. Now the dam is still opened, but if it is blocked, the tree branches or its roots will be rotten and drop to the river that will be hard to consume. That is the point."

4.3. Informed Opinions

Opinions have a stronger footing in fact. However, there is little sense of a shared understanding, or of looking at interests in a collective manner. Here are some examples of informed opinions of farmers and villagers. These are much better articulated than the myths or noise, but are not as widely shared as stories are. They are pronounced from a singular perspective and have consistency and clarity to their narrative.

> "I used to join the meeting twice with the dam representative. And I try to raise the issue, but the price is still kept the same as original. The chief of the village has also complained to the provincial department, but they still use the original plan."
>
> "To my family, this Sur San River provides a lot of benefits to me. Along the river side, the vegetable is plentiful there. The fish is also available. The environment is clean as well. In contrast, it has been changing now."

> "I did not get it. People who live at the down side there is no compensation. However, for those live at the upstream side they had. Three persons from the upstream dam didn't get compensation yet. I also have land there, but it is far from dam."
>
> "To me, people should negotiate through the local authority because they are more powerful and because they have meetings, public forum. When they say in this meeting, their suggestions will be recorded in the minutes of meeting. They, most of the time, complain the company through organizations. The company makes excuse that people are against the development project. The company is careless with the people. Right?"

4.4. Stories

Unlike myths and noise, stories are high in cognition and social meaning, and have a strong outward-looking, other-regarding component, rooted as well in different empirical facts which are more established than the case with the myths. Below are a few examples of these.

> "The government should bring the compensation book and consult with people (villagers). People should be involved in determining or setting the price of that compensation. This is done in order to know whether people agree or not first."
>
> "I worry a lot. I am afraid that when go to new land is not good as old place. Second, I am afraid that the land cannot be farmed. I do not know the kind of land. We grow rice, we get rice. We plant any fruits, and we get the results. We worry. New land may not be the same as old land."

These quotations underpin uncertainty, but with a more articulated position from the respondent in terms of advocacy, what is right or wrong and how they could possibly act upon these. Stories are also riddled with emotions, values and morality claims, for example:

> "Advantage is we can have electricity country wide, and even sell it to outside the country. However, we cannot conclude it until there will be result we can see."

This suggests a lack of trust in government and in people reporting deviant behavior. At the same time, there is a stronger sense of social justice in the statement below:

> "I think that river is a property for all, not for people, or government. It is a property for all. We have to help each other to protect the river, like protect not to have illegal fishing, take care of fish. We must cooperate to protect it."

Stories are the most articulated and widely shared form of narratives and have much in common with advocacy in a sense that they solidify the framing, actors and cause-effect relationships. By such explicit framing, these stories are most likely to gain support of other villagers and develop into a social movement with clear advocacy implications.

5. Conclusions

In this paper, we looked at how local populations in three villages in rural Cambodia, namely Sreh, Plark, and Kbal Romeas have experienced the proposal to build a large hydropower dam in the vicinity of their villages, which reflects the global trend of displacement and increased construction of dams in the South-East Asia often framed in the language of IWRM [8].

The environmental impact assessment showed a number of impacts on their livelihoods, such as the inundation of land, the impact on fisheries and the need for about 2000 people across a number of villages to leave their ancestral lands. With regard to this, we have concerned ourselves with the "lived experiences" of villagers in their everyday life and dependence on the Mekong River.

Theoretically, we have conceptualized these three villages as the sites of "contact zones" where the global push for development comes into contact with the local reality of everyday life and cultivation of rice, fisheries and other economic activities. We are interested in exploring the narratives

advanced by our interviewees and making a distinction between strong and weak narratives on one continuum, and confusion and opinion on the other. To help make sense of the narratives from the field, we modified the typology of Abdelal et al. [27] and put forward a 2 × 2 matrix for classifying narratives.

The four types which we identified are: Myths, stories, noise and informed opinion. Of these, the first two are more likely to be useful in terms of mobilization and policy-making, given that the latter then to be more self-regarding. However, the four quadrants are linked, as narratives evolve from one form to another.

One contribution of our article is to argue that the four paths to social construction can be conceived of jointly as part of a simple matrix. We have also used an empirical test to show how narratives in a certain case can fall into each of these quadrants and how the narratives and discourses in each quadrant differ from one another.

We have argued that stories are strong narratives—coherent and with a strong causal progression, with delineated objects and subjects and causes. These also are socially shared and not individually perceived. Myths are moderately strong narratives, but with a less solid grounding in coherence with external, objective factors. Weak narratives are not socially shared and hence lack the strength of persuasion and richness which the strong narratives have. When a respondent has expressed confusion and uncertainty about the situation, often in terms of fear and lack of control, and when such sentiment has been stated for him or her individually, we have coded this as "noise"—a concern which however is not yet developed into a narrative.

When actors have stated their ideas in a more coherent fashion, presenting causal stories which however were not clearly shared among community members, we coded these as "informed opinion." While the latter may be useful for individual action, the former are poor guides for collective action, for which only strong narratives are useful.

As a result of our study, we found that the anti-dam sentiment among the interviewed villagers is the strongest, and hence gives rise to strong narrative of resistance to the dam and preservation of their land and habitual lifestyles (88 references to this narrative). However, a narrative which we labeled "weak narrative" comes close in its support. It views the building of the dam as inevitable, and encourages villagers to organize in order to achieve a better compensation and future adaptation to changing life conditions. This narrative is common (52 references to it), but it lacks the same symbolic and mobilization power that the anti-dam narrative has, as there are no advocacy groups or NGOs which could strengthen the narrative on behalf of the villagers.

A number of villagers expressed high confusion and helplessness with regard to coming changes (62 references to it), and some others have been clear on how to change things towards better, but not certain if this is achievable (64 references to it). Overall, the two narratives can be discerned from the interviews—a strong "anti-dam" narrative and a weaker "adaptation and accommodation" narrative. Interestingly, we found no evidence of support to the dam despite the presence of compensation for resettlement process as well as the strong support from Cambodian NGOs advocating for resettlement on behalf of villagers to secure the best deal [83].

We found that strong narratives are most visible in the field, but not necessarily the most legitimate, or most widely shared ones. We also found that many ideas and opinions stated individually have the potential of developing into strong narratives. What we are not able to explain at this stage, however, is what makes this shift possible, from weak narratives to strong ones, and from confusion and opinion to weak and strong narratives. It seems to us that these are based on strong leadership, on the open forum for deliberation and discussion, social capital and trust in a community, and possibly the presence of skilled intermediaries, or translators/narrators, who could add symbolic and political power to narratives by making it richer and more authentic. Such leadership may emerge from villagers themselves, but is more likely to originate from national NGOs and advocacy groups that seek to represent villagers at higher levels of governance and fora where the dam is discussed. Baird (2016) [83], in the context of the Sesan 2 dam, raised a possibility that NGOs may pursue some of their own goals in representing villagers in higher level governance fora. If these concerns are grounded, it is important

to understand whether such NGOs first need to create a uniformity of narratives among villagers to rally their support and acquire authority to represent them. Such uniformity is apparently lacking in the villages that we studied—to the opposite, some are ready to fight the dam until last resources, while others prefer to focus on negotiating the best deal for compensation, and the third group remains unorganized and confused. This diversity of experiences enriches the accounts of anti-dam sentiments described by Baird (2016) [83] in the case of the Sesan 2 dam, and other scholars in other dam sites [8,84,85]. Future research should throw light on the extent to which such narrative diversity is an impediment for successful advocacy.

Returning to the major subject of this article, the role of IWRM in the cases of dam-driven development projects, it seems to us that the two incompatible notions of IWRM represent meta-narratives that adversarial parties use to mobilize support in their political struggle. IWRM, however, plays no role at all in the language of villagers. This indicates at a discursive, rather than pragmatic nature of IWRM in this case study; IWRM is a tool to achieve political goals by opposing parties in the conflict around the Sesan 2 dam. Instead of IWRM, studying local narrative types helps understand how such higher level political struggles may develop, but is also important to register lived experiences of those most impacted by the dam, how such experiences get mobilized into anti-dam advocacy and by whom.

This paper thus provides a finishing piece in the move towards adaptive management and IWRM, with the recognition that water governance requires not just the technical management of water but an integration of the human dimension [86,87].

In the case of water management, the notion of "adaptive capacity" has become a necessary component of IWRM, with the need to ensure that designs of water management systems allow the incorporation of new socio-technical systems, the building of social capital in an actor network and restoring multi-functional landscapes [88]. Researchers in the past have argued that local participation provides the best platform of creative adaptation to local context [89].

Given this, the "lived experiences" of locals, with their knowledge of historical development, the physical characteristics of the basin, and other contextual factors, greatly affects how river basin organizations are formed, how they change over time and the functions they perform. Therefore, while this investigation takes places at a granular, local level, it has important implications for how national narratives form and hence how transboundary cooperation can succeed, or fail, as political pressures coalesce around local concerns.

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Appendix A. Detailed Interview Guide

A detailed interview guide was established with questions revolving around three themes:

(1) Everyday Use of Mekong River
(2) The building of the Hydropower Dam
(3) Perceptions of Participation.

The themes are developed in order to formulate the "Local definition of Good Governance in Mekong River". The research aims at identifying related priorities, including those associated with the particular needs of women, the equitable sharing of benefits of river development, and the meaningful accounting of ecosystem services.

The research questions were then translated into local dialects and the interviews briefed on these. The questions are guides, and some of the respondents veered away from these—we recorded these and coded their own responses.

Interview Questions

Everyday Use of Mekong River

1. How would you describe your use of Mekong River or Se San River? What is the most important thing of Mekong River that you use?
2. How is Mekong River part and parcel of your everyday life and why?
3. According to your everyday experience, have you noticed any change in Mekong River? What are the changes? What do you think are the causes of the changes?

Hydropower Dam

1. Do you know about the development of Lower Se San 2 Dam or Ya Li Dam in Vietnam? How do you feel about it?
2. How would your life change, or be affected after the hydropower is constructed?
3. If affected, do you receive any compensation from the government or developer? What are they?
4. Have you experienced any water related disasters like flood and drought? Why did they happen? How did it affect your life? What do you think should be done?

Participation

1. How does the government engage you and community in the development of hydropower? Why?
2. Have you ever provided any suggestion to the authority on the development of dam? Was it effective? Was it accepted? Why?
3. Have you ever been involved in any activities to protect the river and environment? Why did you do it?
4. Are there a lot of women participating in those activities? Why did they participate?
5. What are the skills that you think you need to improve your activities in protecting the environment of Mekong River?
6. How should the government govern Mekong River? Why?
7. What do you think your community should do to protect the environment of Mekong River?
8. Looking ahead, what are some of the most urgent issues that we should be considering in terms of Mekong River?

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Governance Arrangements for Integrated Water Resources Management in Ontario, Canada, and Oregon, USA: Evolution and Lessons

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Abstract: Guidelines produced by some major international organisations create a misleading impression that Integrated Water Resources Management (IWRM) can be implemented in a standardized fashion. However, contextual conditions vary from place to place, and differences in beliefs, attitudes, customs, and norms sensibly influence interpretation and implementation. Experiences with IWRM in Oregon (USA) and Ontario (Canada) are examined with regard to scope, scale, responsibility, engagement, finances and financing, and review processes and mechanisms. Development of IWRM and the evolution of governance have been shaped by different concerns and beliefs. Oregon has adopted a locally-driven and entrepreneurial approach, whereas Ontario developed a co-operative inter-governmental approach. In both cases, IWRM governance has also evolved due to changes in funding and priorities, which have benefitted some catchments and communities more than others. Both cases provide positive examples of reflexivity and resilience, and demonstrate the importance of review processes and strong cross-scale connections for effective governance. While underlying principles may be relevant for other locations, it would be a mistake to think that either of the two approaches for IWRM could be replicated elsewhere in their exact form. Implementation of IWRM in other parts of those countries and the world should, therefore, start with careful analysis of the local context, and existing governance arrangements and governmentalities.

Keywords: catchment; conservation authorities; governance; governmentality; integrated water resources management (IWRM); watershed councils; Ontario; Oregon

1. Introduction

Integrated Water Resources Management (IWRM) has a long history that began in the early 20th century. Reflecting their times, early examples such as the Tennessee Valley Authority focused on natural resource-based economic development, job creation, and social welfare [1]. In the last 20–30 years, IWRM has been re-cast and is now widely regarded internationally as a key approach for achieving water-related sustainable development goals [2–4].

One unfortunate consequence of the globalisation of IWRM as an idea and ambition is that various major international organisations have produced guidelines, which can create a false impression that IWRM is a single, universal, and relatively straightforward approach that can be applied and transferred in a blueprint and sequential fashion. Examples include the guidelines produced by the Global Water Partnership Technical Committee [5], and the United Nations Educational, Scientific, and Cultural Organisation (UNESCO) guidelines for IWRM at a river basin level [6]. In effect, some

international guidelines send a message, perhaps unintentionally, that if policy makers and water managers do the prescribed things, in the recommended ways, and in a particular order, then effective development and implementation of IWRM is assured. However, practical experience suggests that implementation does not, and cannot, work in such a way.

It is obvious that political, administrative and cultural beliefs, attitudes, customs, and norms vary from country to country, from region to region, and even in some cases, from community to community. Furthermore, the highly dynamic, and at times, turbulent nature of society in the 21st century means that any form of linear, highly structured, and programmed policy approach is unlikely to work equally well in each case where it is applied. This view implies any one approach for IWRM that might be favoured and be possible in a catchment or river basin in one part of the world cannot be assumed to comfortably "fit" and operate effectively in all other places. We believe that the varied, context-sensitive, and nuanced nature of water governance and management has important implications for how we should think about, and investigate, IWRM. Rather than attempting to identify universal "best" practices according to pre-determined performance-related criteria or guidelines, a more productive approach involves examining different meanings and interpretations of IWRM in varied spatial and temporal contexts. This change of focus could lead to deeper and more critical research questions and insights regarding how IWRM has emerged and evolved according to varying political, economic, social, and environmental circumstances and needs in particular places, including stakeholder preferences regarding institutional approaches and styles of decision making (i.e., different governmentalities). We believe that this approach is more likely to produce more meaningful insights regarding the reality of IWRM when compared with the results from evaluation studies that strive to assess effectiveness according to generic measures, indicators, or criteria.

In this paper, we adopt a place and context specific approach by examining the evolution of governance arrangements for IWRM over multiple decades in Ontario (Canada) and Oregon (United States). Thus, our aim is to describe and explain why IWRM emerged and how associated governance arrangements have evolved. Ontario and Oregon were chosen for several reasons. Both have many decades of experience related to IWRM, and both are within countries with established and democratic federal state systems of governance. However, Ontario was an early-adopter of IWRM in the 1940s, whereas Oregon was a relatively late adopter of IWRM in the 1980s. In addition, as some of the findings below demonstrate, the two cases show important differences in general approaches to governance and regarding preferred policy approaches concerning water and catchments. As such, we believe some interesting parallels, similarities, and differences shed some fresh insight on how governance arrangements for IWRM take shape and evolve in different, yet comparable situations.

The discussion is organised as follows. We begin by defining and briefly commenting on the nature of governance, governance arrangements, management, and IWRM. This is followed by a summary of our research approach and methods. Attention then turns to the analysis of the two case studies, focusing on six key aspects of IWRM governance: scope, scale, responsibility, engagement, finance and financing, and review processes and mechanisms. The paper concludes by identifying and describing the main insights regarding how and why governance arrangements for IWRM have evolved in particular ways in the two examples, and the potential lessons for implementation of IWRM in other contexts and places.

2. Governance Arrangements, Management and IWRM

The concept of governance has many interpretations, with scholars from different disciplines using the term to describe various functions and relationships involving stakeholders with responsibilities for public policy. According to Young [7], "governance" refers to systems of rights, rules, social norms, and formal and informal decision-making arrangements used to steer society and move human groups towards particular desired outcomes, whilst also avoiding problems or damage. Reed and Bruyneel [8] consider that governance is fundamentally about how decisions are made, who decides, and who gets what. For others, however, the term has a narrower meaning associated with relatively recent

changes in public policy and administration, and the emergence of new methods of making decisions and steering society [9,10]. Some commentators believe that since the 1980s, government-centered approaches for public policy have given way to alternative arrangements emphasizing market-based mechanisms, public-private partnerships, multi-actor configurations, and highly entrepreneurial approaches for decision making [11,12]. As a result, the term governance also has become a motif for a growth in alternative modes for governing, which include deconcentrated, devolved, poly-centric, collaborative, networked, nested, self-organized, and adaptive arrangements.

There are many examples of the use of such alternative approaches in various areas of public policy, including water [13–17]. Nevertheless, conventional government-based organizations, with accompanying laws, regulations, financial arrangements and partnerships still exist. Those organizations and partnerships often control, or at least significantly influence, decision making [18]. As such, governments and government-based organizations can, and still do, perform governance functions, albeit in some circumstances in conjunction with other stakeholders, organizations, and groups. Given the mixed approaches and varied interpretations in use, we use the following broad definition:

> *"Governance arrangements are the combinations of political, legal, and administrative decision-making structures, processes, and procedures used to establish and apply rules, assign rights and responsibilities, provide direction for action, and assemble financial, organizational, and informational resources, in order to influence the behaviours of people, organizations, and groups, at all scales (i.e., ranging from global to neighborhood)."*

The above interpretation aligns closely with the definition of water governance adopted by the World Bank and Global Water Partnership and reported by the Organization for Economic Cooperation and Development (OECD) [19] (p.29):

> *"Water governance is the range of political, social, economic, and administrative systems that are in place to develop and manage water resources, and to deliver water services at different levels of society."*

Furthermore, the OECD [19] (p.31) has proposed the following definition of multi-level governance:

> *" . . . the explicit or implicit sharing of policy making authority, responsibility, development, and implementation at different administrative and territorial levels: (i) across different ministries and public agencies at central government level (upper horizontally); (ii) between different layers of government at the local, regional, provincial or state, national, and supranational levels (vertically); and (iii) across different actors at a sub-national level (lower horizontal)."*

Using the concepts of governance and governance arrangements can help to focus attention on relationships among multiple actors, the cross-scale nature of decision making, efforts to improve co-ordination, and capacities for resolving problems [20,21]. For example, Warner [14] developed the concept of "multi-stakeholder platforms" to describe arrangements designed to enable organizations and groups operating at different spatial scales and with varied interests to co-operate on inter-jurisdictional issues or problems. Others, including Huxham [22] and Watson [23,24], have examined collaborative governance, while Edelenbos, Bressers, and Scholten [25] (p.7) focused on connective capacity, which they define as "the capabilities of individuals, instruments, and institutions to counter fragmentation in water governance processes by crossing boundaries (structure, organization, language, and so on) and establishing linkages between different actors (on different levels, at various scales, and in numerous domains) in the light of solving water issues".

Regarding key governance capabilities, Termeer and Dewulf [26] have identified: (1) reflexivity, or the capability to deal with multiple frames and understandings found in society and policy; (2) resilience, or the capability to adapt flexibly to frequently occurring and uncertain changes;

(3) responsiveness, or the capacity to respond wisely to changing agendas and public demands; (4) revitalization, or the capability to unblock deadlocks and stagnations in policy processes; and (5) scale-sensitivity, or the capability to observe and effectively address cross-scale and cross-level issues and concerns.

While the terms "governance" and "management" are sometimes used interchangeably and without clear operational definitions, important and yet subtle differences exist. Both terms refer to decision making. However, "management" is concerned with operational procedures, models, principles, and information used to implement policies. In contrast, "governance" is more concerned with the structures, processes, and procedures used for making policy decisions. In reality, the distinction between the two is much harder to discern. At times, managers are able to make policy decisions and people with responsibilities for governance are very often also involved in management.

IWRM gained international traction in the early 1990s, and has been adopted as a key approach for sustainable development by the World Water Council, World Bank, and Global Water Partnership (GWP). In addition, the United Nations has adopted IWRM as part of the Millennium Development Goals and the European Union has incorporated elements of IWRM in its Water Framework Directive. Not surprisingly, a large research literature has developed related to IWRM [3]. The GWP [27] (p.22) defined IWRM as:

> *"a process which promotes coordinated development and management of water, land, and related natural resources in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital eco-systems".*

As the GWP definition indicates, IWRM is fundamentally a means to achieve management goals. Furthermore, by including the phrase "a process which promotes", the GWP definition identifies an important connection between IWRM and governance. IWRM does not stand alone from governance, and governance arrangements constitute a major part of the process needed to promote and enable coordinated management. However, while the GWP definition refers to a single process, various governance and management processes and procedures (e.g., stakeholder engagement) are likely to be involved in the development and implementation of IWRM policy.

3. Methods

The research framework developed for this study focuses on six key aspects of governance that are acknowledged in the literature and are particularly relevant and important for IWRM, rather than attempting to define particular criteria related to processes, outputs, outcomes, or impacts in order to try to judge success [1,3,4]. The research presented in this paper emerged from several decades of collaboration among the three authors, who realised there were clear similarities in approach and methods, even though the work in Ontario and Oregon had initially been conducted independently. Both investigations had examined the same kinds of issues related to IWRM and governance, and this allowed the development of a new research framework that built on and extended their previous work. The framework includes four elements (scope, scale, responsibility, and engagement), which have been used in previous frameworks and are present in the literature on IWRM, plus two additional elements, which were identified as important when the findings from the two case studies were analyzed and compared (finances and financing, and review processes and mechanisms). When combined as a single analytical framework, the six key aspects serve as entry points and windows that allow observations regarding how governance arrangements have evolved and for considering potential implications for our understanding and applications of IWRM. The six aspects which constitute our research framework are:

- Scope refers to the range and types of resource-related issues and concerns included and addressed. For example, governance arrangements might focus attention on a single water use, problems or conflicts regarding multiple uses of water, connections among uses of land and water, or, at the other extreme, on far broader relationships associated with the water, energy, climate, and food security nexus [1,3,14,28,29].

- Scale concerns the spatial scale or scales at which governance is intended to operate and accommodate relevant interests, jurisdictions, and relationships within decision-making arrangements [30,31]. It would also embrace many of the aspects of multi-level governance [19].
- Responsibility refers to how functions, responsibilities, and powers are determined and allocated among governing institutions, including public, private, civil society, and hybrid organizations and groups [32–34].
- Engagement concerns how organizations and groups are involved in governance arrangements, including their participation through cross-scale and inter-jurisdictional relationships and in addition to involvement in a particular node or single level or scale of governance [35,36].
- Finances and financing refer to how funding is generated and allocated to enable governance arrangements to operate, and to implement policies, programs, and projects for integrated management. This includes taking account of how benefits and costs associated with revenue generation and expenditure affect different groups and communities [23,37].
- Review processes and mechanisms concern the various ways in which governance arrangements might be assessed and potentially adjusted on the basis of experience, learning, and changing circumstances and needs. The dynamic nature of people-environment relationships and the inevitable shifts in values, needs, interests, and priorities mean that flexibility is required so that governance arrangements can be adapted and are able to remain functional and relevant [38–40].

Termeer and Dewulf's [26] five key governance capabilities have potential relevance for each of the six aspects outlined above. As such, in each case study, attention is given to arrangements and developments that appear to demonstrate or imply reflexivity, resilience, responsiveness, revitalization, and case-sensitivity. The six-component framework was applied to the two case study areas. In each case, data collection occurred in phases and included reviews of relevant statutes, policies, programs, and reports, and interviews with politicians, managers, and individuals involved in catchment organizations, representatives for resource use interest groups, and academics with knowledge related to governance and the management of water and natural resources in the two areas. Twenty-four interviews occurred in Oregon during August and September 2014, and over one hundred interviews were completed in Ontario as part of a long-term research programme on Conservation Authorities, which began in the late 1980s and is continuing.

The questions posed in Ontario and Oregon were not always the same, but often were so similar that we believed it was appropriate to draw on both sets of information to explore similarities and differences. Furthermore, the sources of information used, including documentary evidence (annual reports, policy statements, government reviews) and semi-structured interviews (with individuals from government agencies and departments, conservation authorities and watershed councils, municipal and local elected officials and staff, NGOs and stakeholder groups, and landowners) were similar, and created a rich and credible source of data and insights that allowed a detailed comparison and enabled us to identify important similarities and differences. To ensure the information and findings were current, additional analysis of recent key reports, quantitative data, and other relevant documents was undertaken for both case studies in late 2018 and early 2019.

4. Evolution of Governance Arrangements for IWRM

4.1. Case 1: Conservation Authorities in Ontario

Ontario's Conservation Authorities (CAs) are among the oldest catchment-based agencies in the world. Started in 1946, they were established both to provide World War II veterans with employment opportunities and to respond to deterioration of the natural resource base in southern Ontario [41]. There are 36 CAs, 31 of which are located in the heavily populated catchments of southern Ontario (Figure 1). The five in northern Ontario are centered on major cities and adjacent regions. The six founding principles of the CAs—catchment jurisdiction, local initiative, provincial-municipal partnership, a healthy environment for a healthy economy, cooperation, coordination and collaboration,

and a comprehensive viewpoint—have generally served its integrated water resource program well, although ebbs and flows in its practice have occurred [42].

Figure 1. Conservation Authorities in Ontario.

The CA program has evolved through three periods of integrated water resource management. The first, between 1946 and 1987, was characterized by multiple purpose, multiple means strategies, and relatively stable levels of funding from the provincial government and municipalities across a broad range of programs. The Province also provided comprehensive plans (called Conservation Reports) to each CA shortly after it was formed, as well as ongoing technical support, particularly for water engineering. During this period, some CAs were eligible to receive provincial grants of up to 85% of the total costs for approved projects focused on four broad programs: (i) water management (e.g., structural adjustments, land acquisition, flood plain mapping and regulation, flood warning systems, erosion control, water quality monitoring), (ii) water and land-related management (e.g., reforestation, soil conservation, agricultural drainage, wetland acquisition), (iii) recreation, and (iv) community relations (e.g., public information and education programs to elementary and high school students) [41]. This type of broadly based approach was a feature of contemporary water management of that era [28].

The second period (1987–2002) was characterized by reductions in the scope of projects to be funded and the amount of provincial funds provided to the Conservation Authorities. Following the recommendations in a 1987 review of the CA program, the provincial government identified core (e.g., flood and erosion control, low flow augmentation) and non-core (i.e., land and water activities, recreation, education) responsibilities and would only provide funds for the former. In 1995, further reductions in provincial funding transpired—from $33 million (CAD) to $12 million (CAD) in 1996, and to less than $8 million (CAD) by 2002. Municipal funding to CAs was also limited to

core areas, and was confined to structural flood adjustments, and protection of provincially significant lands [42]. The motivations for these changes were largely driven by the need to reduce the province's expenditures and the desire to reduce overlaps among CAs and other provincial agencies.

The third period (2002–present) was prompted by a tragedy in the town of Walkerton that caused seven people to die and thousands to become ill as a result of bacterial contamination of the community's groundwater drinking water supply. The provincial government adopted many of the 121 recommendations from the Inquiry that followed [43], and also passed the Clean Water Act in 2006 and approved associated regulations. For CAs, the statute identified 19 source water protection areas that CAs were to lead in promoting collaboration among stakeholders (e.g., province, municipalities, Indigenous peoples, other stakeholders) when developing source water protection plans. In this regard, CAs were provided funding by the province to support scientific, technical, and administrative aspects of this planning process. Subsequently, 22 source water protection plans were prepared and formally approved, with their implementation being facilitated by municipalities, provincial ministries, and the CAs. Each source protection plan contains policies that recommend or require actions to deal with threats to sources of drinking water. During this third period, the recognized need to bolster three of the CAs founding principles—catchment jurisdiction, comprehensive planning, and cooperation and coordination—to better meet the needs of Ontario's population of the 21st century was a driving force for change.

At present, more than 11 million people (approximately 90% of Ontario's population) live in catchments managed by the 36 Conservation Authorities, which deliver programs and services valued at more $275 million [42]. In 2015, the provincial government completed a review of the Conservation Authorities Act [44] with a view to:

- Strengthening oversight and accountability
- Increasing clarity and consistency in Conservation Authority programs and services
- Increasing clarity and consistency in regulatory requirements
- Improving collaboration and engagement
- Modernizing funding mechanisms.

Based on the recommendations arising from this review, a new Conservation Authorities Act was passed in 2017, followed by a Memorandum of Cooperation between the Province and Conservation Ontario on April 17, 2018. Many of these recent changes have implications for the six themes (scope, scale, engagement, responsibility, financing, and review) identified earlier. The following sections examine experiences in relation to those six themes.

4.1.1. Scope

The Conservation Authorities Act in 1946 identified the mandate for the CAs as the conservation, restoration, development, and management of natural resources other than gas, oil, coal, and minerals [41]. This broad approach is specifically endorsed by one of the founding principles (comprehensive approach), which has often translated to a consideration of both water and related land-based resources, and urban as well as rural areas within a catchment context. Today, the CAs explicitly embrace an integrated water management approach, which they have defined as "the process of managing human activities and natural resources on a catchment basis, taking into account social, economic, and environmental issues, as well as community interests, in order to manage water resources sustainably" [45] (p.1). Through that integrated approach, Conservation Ontario [44], consisting of all CAs and working to advocate on their behalf to the province and promoting the sharing of information and professional development within the CAs, identifies nine priorities:

- Integrated Watershed Management
- Climate Change
- Flood Management

- Science and Information
- Great Lakes
- Planning and Regulations
- EcoHealth
- Green Economy

The above illustrate the high priority given by CAs to both effective and efficient program delivery pertaining to water and related land resources, and the important role of science, monitoring, and educational activities. The Conservation Authorities also consider integrated water resource management within the very broad context of local communities. For instance, conservation authorities are aware of the need to provide land for housing development and maximize the use of urban infrastructure, and recognize that both must be balanced with the need to protect residents from the risks of flooding [46].

The changes to the 2017 Conservation Authorities Act acknowledge and support the flexibility provided in the mandate to respond to local needs. Current regular programming includes:

- Natural Hazard Management
- Flood and Erosion Management
- Stewardship and Conservation
- Planning and Permitting
- Research and Monitoring
- Drought and Low Water Program
- Education, Recreation, and Outreach
- Technical and Advisory Services
- Watershed Plans and Reporting
- Drinking Water Source Protection [47].

As the historical overview above indicated, changes to financial arrangements from the provincial government, limitations placed on where municipal contributions to CAs can be spent, the capacity of the provincial government to fund planning and provide technical staff to CAs, and varying capacities of individual CAs to hire their own (or share) staff have influenced the depth and breadth that CAs have actually achieved regarding this broad mandate.

4.1.2. Scale

The conservation authorities are based, for the most part, on catchment boundaries. In 1946, it was believed that an understanding of the hydrologic cycle was fundamental for effective management of renewable resources. The catchment jurisdiction has also been an important feature of the Muskingum Watershed Conservancy District (Ohio, USA), and the Tennessee Valley Authority (USA), both of which were visited by the founders of the CA program during its formative period. The catchment was also used as the management unit in New Zealand, and England and Wales [41]. Thus, precedents could be identified to justify the choice of the catchment as the desirable administrative unit. In practice, only parts of the province are covered, with CAs established in the populated areas of southern Ontario and in five urban areas in northern Ontario. The 2017 changes to the Act did not deviate from this past practice. A general observation is that achieving a balance among being responsive to local needs (e.g., local initiative principle), achieving a reasonably consistent delivery of programs across all CAs, and being affordable for local residents, has been and remains challenging. A key consideration in establishing a CA is whether there is the prospect of sufficient funding from local governments in a catchment to allow a CA to function effectively.

4.1.3. Engagement

In 1946, the key partnership was between the provincial government (and its Departments) and local municipalities. As noted earlier, those arrangements evolved during the 1950s and 1960s to incorporate landowners, particularly the farming community in a range of stewardship initiatives [41]. Although CAs have always relied on local initiative to request that a CA be formed and for local municipalities to appoint members to the CA Board, the significant provincial funding cuts in the 1990s prompted CAs to enhance this partnership with local governments and ensure that the priority needs of catchment residents were met. In addition, CAs sought partnerships with other provincial and federal agencies in order that resources would be used efficiently and effectively.

Conservation Authorities now facilitate five layers of engagement with their many partners. First, the key partnership remains with the provincial government and local municipalities. The members of the local conservation authority and the administrative arrangement with the Ontario Ministry of Natural Resources and Forestry, which oversees the CA program on behalf of the province, are the cornerstone of this partnership. Second, as funding has become less relative to the desire or need to deliver programs, many conservation authorities have established financial partnerships with other provincial and federal agencies to deliver specific services (e.g., fisheries, monitoring). Third, partnerships have been extended to non-governmental organizations, which provide information and expertise to a Conservation Authority in a specific geographic region (e.g., sub catchment) or on a specific issue (e.g., water quality, habitat rehabilitation). For instance, Mitchell at al. [42] described the partnership network (federal, provincial, local governments, stakeholders, landowners) developed by Halton Conservation to address water quality problems in Hamilton Harbor, as well as the evolution of initiatives by the Grand River Conservation Authority to develop an integrated catchment plan for the Grand River. Fourth, conservation authorities engage the public through a variety of public participation programs and social media in order to obtain input on specific issues as well as strategic advice on management priorities. Fifth, conservation authorities offer education programs or outdoor learning facilities as a way of engaging school children. These are often delivered to K-12 (kindergarten to grade 12) students through arrangements with local school boards.

The 2017 changes to the Act focused considerable attention on the governance aspects of engagement, the heart of the provincial-municipal partnership and corporate aspects of CA operations, as well as establishing minimum levels of expectations for engagement with the public and stakeholders [47]. The recruitment and selection for appointment of members of a conservation authority by municipalities will be more rigorous and professional, including establishment of codes of conduct, requiring meetings of the conservation authority to be public, and enabling the Province and the public to obtain information about programs and financing. Concerning public and stakeholder engagement, best practices are being, and will be, developed for engagement with Indigenous peoples, the public, and stakeholders. There is a desire to enhance current levels of collaboration among conservation authorities, local government, and relevant provincial ministries.

4.1.4. Responsibility

While the broad mandate of the Conservation Authorities Act has allowed CAs to develop and engage in a wide range of renewable resource management activities, concern has emerged that inefficiencies and confusion sometimes arise due to jurisdictional overlaps with provincial agencies that administer narrowly defined but related legislative mandates (e.g., point and non-point source pollution, water taking permits, dredging, fisheries). Previous attempts to ensure various organizations address water and land-related issues in a complementary, mutually exclusive, and simple manner, while achieving administrative efficiency, effectiveness, and public acceptability, have been fraught with difficulty, indicating that some degree of overlap is inevitable. The key is to be able to manage such overlap, and ensure that where overlap does occur it provides desirable and intended redundancy to ensure that if one agency struggles, the actions by another will keep an issue manageable or under control.

In 2012, Conservation Ontario [48] suggested that a more flexible and accountable division of responsibilities be developed with the provincial agency that oversees the CA program, as well as with other provincial agencies responsible for other aspects of water management. For instance, while many CAs have had a long involvement with farmers concerning soil conservation, the provincial agriculture ministry has some similar and competing programs. This flexibility appears to have been maintained in proposed changes to the CA Act and identification of the three types of programs CAs can engage in.

Since 1946, the CAs have engaged with different levels of government and shared responsibilities via a range of partnership arrangements. At first, the key partnership was between the province (and its Departments) and local municipalities. That arrangement evolved during the 1950s and 1960s to incorporate landowners, particularly the farming community, in various initiatives, such as erosion control, fertilizer applications, and manure management [41]. Although CAs have relied on local initiatives to request that a CA be formed and for local municipalities to appoint members to the CA Board, the significant provincial funding cuts in the 1990s prompted CAs to engage more at the local level to ensure priority needs of catchment residents were met.

In addition, CAs sought to share responsibilities with other provincial and federal agencies in order that resources might be used more efficiently and effectively. For example, the North Bay-Mattawa Conservation Authority (NBMCA, one of the five northern CAs) supports some unique programs, which include "sewage system programming, working with stakeholders to restore fish habitat, plant trees, and ensure full compliance of hunting programs. This allows the NBMCA to effectively deliver its mandate while meeting the needs of those within their jurisdiction" [47] (p.14).

By engaging organizations and groups in different forms of partnership, opportunities exist to increase administrative efficiencies and public understanding of the CA program. The broad legislative mandate, combined with the variety of environmental problems and capacity or willingness to fund programs, have led to differences among the CAs about the breadth and depth of programs that should be, could be, and are, implemented. The 2017 Conservation Authorities Act recognizes and supports this reality [47]. On the one hand, the Province wishes to better define the scope of CA involvement in this wide range of programs, as well as achieve a more consistent level of delivery and transparency of program delivery, regardless of financial capacity of different CAs [46]. On the other hand, the Province acknowledged that there will be continued and likely significant differences in the range of programs offered by CAs, when it stated:

> *"While some conservation authorities may choose to largely focus the programs and services that they offer on those programs and services mandated by the Province, conservation authorities that choose to offer additional programs and services beyond those mandated by the Province and municipalities should not be considered to be "exceeding their mandate".* [46] (p.17)

A key to achieving the province's aspirations for a more consistent level of program delivery, therefore, will be found in the nature of financial arrangements and the level of funding.

4.1.5. Finances and Financing

Initially, a 50/50 cost sharing of projects between provincial and partner municipal governments was a cornerstone of the CA program, and was prompted for two pragmatic reasons. First, it was thought that local municipalities should finance a portion of costs in order that priority needs (and not wants) were identified and implemented. One implication is that an adequate municipal tax base must exist to generate the funds needed for a CA to function. Second, the provincial contributions served as an incentive for municipalities to agree to form a CA because these funds would not be available to them unless a CA was created. As the comments above indicate, the division of financing has evolved and has been the subject of ongoing debate, particularly between the Province and municipalities.

A key challenge has been to achieve effective, efficient, and equitable delivery of services. However, since the nature of problems, cost of solutions, and the supporting local tax base are

not evenly distributed throughout the province, the equitable delivery of services will not mean local tax payers are treated equally or bear the same proportion of CA program costs. To illustrate, the per capita levy requested for each CA in 2010 ranged from $2 (CAD) to $35 (CAD) [48]. Nevertheless, the CAs are considered by municipalities and the CAs themselves to be doing "good work and provide good value for money" [49] (p.9). In 2018, the average distribution of funding sources for individual CAs was as follows: municipal levies accounted for 54%, self-generated revenue, 34%, provincial grants and special projects, 9%, and federal government contracts and grants, 3% [50].

The 2017 changes suggested that the formula that determines the apportionment of costs between the province and municipalities be simplified and more transparent. The fee schedule for conservation authorities to recover costs for services rendered (e.g., an application for development on the flood plain) would be reviewed and made more accessible. Finally, the level of funding provided by the province would be assessed for its adequacy and efficiency, and opportunities "to better leverage existing funding envelopes to help finance conservation authority programs and services" would be explored [47] (p.31).

4.1.6. Review Processes and Mechanisms

There have been four reviews of the conservation authority program, two major events and one provincial budget that have significantly influenced the programme. The four reviews were:

- Select Committee on the Conservation Authority Program (1967) [51]
- Report on the Working Group on the Mandate and Role of the Conservation Authorities of Ontario (1979) [52]
- Review of the Conservation Authorities Program (1987) [53]
- The previously mentioned Review of the CA program in 2015 and subsequent changes to the Act [45]

The two events were:

- Hurricane Hazel in 1954, which highlighted the need for flood management and the important role of CAs [41]
- The previously mentioned Walkerton Tragedy and the subsequent public inquiry and introduction of the Clean Water Act [43]

In 1965, a select Committee on Conservation Authorities was appointed to review the program, with particular attention to membership, financial arrangements and the ability of municipalities to pay their share of conservation activities, the power of conservation authorities to acquire or expropriate land, and the administrative practices and methods of conservation authorities. The Committee noted the limited number of conservation authorities outside of southern Ontario and urban areas in northern Ontario. The Committee observed that the limited financial base of many areas was a barrier for the creation of authorities. Under prevailing arrangements, participating municipalities had to raise 50% of the operating costs of conservation authorities. This proportion was prohibitively high in townships with low populations and sparse assessment. Where the local economy was based on agriculture or seasonal wood harvesting or tourism operations, the funding required to support a conservation authority was "simply not available" [50] (p.20), even though it was just such areas in which conservation practices were urgently required. The Select Committee concluded that "the financial base of municipalities making up an authority largely determines its program. Conservation authorities that are predominately rural are less able to support an active program than authorities with large urban centres" [50] (p.53). In response to this problem, the provincial government established a supplementary grant structure. The intent of this initiative was to provide a higher level of assistance to more rural conservation authorities.

The Provincial Budget of 1995, the final major influence, restricted and reduced provincial funding, which also had major implications for the conservation authority program. Collectively, there has

been very strong endorsement for the six founding principles of the CA program. There has been ongoing support for conservation authorities continuing to have primary responsibility for flood and erosion control, low flow augmentation, wetlands, and regionally significant parks, while sharing responsibility for non-point pollution control, urban drainage, water quality monitoring, water supply and Niagara Escarpment Parks. Their role in groundwater management was clarified and enhanced following the O'Connor Inquiry [43]. The desire to have clear and consistent agency mandates across the province has proven an ongoing challenge, given the manner in which water and related natural resources interplay with a vast array of human needs and the range of human geographies in Ontario. The provincial government remains an important contributor to the CA budget, although municipalities have played an increasingly important role, and CAs have found other sources of funding. Two authorities have amalgamated and numerous others share some services in order to achieve better economies of scale. Membership of the conservation authority boards has been reduced, largely by eliminating provincially appointed members and through the amalgamation of municipalities, which occurred after 1995.

4.2. Case 2: Watershed Councils and IWRM in Oregon

Interest in integration and developing a catchment-based approach emerged in Oregon during the late 1980s in response to concerns regarding endangered salmonid fish species. At that time, the Governor of Oregon began to express strong preferences for voluntary and community-based efforts towards river restoration and recovery of salmonid populations, rather than direct government intervention. For clarity, watershed councils in Oregon are catchment-based organizations. In this section, we use the term "watershed councils" when referring to those organizations by name. Otherwise, the term "catchment" is used to be consistent throughout the paper.

Integrated water management and watershed councils have developed in Oregon in three key stages: 1987–96, 1997–2008, and 2009–present. In 1987, Senate Bill 23 approved establishment of the Governor's Watershed Enhancement Board (GWEB) to provide training and financing for private landowners and the 45 Soil and Water Conservation Districts in Oregon in order to improve riparian habitats. In 1993, Oregon passed House Bill 2215, which approved establishment of watershed councils to conduct watershed assessments, develop and implement action plans, and monitor ecosystem health. Watershed councils were conceived as non-government organizations with a mandate for voluntary environmental protection and restoration. By the end of the first stage in 1996, 60 watershed councils had been established and were formally recognized by county-level governments.

The beginning of the second stage in 1997 coincided with the launch of the Oregon Plan for Salmon and Watersheds (or "Oregon Plan") by the State government. The Oregon Plan was central in the State's proposal to the US federal government for a voluntary, community-based, and coordinated response that would avoid "listing" of salmon and other economically important fish under the Endangered Species Act.

Following federal approval of the Oregon Plan, watershed councils became the state government's key mechanism for salmon recovery and river restoration. In 1998, the GWEB was replaced by the Oregon Watershed Enhancement Board (OWEB). OWEB is a government agency with responsibility for prioritizing and coordinating restoration efforts, including the allocation and administration of all watershed restoration funds. In the second stage, approximately US$500 million from federal and state sources was allocated to implement the Oregon Plan, including US$169 million for restoration grants from state lottery funds [54].

In 2009, a third stage began to develop. The Oregon Water Resources Commission published Oregon's first Integrated Water Resources Strategy (IWRS) in August 2012, which included recommendations for place-based integrated water planning, collaboration, and public involvement, and coordinated implementation of natural resource plans [55]. Draft guidelines for place-based integrated water resources planning were published in February 2015 [56] and an agreed IWRS for Oregon was published in 2017 [57]. In parallel with the implementation of the IWRS, local watershed

councils have continued to develop. As of February 2019, there were 89 watershed councils throughout the state that were recognized and approved by county-level government administrations. Sixty of those watershed councils had met OWEB eligibility criteria and were in receipt of funding via OWEB (Figure 2).

Figure 2. Watershed Councils in Oregon.

We now examine the six aspects of governance outlined in the research framework in relation to the evolution of watershed councils and IWRM.

4.2.1. Scope

Watershed councils in Oregon illustrate a tightly focused approach to integrated water management. Under Oregon's Revised Statute (ORS) 541.351 (15), a watershed council is defined as "a voluntary local organization, designated by a local government group convened by a county governing body, to address the goal of sustaining natural resource protection, restoration, and enhancement within a watershed" [58]. The 2018 OWEB Strategic Direction and Principles document [59] defines five key goals:

- Adaptive investment: Restore and sustain resilient ecosystems through programme and project investments that enhance catchment and ecosystem functions and processes and support community needs.
- Local infrastructure development: Support an enduring, high-capacity local infrastructure for conducting catchment and habitat restoration and conservation.
- Public awareness and involvement: Provide information to help Oregonians understand the need for and engage in activities that support healthy catchments.
- Partnership development: Build and maintain strong partnerships with local, state, tribal, and federal agencies, non-profit organizations, and private landowners for catchment and habitat restoration and conservation.
- Efficient and accountable administration: Ensure efficient and accountable administration of all investments.

The above definition and goals could imply a broad ecosystem-based approach for catchment management. However, in practice, the councils and OWEB have focused on riparian land and in-stream environments for fish and wildlife. To illustrate, key accomplishments reported for 1999–2017 include making 9800 km of river habitat accessible for fish, restoring more than 8200 km of streams and assisting riparian landowners to improve more than 4600 km^2 of upland habitat and creating 206 km^2 of wetland and estuarine habitat [60].

Development of the Oregon IWRS also includes insights regarding change to scope. Initially, the policy advisory group created in 2010 to create the original strategy developed a broad 50-year vision [57] (p.14):

> *"Everywhere in our state, we see healthy waters, able to sustain a healthy economy, environment, and cultures and communities. Healthy waters are abundant and clean. A healthy economy is a diverse and balanced economy, nurturing and employing the state's natural resources and human capital to meet evolving local and global needs, including a desirable quality of life in urban and rural areas. A healthy environment includes fully functioning ecosystems, including headwaters, river systems, wetlands, forests, floodplains, estuaries, and aquifers. Healthy cultures and communities depend on adequate and reliable water supplies to sustain public health, nourishment, recreation, sport, and other quality of life needs."*

However, the policy advisory group established to create the 2017 IWRS appears to have had a very different outlook and set of concerns, stating that [57] (p.14):

> *"Water is a finite resource with growing demands; water scarcity is a reality in Oregon. Water-related decisions should rest on a thorough analysis of supply, the demand or need for water, the potential for increasing efficiencies and conservation, and alternative ways to meet these demands."*

These two contrasting statements, written just six years apart, illustrate how the scope of one of Oregon's main IWRM initiatives has shifted from a broad concern for all aspects of water to a much narrower focus on water quantity and supply for human use.

4.2.2. Scale

Interviews conducted in Oregon during 2014 provided insights regarding scale. For example, the attention of the watershed councils is sharply focused on habitat restoration and protection in individual small-scale catchments, which local communities and populations readily identify with. The focus on local-scale action by communities and resource users, facilitated by the watershed councils, reflects the underlying philosophy and approach to resource governance in Oregon. In other words, the State government has pursued a deliberate strategy of governing indirectly and at a distance by establishing OWEB to steer and support watershed-scale management, and by encouraging and incentivizing local communities and stakeholders to join together in creating a watershed council.

In contrast, the IWRS includes water quantity and land-based resources in addition to water quality, and attention is given to relationships within much larger river basins, as opposed to local catchments. Most interviewees believed that each watershed council should stay focused on local concerns within individual catchments in order to maintain public support. Many interviewees also argued that councils would be far less effective if they were organized and operated at a basin scale, or if their scope were increased by adding further responsibilities. Analysis of the contents of the 2017 version of the Oregon IWRS [57] provides useful insights into how a basin scale has emerged as a new and additional focus for integrated management, operating in parallel and separately to local-scale integrated catchment management. Specifically, in 2015, State Senate Bill 266 was passed and made provisions for communities to be solicited regarding their interest in developing an integrated water resources strategy for their area. Of the 16 that expressed interest, four were selected by the State government for funding. All four involve developing a strategy at a basin scale. In two of those cases, a watershed council acts as a co-convener alongside another organization, such as a city or county

administration or court, or a Soil and Water Conservation District. What this appears to show is that IWRM has evolved in Oregon as two distinct and quite separate initiatives, with one focused on local catchments and the other aimed at managing river basins.

4.2.3. Responsibility

Watershed councils in Oregon reflect the Western Governors Association's "Enlibra2 doctrine for sustainable development and balanced ecosystem-based management [61]. Key Enlibra principles include shared responsibility, collaborative problem-solving, use of markets, incentives and performance-based rewards, use of environmental rather than administrative boundaries, reliance on science for evidence, and participatory processes for identifying priorities. Following that orthodoxy, Oregon watershed councils use a bottom-up approach intended to encourage self-organization and direction among local communities. There is no legal requirement at any level of government in Oregon for watershed councils to be formed. However, statutory provisions, institutional structures, and procedures are designed to ensure watershed councils do meet public policy objectives, are governed and managed well, and are accountable for funding received.

Oregon has developed a two-tier system for the approval of watershed councils. State legislation stipulates that the creation of a watershed council must be initiated by a local government group, such as a municipal, city, or county authority with jurisdiction over the catchment area. The Board or Commission of the relevant authority has responsibility for the first level of approval, and may give authorization provided that the watershed council is a voluntary and local organization and represents a balance of affected interests within the catchment. Where a catchment includes more than one county, OWEB requires all of the relevant governing bodies to give their approval before a watershed council can be designated. According to interviews, first-level approval is generally given without difficulty because the concept is popular, local government financing is not required, and watershed councils are likely to attract additional state and federal government revenues.

OWEB is responsible for the second-tier approval process, which is more demanding and is used to determine whether a watershed council is eligible to apply for state funding. To gain recognition at the state level and to access OWEB funding, watershed councils must demonstrate compliance with explicit criteria related to effective governance and management, organizational planning, on-the-ground catchment restoration, and community engagement, in addition to having local government approval.

4.2.4. Engagement

Engagement of multiple interests is a key objective of both Oregon's watershed restoration program and IWRS. For restoration, engagement occurs through OWEB and individual watershed councils. OWEB has a 17-member Advisory Board, which meets four times annually to evaluate grant applications and to provide policy oversight. Eleven members have voting powers and include one tribal representative, five citizen representatives and one representative for each of the state Forestry Board, the Agriculture Board, the Environmental Quality Commission, the Fish and Wildlife Commission, and the Water Resources Commission. The six remaining non-voting members represent federal resource management agencies and the Oregon State University Extension Service. All Board members are appointed by the State Governor and approved by the Senate for four-year staggered terms.

Interviews and analysis of documents related to OWEB-approved councils indicated that board membership included representatives for a broad range of interests related to catchment restoration, but provided more limited involvement of organizations and groups with stakes in other aspects of natural resources use and management. Decision-making procedures varied among the councils, although all operate by consensus and are required by OWEB to adopt bylaws prohibiting the use of litigation to accomplish their mission. Some councils follow procedures indicating the level of consensus. For example, for the McKenzie Watershed Council, board members vote according to seven options: (1) wholeheartedly agree, will take the lead in follow-up; (2) good idea, can bring resources

forward; (3) supportive, but not likely to provide resources; (4) reservations, but will stand aside; (5) serious concerns, but will live with the decision; (6) cannot participate in the decision, will work to block it; and (7) abstain.

Diverse representation and engagement is also a key tenet of the place-based approach advocated for Oregon's IWRS. However, implementation guidelines explain that representation should encompass in-stream and out-of-stream needs, and the quantity and quality of surface and groundwater. Tellingly, watershed councils are not explicitly mentioned as potential participants, although "conservation groups" and other interests, including local and tribal governments, are included. A possible explanation is that the ethos, scale, and focus of the watershed councils do not fit comfortably with the much broader, inter-governmental and place-based approach associated with the IWRS.

4.2.5. Finances and Financing

Financing arrangements have evolved and become more secure. In 1993, Oregon legislators passed House Bill 2215 and approved the use of proceeds from the state lottery for catchment restoration. Following approval of the Oregon Plan in 1997, total funding, including state and federal government contributions, increased from approximately $1 million to $20 million (US) annually. A public ballot in 1998 resulted in legislators committing 7.5% of annual state lottery revenues for catchment restoration, including the resourcing of OWEB. State legislation also dictates that at least 65% of the allocated lottery funds must be used for capital expenditure. In 2010, legislators permanently reauthorized the use of 7.5% of state lottery funds for implementation of the Oregon Plan, and that arrangement is still in effect in 2019.

Between 1999 and 2019, OWEB received a total of US$669 million in funding, comprising US$510 million from state lottery funds, US$154 million from the federal government Pacific Coast Salmon Restoration Fund (PCSRF), and US$5 million from sales of "Salmon" vehicle license plates. Regarding expenditure, by the end of 2017 OWEB had awarded more than 8700 grants to watershed councils, totaling US$566 million. Of that amount, 65.4% was allocated to river restoration programs and projects, 14.5% to building local governance and management capacity, with the remainder used for monitoring and assessment, education and research, and technical assistance [60]. OWEB funding is locally allocated via competitive schemes for on-the-ground catchment improvements, although organizational capacity grants and partnership development grants are provided to eligible organizations on a non-competitive basis.

Interviews with watershed council representatives revealed three main concerns or challenges regarding financing. First, the actual level of funding available in any one year depends highly on state lottery revenues, which fluctuate according to economic conditions. Second, the council resources and staff time required to complete grant applications can be disproportionate to the levels of funding available. Third, some believed the funding regime to be unfair and to favor councils in more populated and developed areas, reflecting more experience and capacity for preparing strongly competitive grant applications. Analysis of county-level data for OWEB watershed investments appears to support their claims. For 1999–2017, total OWEB investment by county ranged from US$1 million to US$35 million. Furthermore, 31% of total OWEB investment was allocated to four of Oregon's 36 counties (Coos, Deschutes, Douglas, Lane, and Malheur counties), which include some of the largest and most populated communities in the state.

4.2.6. Review Processes and Mechanisms

In 2010, following more than a decade of experience with supporting the development of watershed councils, OWEB began a review process. The review was focused on the capacity grant program, which is one of the key support mechanisms available to OWEB when a local group is convened by a county governing body for the purpose of establishing a watershed council. In March 2012, OWEB board members directed staff to examine the outcomes and award process associated

with the capacity grant program. Listening sessions and work groups were organized by OWEB and used throughout the state to gather feedback from watershed council representatives. As a result, a subcommittee of the OWEB Board developed a proposal for revised eligibility and merit criteria with the aim of maximizing the benefits of future expenditure and investment. In July 2013, the Board authorized staff to begin revising the rules for OWEB grants, and in July 2014 new guidance was produced for watershed councils seeking capacity grants. In brief, the revised rules signaled a change of policy from encouraging the formation of new watershed councils towards combining and sharing existing councils, and consequently enabling the total number of grants to be reduced over a 5–10 year period. To reinforce the change of direction, eligibility for grants was limited to a total of 64 existing catchment areas that had previously received OWEB funding. In effect, the rule changes were designed to encourage consolidation and building of stronger local capacity and to avoid increased competition for funding and administrative duplication.

The changes have resulted in some amalgamations of watershed councils and adjustments to areas. For example, on January 1, 2015, four independent watershed councils (Bear Creek Watershed Council, Little Butte Creek Watershed Council, Upper Rogue Watershed Council, and the Stream Restoration Alliance of the Middle Rogue) merged to become the Rogue River Watershed Council. In addition, the North Santiam Watershed Council has expanded its operating area to include areas not covered by another watershed council. Overall, the review led to new phase of consolidation and sharing of established management capacity after a phase focused on initiation of individual watershed councils and expansion of watershed council movement across the state.

5. Discussion, Conclusions, and Lessons

Our comparative analysis of Ontario and Oregon has shed some fresh light on why IWRM might be initiated, and also how different beliefs and attitudes regarding what is appropriate and how things should be done have influenced the development of governance arrangements.

Despite some clear differences in approach, both cases illustrate the importance of problem perception as a motivator for the initiation of IWRM. In Ontario, the initial motivation was provided by the depleted state of natural resources and the desire to provide employment for war veterans. In Oregon, early motivation was provided by threats to economically and culturally important fish stocks. One consequence of these different starting points was that Ontario embarked on a process of developing comprehensive approaches for land and water for entire catchments, whereas Oregon initially moved to develop a narrower and more targeted program focused on improving the management of riparian land and enhancing in-stream conditions and habitats in smaller, local-scale catchments. An important conclusion for both research and for policy is that one approach or interpretation is not necessarily better or worse than the other. Rather, in the two cases examined here, IWRM was grounded in the issues and concerns that mattered most in a particular place and at a certain point in time. This was crucial for gaining political and public support and attracting the investment needed to develop governance arrangements, in the form of CAs and watershed councils. International organizations seeking to produce guidelines and promote effective implementation of IWRM should, therefore, be mindful of the need for flexibility and sensitivity towards different circumstances, and not on promoting one particular interpretation or approach.

A second conclusion concerns the importance of beliefs, norms, and traditions, or "governmentalities", as influences on the choice of governance arrangements for IWRM implementation. It is here that some of the most significant and interesting differences between Ontario and Oregon are apparent. In Ontario, there are strong traditions of co-operation among neighboring municipalities, and co-ordination and collaboration among public organizations operating at the municipal and provincial levels. It is not a coincidence, therefore, that the CAs have developed clear, direct, and accountable systems of governance for IWRM that encourage and depend on effective inter-organizational relationships and procedures. In contrast, traditions and values in Oregon have tended to favor "looser" arrangements between local actors and state-level government departments.

Consequently, IWRM has been driven by encouraging watershed councils to be entrepreneurial and to compete for public funding. In addition, the watershed councils are not government-based organizations and their preferred approaches to IWRM involve voluntary action and land purchases rather than use of regulations. In essence, the CAs illustrate an inter-governmental approach to IWRM, whereas the watershed councils in Oregon demonstrate a more market-based style of governance. Again, the point is not that one system is necessarily better than the other, but that the respective arrangements are specific to the geographic context and prevailing ideas and beliefs about how coordinated management of land, water, and other natural resources can be achieved.

A third conclusion concerns the important role of finances and financing arrangements for steering the development and implementation of IWRM. In many countries, including Australia, Canada, UK, USA, and in Europe, governments and their departments are seeking to be less involved in delivering services and becoming more interested in steering and incentivizing private and non-governmental organizations, and also private citizens, to take more responsibility for action and problem-solving [9,10,18]. Those sorts of strategies are evident in both case studies, where state and provincial government organizations have used both the availability of new funding and the withdrawal of existing funding to re-priorities watershed-related issues and concerns. Returning to our earlier point regarding governance being concerned with "who gets what", it is clear that the use of financing in these ways can have significant implications for equity. In Oregon, a small number of watershed councils from just a few of the 36 counties in the state have received a significant proportion of the available government funding for IWRM, while others have received very little or none at all. In Ontario, municipalities have had to find ways of coping with reduced provincial government funding for CAs, either by reducing services or generating replacement funds through user charges and other mechanisms. In addition, it is a reality that the CA model favors more urbanized areas where more residents can contribute through property taxes. The CAs and watershed councils illustrate different interpretations regarding what might be regarded as equitable financing arrangements to support IWRM. Equity is highly subjective and it is not possible to state unequivocally whether financing approaches used in Ontario are more equitable or better than the arrangements developed for IWRM in Oregon.

A fourth conclusion concerns the governance capabilities proposed by Termeer and Dewulf [26], and discussed earlier in our paper. Both case studies have provided insights regarding reflexivity in connection with IWRM, and the associated challenges of accommodating varied understandings and frames in programs and decision making. Local initiative, strong municipal government representation, and public engagement are core elements in the CA program, helping to ensure that individual conservation authorities maintain a balanced catchment-wide perspective with regards to interests, needs, and concerns. Similarly, governance rules regarding composition of the OWEB board and the requirement for balanced representation for individual watershed councils have helped to ensure that multiple views and interests can be taken into account. Nevertheless, the arrangements developed for Ontario and Oregon are not perfect in that regard. For example, the CA program was designed for areas with a sufficient local tax base to help to fund catchment management. Consequently, compared with their counterparts in the more densely populated southern parts of the province, rural communities in northern Ontario have not had the same kinds of opportunities to address resource-related issues and concerns. Different challenges exist in Oregon, where watershed councils have tended to attract organizations with interests in river habitat restoration. As such, despite having been given broad mandates, the watershed councils have tended to overlook other aspects of catchment management related to land use, water quality, and water quantity. Some of those additional aspects have subsequently been incorporated within the Integrated Water Resources Strategy for Oregon, a government-based program not clearly connected to the arrangements for the watershed councils.

A remarkable feature of the CAs, given they originated more than 70 years ago, concerns their resilience and ability to adapt. In part, their resilience relates to their strong reputation and being valued by local groups, which has helped to withstand calls on occasions from some politicians for the

CA program to be reduced or cancelled. In addition, the shared funding model has meant that the CAs have been able to cope with reductions in provincial government contributions and to re-prioritize their work to focus on matters of greatest importance to the municipalities and local communities that have continued to provide financial support. In contrast, the watershed councils in Oregon illustrate a more rigid management approach, with a narrower set of fixed objectives and dependence on OWEB as their only source of major funding. Although the watershed councils have yet to experience a major test of their resilience, they are nevertheless vulnerable to potential political and economic shifts, which could result in changes to state water policy or legislation.

In both case studies, review processes and mechanisms have been important for ensuring catchment management organizations have responded positively to changing agendas and have revitalized their operations when necessary. For the CAs, the Walkerton Inquiry, and preparation of the 2006 Clean Water Act and the revised 2017 Conservation Authorities Act were instrumental in identifying limitations and gaps in existing arrangements and introducing changes that included improvements to the governance of CAs, greater flexibility regarding the depth and breadth of individual CA programs, and better protection for drinking water sources. On the other hand, the fact that the Walkerton tragedy did happen might suggest that more regular and thorough reviews should be undertaken to ensure the CAs and related organizations maintain their vitality and are able to respond effectively to pressures and new demands, and avoid major crises. In Oregon, the OWEB review process was important in the evolution of the watershed councils, re-directing funding to improve administrative efficiency, and consolidating rather than continuing to expand the overall program. However, while existing watershed councils have benefitted from the changes, one downside is that any new watershed councils approved by county administrations cannot apply for OWEB funding or support.

While the CAs and watershed councils are entities in their own right, the case studies highlight the importance of cross-scale connections with other organizations and layers of decision-making. The CA model has some clear advantages with respect to scale-sensitivity and cross-scale governance and management, since each CA is linked through the membership structure to a group of local municipalities with interests in different parts of the catchment. In addition, links and partnership arrangements with local communities, provincial government departments, and federal government agencies have created other advantages, such as CA involvement in protection of the Great Lakes and contribution to climate change initiatives. However, watershed councils in Oregon do not appear to exhibit the same level of cross-scale connectivity and sensitivity, despite membership rules that require balanced and diverse local representation. In particular, it appears that the watershed councils have very little involvement in the State government's Integrated Water Resources Strategy (IWRS), which is intended to address water quantity and water quality issues and concerns at a basin scale and advocates the development of place-based collaborative management groups.

Turning to more general lessons, we believe it is particularly important to rebuff calls to tighten the definition of IWRM and to provide more exact prescriptions for how things should be done. CAs in Ontario and the development of watershed councils in Oregon are success stories in their own terms, and neither would have been possible if policy makers had been tied to using one particular off-the-shelf governance model or approach. A second lesson concerns the prospect of transferring and up-scaling a successful approach to other locations, in which issues and challenges require integrated responses. While some of the underlying principles and basic ideas may be relevant for other locations, it would be a mistake to think that either the CA model or the Oregon watershed council model could be replicated elsewhere in their exact form. The CAs were designed for, and have evolved according to, the changing political, economic, social, and physical environment of Ontario. The same is true for the Oregon watershed council system. One implication is that any attempts to develop and implement IWRM in other areas need to start with a careful and detailed analysis of the system or systems to be managed. Analysis should give attention to the prevailing governmentalities and existing governance arrangements, as both are of critical importance for determining what may, or may not, be acceptable

and possible in the future. A third lesson to emerge concerns the importance of review processes and mechanisms. Reviews have resulted in significant changes that have enabled the CAs to continue to adapt and remain relevant as conditions within each catchment and management priorities have continued to evolve. Similarly, a major review by OWEB resulted in a transition from an initial phase of watershed council development to a new phase of consolidation aimed at ensuring efficient use of resources and maximizing environmental impacts and benefits. Those experiences imply that review processes and mechanisms regarding governance arrangements can significantly help to improve IWRM implementation, and therefore should become normal practice for IWRM initiatives in other parts of the world. A final lesson for future research concerns the importance of taking a long-term view of IWRM. Short snap-shots can be useful but can also be misleading. By examining the evolution of IWRM over extended time periods of several decades, as we have done here for the two case studies, it is possible to create a deeper and richer understanding of how governance arrangements change in response to external political and economic drivers. In addition, this study has shown how the interpretation and application of IWRM are relational, and dependent on the interplay among key organizational variables that include scope, scale, responsibility, engagement, finances and financing, and review processes and mechanisms.

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Article

Analysing the Role of Visions, Agency, and Niches in Historical Transitions in Watershed Management in the Lower Mississippi River

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Abstract: This paper analyses five major transitions in watershed management in the Lower Mississippi River from the early 19th century to the present. A conceptual framework is developed for analysing the role of visions, agency, and niches in water management transitions and applied to a historical case on water management in the Lower Mississippi River. It is shown that water management regimes change over time and that major transitions were preceded by niches, in which new visions were developed and empowered. The case shows that: (i) emerging visions play an important role in guiding transitions; (ii) agency enables the further diffusion of visions and niches; (iii) vision champions play an important role in transitions, but are not decisive; (iv) each transition has led to an extension of the number of societal functions provided, which has led to more complex water management regimes in which functions are combined and integrated; and (v) external landscape factors are important, as they can lead to awareness and urgency in important decision making processes.

Keywords: transitions; water management regimes; water resource management; niches; visions; agency

1. Introduction

From the 20th century onwards, the management of water resources has undergone at least four major paradigm shifts [1]. At the beginning of this century, the dominant paradigm was single purpose water resources management in all industrialised countries. This means that each water resource was managed for a specific purpose. For example, streams were harnessed for generating hydroelectric power. Fields were irrigated from canals and diversion or storage reservoirs. Cities were served with domestic water from wells and storage dams, and streams were rendered navigable by channel works. However, this was done without taking the interconnectedness of different functions of rivers into account [2]. By the 1930s, the prevailing paradigm had become multi-purpose water resource management, which aimed at combining functions of rivers. In this period, it had become possible to build dams to generate hydroelectric power, while also storing water for other purposes like agricultural irrigation, increasing the security of fresh water and water safety.

By the 1970s, a third paradigm emerged, due to the growing awareness of the full social and environmental impacts of river management re-shaping the natural landscape [3]. This led to the implementation of more environmentally sound forms of water engineering approaches like floodplain management and conservation. All three paradigms were technocratic as they assured high predictability and controllability of the water systems to be managed. However, they failed to account

for the complexity and strong interconnectedness of social and ecological components of these systems, also in disregard of potential risk of causing unexpected or unintended consequences [4–6].

By the 1990s, thinking about water management entered a fourth period [7], as the shortcomings of the prevailing water management paradigms became evident. A key change was that water systems were increasingly characterised as complex adaptive systems, which are not only self-organising, but also unpredictable and non-linear in their response to intervention what further complicates their management [8]. New and more integrated and adaptive water management approaches have been developed and are still being implemented to compensate for the perceived shortcomings in earlier management approaches [9].

The discussion above makes it clear that water management regimes have evolved over decades, and changing them requires time [8,10,11]. It includes changing their underlying paradigm—the set of guiding principles determining the internal logic of water management regimes and depends on the emergence of novel visions that provide guidance and orientation. Transitions in water management are complex processes, in which visions and actors play a vital role that needs further investigation to better understand and manage future transitions, for instance, toward adaptive water management regimes.

The relevance of guiding visions has been recognised in (sustainable) technology development [12], in system innovations towards sustainability [13] and in transition studies [13–17]. Despite increasing popularity of visioning approaches in the past two decades, theory development on the guiding potential of visions is still limited [18]. Much is known on how transitions are preceded by niche developments [19], but little is known how alternative visions emerge and further guide the development of niches and novel societal functions. As little research has been conducted on niche developments in successive transitions, our purpose is to provide more insight into such transitions based on a historical case on water management in the Lower Mississippi River. The aim of the paper is to develop and apply a framework for analysing water management transitions and emerging visions and niches and to enhance our understanding on: (i) what is the role of emerging visions and niches in such transitions and (ii) what is the role of agency and how does it relate to vision development and niche formation?

The paper is structured as follows: Section 2 presents an overview of various theoretical perspectives in the literature on transitions, agency and visions, which provides the theoretical foundation of our conceptual framework. Section 3 presents an inquiry into historical transitions in watershed management in the Lower Mississippi River, which analyses water management transitions covering several transitions in a time span over more than two centuries. Section 4 discusses major lessons from this inquiry, followed up with concluding remarks in Section 5.

2. Materials and Methods

2.1. Theory

2.1.1. Multi-Level Perspective and Socio-Technical Transitions

A major analytical lens associated with the transitions approach is the Multi-Level Perspective (MLP) that explains transitions by the interplay of dynamics at three levels (see Figure 1) [20–22]. These are the levels of niches, socio-technical (ST) regimes, and landscape. The MLP takes as a starting point that novelty emerges and develops at the niche level, which eventually can result in transformation or replacement of ST regimes. Regimes can be conceptualised as consisting of actors, institutions, and (socio-technical) systems [23]. At the landscape level, gradual developments and sudden shocks like natural disasters or economic crises might put pressure on existing ST regimes and may create windows of opportunity for niches to break through.

The emphasis in transition studies is generally on ST-transitions in provision systems that relate to one or multiple societal functions like water supply [24,25], food, or energy [19] These systems provide products and services to users through companies and markets and the focus is on the emergence

and the rise of new technologies that bring new functionalities. The nature of change in ST-systems is evolutionary and path-dependent, while the dynamics of such systems are subject to risk and uncertainty, and thus inherently unpredictable. Geels and Schot [26] have argued that transitions can only take place if a niche is sufficiently developed to take advantage of a window of opportunity. In the MLP, niches represent alternative socio-technical configurations, which are not yet institutionalised but are potentially embryonic nuclei for the future. Other related types of niches can be found in the literature, ranging from backcasting niches [27] to technological niches [28], transition experiments [29], and market niches [30].

2.1.2. Social-Ecological Transitions and Management Regimes

In addition to the sociotechnical perspective on transitions discussed in Section 2.1.1, there is a social-ecological perspective on sustainability transitions [17,31], which has similarities and differences with the ST-perspective. The similarities include that both perspectives conceptualise transitions as nonlinear disruptive systemic changes. The central notion in both perspectives is the concept of regime, which refers to a dominant and stable configuration in one of these systems [17]. Like ST-systems, a social-ecological system (SES) can be considered as complex adaptive systems, characterised by complex, dynamic, multiscale, nonlinear, and adaptive properties posing common challenges to the regimes in governing transitions in these systems [31]. The concept of SES is used to emphasise interconnectedness of social and ecological systems through human and natural elements that are closely interacting and mutually constituting [32], which is the case in water systems.

Similar to ST-regimes, water management regimes cover a wide range of interdependencies among actors and institutions, including the power relations and role constellations between different actors [33,34].

However, the ST and social-ecological perspectives conceptualise transitions in a different way, due to a different focus, unit of analysis, and system delineation. Social-ecological transitions relate to a large variety of human-ecosystem interactions that weaken or strengthen an ecosystem's resilience, which is its ability to withstand shocks, while maintaining its function, and transform, anticipating external pressures, shocks, and threats [35,36]. The focus is on supporting resilience in existing system, or transform ecosystems into more desirable systems [37]. Regimes dedicated to the management of SES are place-bound as they are embedded in a SES that provides the main unit of transition analysis, whereas ST-regimes operate simultaneously across clearly demarcated industrial sectors with multiple localities [31]. Each management regime implicates different patchworks of SES through resource extraction, service consumption and waste assimilation.

Another difference entails the nature of the regime. Rather than using the term social-ecological regimes as proposed by Fischer-Kowalski [38], we propose that the challenges of managing SES, for which technology can be used, can be associated with the notion of management regime. Management regimes provide stability of ecosystems by enhancing their capacity to deal with disturbances through transformation [17]. To govern social-ecological transitions, agency is needed just like in socio-technical transitions. A management regime can be seen as a conceptual configuration of social and ecological elements that condition human–ecosystem interactions, whereby ST-regimes can help to sustain SESs through technologies [31]. After Smith [31], we consider a management regime to encompass a patchwork of different ST-systems that evolve around a SES, which is typically rooted in a particular spatial context such as a watershed e.g., land-use management, waste management, resource management, and environmental management.

2.1.3. Water Management Regimes

Within the confines of water management, a management regime is embedded in a SES. Water management regimes have evolved around a particular SESs that provides essential ecosystem services (e.g., water). The emphasis in management regimes is on managing societal functions generally considered as public tasks. This focus is reflected in the definition of water management regime by

Pahl-Wostl [8] (p. 8): "*the whole complex of technologies, institutions, environmental factors, and paradigms that are highly interconnected and essential to the functioning of the management system that is targeted to fulfil a societal function such as water supply or flood protection*". Paradigms refer to a set of guiding principles for water management [39].

Water management regimes are generally about balancing different and sometimes conflicting societal functions and interests, taking a public or governmental perspective. Water management regimes are not solely meant for delivering water-related products and providing functions to end-users. They are also about managing societal functions related to water that are relevant for several ST-regimes. Water management not only concerns flooding protection, but also transportation, water quality, production of drinking water, as well as water for industry and agriculture.

2.2. Visions in Niches and Transitions

2.2.1. Visions

Visions are considered important for transitions because they provide a common reference point for action and guide actors in their actions and behaviour in reaching out to that point [13–17]. Various vision concepts can be found in the literature on innovation studies and transitions towards sustainability, while distinction is made between different levels like niches or projects (micro), networks and sector (meso), and society at large (macro) [27]. Various authors e.g., Smith et al. [40] have emphasised the important role of guiding visions in transitions. In transition management, visions are referred to as: "a framework for formulating short-term objectives and evaluating existing policy (. . .) these visions must be appealing and imaginative and be supported by a broad range of actors" Rotmans et al. [41] (p. 23). Most vision concepts address emerging phenomena like the development and diffusion of new technologies, the rise of new scientific disciplines and transitions towards sustainability [13]. Alternative visions like sustainability visions [13] or climate change adaptation futures [42,43] are backed by alternative trend-breaking expectations about possibilities and may be based on different alternative worldviews.

Visions emerge in different contexts (e.g., organisation, communities, research projects) and shapes, but show three common aspects [18]: an image of the future, an ideal, and a desire for deliberate change. These aspects reflect the guiding potential of visions. Building on Grin [44], Quist et al. [45] and van der Helm [18], we define a guiding vision as a shared multi-actor construction of a desirable future that may have the potential to guide actors in their actions and behaviour to bring about that future, especially when generated in a participatory process. Visions can become more guiding once they are shared by a growing group of actors.

2.2.2. Agency

Agency is widely considered key to emerging visions and niches [13]. Emerging visions are connected to actors and networks that can either endorse or contest visions and when the vision changes the supporting network may change too (and vice versa). Actors can provide agency, influencing the speed and direction of transitions [34,46,47]. For agency in water management transitions we build on Smith et al. [40], who describe agency in transitions as the capabilities of actors to intervene and alter the balance of selection pressures bearing on a regime and their adaptive capacity.

Building on the guiding vision, which was originally proposed as the German Leitbild concept [48,49], Quist [13] has introduced the concept of a vision champion, which is a key individual or a group of key persons who are able to motivate and coordinate the collective pursuit of change. A vision champion can play a vital role in realising major change like policy entrepreneurs who are individuals that instigate, implement and sometimes block transitions [50–52], or system builder-entrepreneurs who lead and manage development and further growth of the large technical systems [53]. It should be noted that such key persons or key groups are often embedded in informal networks, typically governed by not yet institutionalised rules. Such networks are in the beginning

informal and flexible in terms of membership, role, power of actors and connections, but their members can also be active in more formalised networks. Niches are created for setting up experiments and steering directions of experimenting, learning innovations, and adaptation, which are mechanisms that underlie transitions [15]. These mechanisms relate experiments to other niches, either within or outside the domain or function of the experiment [29]. Therefore, niches are closely connected to formal and informal networks, as they enable learning processes for (radical) innovations by providing access to new kinds of knowledge and supporting multiple ways of interpretations.

Emerging visions can be seen as seeds for change (co-) shaped by a range of actors, that challenge rules that are deeply entrenched in existing structures and the actors supporting and protecting such structures [44]. Visions are emerging phenomena, guiding activities, and changes that eventually may alter the dominant regime [13]. Emerging visions are usually rooted in entirely different beliefs, values and mental frameworks initially not shared by larger groups in society [13]. Such visions are typically associated with outsiders, who are likely to conduct rule-breaking behaviour [54,55], because they pursue divergent and sometimes marginal perspectives [56]. Learning is key to vision development and niche formation [13], but our focus is more on the interaction of visions and actors in niches and less on learning processes and knowledge.

2.3. Framework and Methodology

2.3.1. Conceptual Framework

Building on the theoretical perspectives presented in the previous sections, we develop a conceptual framework for analysing water management transitions. The framework builds on the MLP, as it provides a base for conceptualising the interplay of niches, visions, and agency. Following the MLP, Transitions are the outcomes of alignments and de-alignments between processes at the niche, regime and landscape level, which in turn enables the breakthrough of a niche. This requires the empowerment of the niche, in which visions and actors play a key role.

Our framework builds on the interplay of visions and actors to describe niche-driven change in water management regimes. The principal mechanism for such changes is triggered by alternative visions that emerge in niches, linked to supportive networks of actors, providing agency (see Figure 1). Actors develop niche visions, which introduce new guiding principles for water management that challenge the established rules e.g., the dominant guiding principles for water management. Actors need to support the niche visions, which evolve together with the development and testing of novelties in the niche through niche experiments. The niche vision that becomes shared and adopted by actors further guides the development of a niche and the actions of actors in the network to further empower the niche to challenge existing rules of the regime. The replacement of rules leads to a transition.

Based on the theoretical concepts discussed in Section 2, Table 1 shows the variables and evaluation criteria for each of the dimensions of our framework.

Table 1. Evaluation criteria of niche-driven innovations.

Dimension	Variable	Criteria
Landscape	Landscape factors [22,23]	What were important *gradual* and *disruptive* developments?
Regime	Societal functions [24,25] Guiding principle(s) for water management	What were the *societal functions*? What were the dominant *guiding principle*(s) for water management?
Niche	Niche vision [18] Guiding principle(s) for water management Agency [13]	What was the *desired change*? What were the new *guiding principle*(s)? Who provided *agency*?

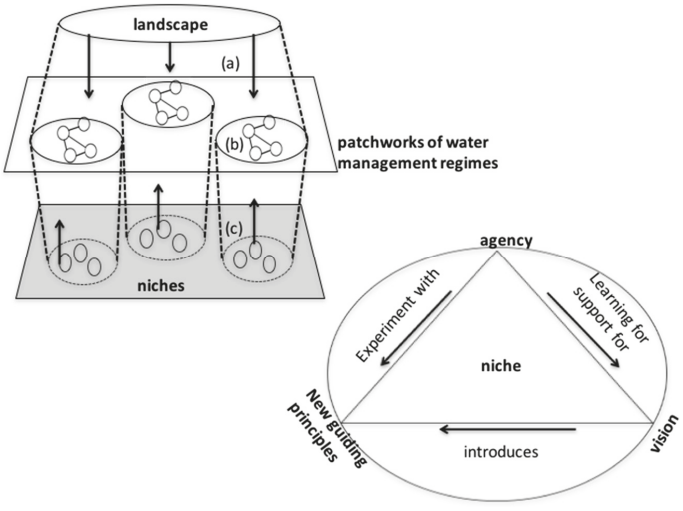

Figure 1. A graphical representation of mutual relationships between visions, guiding principles, and actors in niche-driven change in water management regimes.

2.3.2. Research Methodology

A qualitative historical single-case study allows for learning from historical transitions, by studying processes and tracing specific causal-event chains within their own context [57]. Transitions are complex processes of multiple conjunctures of causal conditions in time and space, yielding a given outcome. Even though causality may exist, it remains quite difficult to clearly indicate the cause producing the outcome of interest [57,58]. The relevance of the Lower Mississippi River lies in its rich history of major flood disasters and damages in conjunction with a wide array of enactments by US Congress and policy developments and the wide availability of secondary historical sources that report on these events [59].

We here use causal narratives that explain certain outcomes of sequences of historical events, which are tied together by a central theme. Causal narratives help us to trace unfolding processes and study event sequences, timing, and conjunctures [60]. Our interest lies in the interplay of factors and influences across the landscape, regime and niche level. Each narrative captures complex interactions between agency and visions (niche level) and changing contexts (landscape and regime level), time, event sequences, making moves in games, and changing identities. However, causal narratives need to be guided by 'heuristic devices' that specify a certain plot [61]. The principal mechanism for niche-driven regime change will be used as a central plot for our narratives.

2.3.3. Data Sources

Secondary historical sources such as scholarly books and papers are used to draw the overall picture and patterns over a much longer period of time. Geels [61] emphasises the exploratory and illustrative character of transition studies. In transition research, it is common practice to use secondary sources and to use a framework as a lens to look at these sources in a transparent and systematic way see e.g., [22,62–64].

We applied data triangulation to construct our narratives with a beginning, middle, and an end, focusing on historical events as well as on underlying factors see e.g., [65]. Triangulation involved the comparison of various historical accounts i.e., [3,66–68] to determine the appropriate time span for each narrative. Our inquiry and data triangulation is based on multiple interpretations extracted from

secondary sources. We will evaluate and compare the narratives in terms of the criteria presented in Table 1 to identify recurring patterns.

3. Results: A Case Study on the Lower Mississippi River

3.1. Historical Context

Floods were part of the earliest recorded history of the Mississippi River. Since its foundation in 1718, New Orleans has been the epicentre of floods, resulting from both hurricanes and extreme run-offs of the Mississippi River. About eleven flood events occurred on the Mississippi between 1849 and 2001, with catastrophic floods in 1927, 1936, 1973, and 1993 labelled significant enough to merit regional or national attention. From the settlements in the State of Louisiana in the early 1700s until the early 20th century, the principal and often only approach to flood damage reduction was the construction of levees. These flood disasters and the associated policy responses have played an important role in the evolution of US watershed management. Watershed management is a management planning process that seeks to balance healthy ecological, economic, cultural, and social conditions within a watershed, whereas water resources management includes the management related only to water resources [69].

Following Sabatier [3], our historical inquiry covers five consecutive transition periods, which cover the key eras of water(shed) management in the US: the Manifest Destiny Era (early 1800s–1889), the Progressive Conservation Era (1890–1928), the Federalism and New Deal Era (1929–1967), the Environmental & Flood Insurance Era (1968–1994), and the Watershed Collaborative Era (1995–present). Results for each period are summarised in Table 2.

Table 2. Summary table of transition periods.

Criteria	Transition Period				
	Manifest Destiny Era (Early 1800s–1889)	**Progressive Conservation Era (1890–1928)**	**Federalism and New Deal Era (1929–1967)**	**Env. & Flood Ins. Era (1968–1994)**	**Watershed Collaborative Era (1995–Present)**
Dimension 1: Landscape factors					
Gradual developments	Increased land-use for agriculture	Increased environmental awareness	Strong state-based federalism	Increased floodplain occupancy	Increased vulnerability to flood disasters
Disruptive events	The 1849 & 1850 floods/The 1849 & 1850 Swamp Land Acts	The 1927 flood disaster	The Great Depression	The 1993 flood disaster/NFIP	The 2005 flood disaster
Dimension 2: Regime					
Societal functions	Drinking water supply, waste disposal, hydropower, navigation	Drinking water supply, waste disposal, hydropower, navigation, flood control	Drinking water supply, waste disposal, hydropower, navigation, flood control, land use planning	Drinking water supply, waste disposal, hydropower, navigation, flood control, land use planning, flood plain based flood control	Drinking water supply, waste disposal, hydropower, navigation, flood control land use planning, flood plain based flood control, wetland based flood control.
Dominant guiding principle	Single-purpose approach for navigational enhancement	Single-purpose; Levee based Flood control	Multi-purpose watershed management (systematic management of rivers)	Multi-purpose watershed management; Flood control engineering & multiple adjustments, flood insurance	Multi-purpose & collaborative watershed management based on IWRM principles
Dimension 3: Niche					
Niche visions	Reservoirs for flood control (Ellet) Levees for flood control (Humphreys) Jetties for flood control (Eads)	land use planning for comprehensive watershed management (Hoover)	Human adjustments to floods (White)	Floodplain restoration (Galloway) Wetland & floodplain restoration (Kusler)	Adaptive water management and disaster resilience

3.2. The Manifest Destiny Era (Early 1800s–1889)

3.2.1. Landscape Developments

The Manifest Destiny is a term for the period of American expansion where the US was destined to stretch from coast to coast in the 19th century. In this period, land was heavily exploited, especially in the West of the US. Due to *disruptive events* like the large floods of 1849 and 1850 in the Lower Mississippi Valley, US Congress enacted the Swamp Land Acts of 1849 and 1850. This gave rise to a *gradual development* of millions of acres for agricultural use, ultimately exacerbating the flood problem [70].

3.2.2. The Existing Regime

Although watershed management was essentially absent in the Manifest Destiny Era, rivers and lakes were envisioned as a source for fuelling economic development [3]. Property usable to waterpower was seized by private concerns. Mining companies practiced improper and wasteful mining practices. The overall societal function of water management comprised mainly the functions drinking water supply, waste disposal, hydropower, generally generated by dynamo water turbines, and navigation. In this single purpose era, these functions were not interconnected and managed separately. Without any attempts to reconcile or combine functions, water quality and habitat protection were on virtually no one's radar screen [3]. This principle was institutionalised in the engineering work of the US Army Corps of Engineers (hereafter referred to as the Corps), as the principal federal authority in water affairs. The aim of water management was to tame the river for navigational purposes and commercial interests, by controlling, diverting, and damming it. The dominant *guiding principle* for water management was a single-purpose approach of navigational enhancement of the Mississippi River, by removing obstructions from the channels of the river (boulders and snags).

3.2.3. Niche Developments

In this period, there were three niche visions on flood control: (i) building reservoirs, (ii) levees, and (iii) jetties for flood control. The key person for the first vision was Charles S. Ellet Jr., one of the best-known engineers of his time, who associated the growing flood problem with increased cultivation in the valley [71]. Ellet recommended the practicability and value of building reservoirs on the Mississippi's tributaries to reduce flooding. His vision and ideas were considered controversial and impracticable and were never adopted [67].

The second vision gained more support and was based on the most extensive study on the Lower Mississippi River ever undertaken at that time, by Andrew A. Humphreys and Henry L. Abbot, two officers from the Army Corps of Topographic Engineers. Their study addressed the environmental impact of over-exploitation of swamp and overflow land. Their pioneering work challenged existing hydraulic theories and introduced a new universal formula and a method to explain river flow. It provided the scientific base foundation for their vision that proposed a *desired change* towards levee-based flood control, targeted at realising levee construction along the Mississippi River [71]. Humphreys assumed that levees would not prevent the water from rising but, if sufficiently high, levees would prevent flooding.

Based on his new method for measuring and computing the river's discharge and flow, Humphreys proposed the new "levee-only" vision for flood control along the lower Mississippi. The novel vision was believed to achieve cost efficiency in flood control engineering. The novelty lies in the new *guiding principle* assuming that levees only could control flooding along the lower Mississippi River without costly reservoirs and river cut-offs [71]. When Humphreys became Chief of Engineers of the Corps in 1866, he played an important role in building a network and restructuring the Corps and its river engineering practices around the "levee-only" vision. Favourable factors for building support for his vision were: (i) private engineers and congressmen questioned the Corps'

capabilities; (ii) the growth of professional engineering societies; (iii) increased demand of US Congress for public works projects.

The third vision was supported by the famous civil engineer James Buchanan Eads, who argued that levees would actually lower the bed of the river, as they would allow floodwater to scour a deeper channel. Eads envisioned that closing all gaps in the levees and then imposing a uniform width on the river by narrowing wide places through jetties would eventually secure a sufficient depth for navigation to yield levees unnecessary. Eads's successful accomplishments with jetties at the South Pass Channel triggered influential developments, which crumbled the Corps' responsibilities and reputation in river engineering. US Congress deprived the Corps from its right to conduct scientific expeditions in the West, after which it weakened the Corps' authority on the Mississippi River by establishing the Mississippi River Commission. The success of the jetties showed the Corp's incompetence in river engineering because its river engineering approach was based on the false assumption—that levees alone could adequately confine the Mississippi River [71]. This encouraged private civil engineers to break the Corp's monopoly on federal public works projects.

There was a fierce clash between the advocates of the second and third vision, which represented two river engineering schools. Due to commercial interests in navigation, the course of the dispute seemed to be determined in favour of the third vision supported by Eads. Ironically, despite Eads's successful accomplishments with jetties, the "levee-only" approach advocated by Humphreys became and remained the dominant guiding principle until the Great Flood of 1927 because many Corps officers supported this approach.

3.3. The Progressive Conservation Era (1890–1929)

3.3.1. Landscape Developments

During the Progressive Conservation Era, the over-exploitation of natural resources for private gain was a key factor for change. Being a *disruptive event*, the Great Flood of 1927 unmistakably revealed the shortcomings of the prevailing 'levee-only' guiding principle, which shifted public opinion towards liability of federal government for flood damage [66,70]. The flood caused over $200 million in property damage (about $2 billion in 2000 US dollars) [66]. The public's *gradually growing* critical awareness of natural resources and environmental developments like the over-exploitation of natural resources for private gain contributed to the growth of the Progressive conservation movement [72]. The Progressive Conservation movement was a coalition of reformers who believed in mankind's ability to improve the environment and conditions of life, an obligation to intervene in economic and social affairs.

3.3.2. The Existing Regime

The overall societal function of water management comprised the functions described in Section 3.2.2. In this period, the set of functions expanded with flood control that was driven by the dominant guiding principle of "levee only" based flood control. Due to the rise of the Progressive Conservation movement, there was a tendency to strike a balance between economic and environmental objectives [3]. In contrast to the federal level, the state and local levels were considered the appropriate levels at which water issues were tackled [70]. Emphasis was put on the ability of experts and in the efficiency of government intervention for federal supervision of the nation's waterways and their preservation of those resources for future generations.

3.3.3. Niche Developments

In this period, there was only one niche vision on federal government involvement in water affairs. The vision was strongly supported by Hoover, at that time the US Secretary of Commerce. The vision proposed a desired *change* towards treating each river as an integrated unit from source to mouth [68], targeting at realising multi-purpose water programmes. As a summer student-assistant, Hoover had become a strong supporter of the underlying philosophy of this vision by Stanford geography

professor John Wesley Powell, who appealed in his innovative 1878 Report on the Lands of the Arid Region of the US for planned development of water and land resources in the country. He had been the first who defined a watershed as an area of land, a bounded hydrologic system, within which all living things are inextricably linked by their common water course and where, as humans settled, simple logic demanded that they become part of a community [73]. By the time Powell made his famous plea in 1890 for making local government boundaries coincide with hydrographical units, the jurisdictional decisions had long been made and he was ignored [3].

Inspired by the vision of Powell, Hoover supported a new vision for multi-purpose water resources management, which was based on the novel assumption that rivers were to be managed as bounded hydrological systems. The vision included a novel *guiding principle* of multi-purpose water resources management, prescribing that rivers need to be developed and managed in a systematic and consistent way, with the aim to reconcile navigation, flood control, irrigation, and hydropower. Under his presidential leadership, Hoover played a vital role in a series of political compromises that resulted in the adoption of the 1928 Flood Control Act [66]. This happened rather quickly, as the 1927 flood disaster helped him to mobilise support for the new vision and also to become elected president [70].

3.4. Federalism and New Deal Era (1929–1967)

3.4.1. Landscape Developments

The post-1928 flood control acts triggered macro-political developments that fragmented the governance landscape. These *gradual developments* drove public opinion in favour of strong state-based federalism, although states led in canal-building and flood control, with water issues resolved primarily at state and local levels [70]. However, the 1928 Flood Control Act made the federal government responsible for the Mississippi River, but also immunised this government from any liability of any kind and for any damage from or by floods or floodwaters at any place.

An important *disruptive event* was the 1929 Great Depression, which led to the 1932 presidential election of Franklin Roosevelt [66]. The New Deal continued large public works projects to alleviate poverty and unemployment between 1933 and 1936. The New Deal focused on what was called the "Three Rs" related to Relief, Recovery, and Reform: Relief for the unemployed and poor, Recovery of the economy to normal levels; and Reform of the financial system to prevent a repeated depression [74]. The New Deal is the hallmark of state-based federalism, in which new federal institutions were established to enable an integrated planning approach for regional economic development, land use development and water resources management.

3.4.2. The Existing Regime

The overall societal function of watershed management comprised the functions described in Section 3.3.2. In this period, the set of functions expanded with land use planning. Strong federal government was seen as a requirement for watershed management [68]. The Tennessee Valley Authority (TVA) was the first federal authority to broadly apply alternative approaches to control flood damage, choosing to add land use planning methods to the popular structural measures already used to control the paths of floodwaters. The TVA was envisioned as a blueprint for the integration of land and water as well as land use planning methods and existing measures that were already used to control the paths of floodwaters.

Meanwhile, the Corps refused to join the movement toward watershed management, preferring to conduct river management in a piecemeal fashion for the benefit of many local interests [70]. Nevertheless, federalism in water affairs, including the guiding principle, was supported by emerging technologies like concrete dam building design (e.g., the Hoover Dam and Norris Dam) that could enable multi-purpose watershed management. Multi-purpose watershed management was envisioned to strike a balance economic and environmental objectives [3]. During the Roosevelt administration, more administrative layers were added to the complicated variety of authorities for the construction

and maintenance of flood control devices, which deviated watershed management further from Hoover's ideal of comprehensive watershed planning [66]. This ideal was reflected in the dominant *guiding principle* that rivers are to be treated as bounded hydrological systems and the watershed or river basin was considered the appropriate scope of management. Multi-purpose watershed required (i) government to be active and strong as markets could not be trusted to manage water resources; (ii) multipurpose and region-wide planning as exemplified by the TVA; (iii) intergovernmental coordination in flood control.

3.4.3. Niche Developments

In this period, there was only one niche vision on more human adjustment to floods. The vision was strongly supported and further developed by a renowned geographer and an influential proponent of an integrated planning approach, Gilbert F. White [75]. He concluded that many water problems, including floods, were the inevitable result of past human modifications of natural conditions set by the dominant guiding principle. The novel vision articulated the desired *change* to adjust human occupancy to the floodplain environment for effective use of the natural resources of the floodplain. Multiple human adjustments to floods or non-conventional flood control engineering measures were envisioned to protect the occupants of floodplains against floods and to aid them when they suffer from flood losses, and of encouraging more intensive use of floodplains [76].

The new vision was inspired by White's work, which assumed that floodplains were key to flood control [76]. This implied that the integration of land-use restrictions, and forecasting and warning systems had to be part of watershed management. The vision included a new *guiding principle* of multiple adjustments to floods, combining conventional measures (e.g., levees and dams) and non-conventional measures (e.g., floodplain abandonment and flood insurance). Due to growing concerns about increasing floodplain occupancy, White's ideas and work reached a broader audience that allowed him to play a key role in building a supporting network for the new vision and his studies. White's cost-benefit analysis received support from Harvard professor Arthur Maass, who criticised the role of the Corps in its rivers and harbour activities and introduced his theory on the economics of water resources planning [68]. Support also came from two US Geological Survey hydrologists, who revealed the major ineffectiveness of the Corps' upstream and downstream flood control measures.

White's studies received criticism from the Corps because it revealed the shortcomings of the conventional flood control engineering approach [68]. The opponents, generally from an engineering background, found White's ideas on human adjustments highly controversial, and argued he promoted un-American ideas. They were great proponents of engineering as a panacea for solving all flood management problems [77]. However, White's 1958 study Regulating Flood Plain Management and increasing loss of property and cost of flood damage, changed the course of the debate in White's favour. The new vision received federal support from the Council of State Governments and US Congress, as both were convinced that White's vision and guiding principle offered a real alternative to existing flood control practices. This led to the expansion of the Corps' role in broader flood control approaches in line with the new guiding principles. Endorsement of the recommendations of White's [78] study Choice of Adjustments to Floods by US Congress led to enactment of land-use regulations for floodplains and flood hazard evaluation guidelines for federal executive agencies [68].

3.5. The Environmental and National Flood Insurance Era (1968–1994)

3.5.1. Landscape Developments

Already five years after the enactment of the national flood insurance programme (NFIP), White's admonition was validated. Flood losses were continuing to increase due to accelerated *macroeconomic developments* like floodplain development [68]. The 1968 National Flood Insurance Act led to floodplain abandonment, but also triggered the perverse effect of stimulating the development of vulnerable areas and exacerbating the flood damages. Both federal flood control construction and the availability

of federally insured loans and grants for land acquisition and building were at fault. The *disruptive event* of the 1993 flood revealed that the federal government's emphasis on flood insurance and local floodplain management was insufficient.

3.5.2. The Existing Regime

White's plea for a national flood insurance programme (NFIP) to involve federal, state and local governments and the private sector in recovering flood losses, led to the adoption of the 1968 National Flood Insurance Act. The adoption of the National Environmental Policy Act and the creation of the US Environmental Protection Agency (EPA) embodied the limitations of human occupancy in floodplains.

The overall societal function of water management comprised the functions described in Section 3.4.2. In this period, the set of functions was extended to floodplain—based flood control, which included arrangements imposed by a governing body (local, regional, or national) to restrict the use of floodplains, or flexible human adjustments to flood risk that do not involve substantial investment in flood-control engineering works [79]. The dominant *guiding principle* for water management was multiple adjustments to floods, combining conventional measures and non-conventional measures.

3.5.3. Niche Developments

In this period, there were two niche visions: (i) floodplain conservation and (ii) integrated floodplain management. The first vision emerged in the aftermath of the 1993 flood, when Congress adjusted the NFIP and authorised buy-outs for some structures and cropland in the floodplain. Congress also appointed the Special Inter-Agency Floodplain Management Review Commission to assess existing flood control programmes and make recommendations for radical change. The Commission, chaired by the former Corps Brigadier General Gerald Galloway, envisioned a more balanced approach to federal floodplain management, using both conventional (levees) and non-conventional flood-control engineering measures (wetland restoration for reduced peak flood flows). This vision differed from the dominant vision of multiple adjustments to floods, as it emphasised that more of the floodplain should be reserved for wetlands, forests and agriculture. However, the Commission failed to recognise a major role for wetlands in providing flood protection [70]. Ironically, supported by new federal legislation, some communities successfully experimented with retreating from flood-prone areas rather than resorting to yet more mainstream flood control engineering [70]. They learnt the hard lesson of the 1993 flood and realised that some floodplains are best left in their natural conditions [68].

A second niche vision on integrated natural resource management in floodplains and wetlands emerged, while the lesson on ecological restoration of floodplains at the grassroots level appeared on the radar screen of the Federal Interagency Floodplain Management Taskforce. The Taskforce's Chair, Frank Thomas, was inspired by Jon Kusler of the University of Wisconsin, who supported the new vision [68]. This vision challenged the dominant guiding principle. It emphasised the need for environmental legislation, by targeting on addressing multiple measures or problems at a time, establishing interagency coordination, preventing endless litigation, and neglect social and economic impacts [3].

The new vision was based on the assumption that functions and resources of wetlands and floodplains need to be restored in order to reduce flood losses and environmental harm. New environmental protection goals were set for federal, state, and local government agencies and interest groups and new targets were set for collaborative and integrated watershed management. The new *guiding principles* for watershed management included: (i) strengthening state, federal, and local wetland programmes by facilitating and improving cooperation among these governmental entities; (ii) integrating public, private, and academic efforts to achieve wetland protection and management goals; and (iii) identifying and quantifying the beneficial ecosystem functions of wetlands in order to improve their management and restoration.

Based on Kusler's effort to coordinate floodplain management and measures, the new vision rapidly acquired national attention and support to bring about changes in line with the vision. During

the 1980s, Kusler played a key role in establishing a supportive network of representatives of the EPA's Office of Wetland Protection for the vision and to promote his work on integrating floodplain and wetland management approaches [68]. The vision was endorsed by the Corps and other federal agencies because they had to step up to their environmental commitment. These agencies internalised an ethic dedicated to environmentally friendly water resources projects. In line with the new vision, US Congress further refined and expanded the Corps' environmental reach by authorising it to protect, restore, and create aquatic and ecologically related habitat, including wetlands.

3.6. The Watershed Collaborative Era (1995–Present)

3.6.1. Landscape Developments

In New Orleans and along the Gulf Coast, a convergence of natural and human forces set the stage for predictable and predicted environmental developments such as flood catastrophes. Once again, levees proved to be insufficient to secure settlement in the floodplain, which gave rise to a *gradual development* like increased vulnerability to flood disasters. The Mississippi River floods in the Midwestern states led to a flurry of rebuilding within the floodplain in the 1950s and 1990s, so did the Hurricane Betsy encouraged levees support floodplain development. In 2005, Hurricane Katrina revealed many of the challenges faced by planners and managers who attempt to understand and manage flood disasters [80]. Being a *disruptive event*, Hurricane Katrina also demonstrated that a loss of coastal wetlands in Louisiana increased the vulnerability of the area to hurricane impacts [81].

3.6.2. The Existing Regime

The overall societal function of watershed management comprised the functions described in Section 3.5.2. In this period, the set of sub functions was extended to wetland-based flood control [3] (see Table 2). The *dominant guiding principle* was to achieve increased collaboration between federal, state, and local government agencies for environmentally sound collaborative watershed management (Section 3.5.3). Even stakeholders were considered to hold valuable local knowledge and expertise to participate in collaborative negotiations with their counterparts.

3.6.3. Niche Developments

In the aftermath of Katrina, the Louisiana Coastal Protection and Restoration Authority was created. This post-hurricane development was based on the recognition that wetland ecosystems, whether forested or not, are critical buffers for mitigating the impacts of hurricanes in coastal areas [80]. Although US Congress gave the Corps a specific ecosystem restoration mission in the 1990s, ecosystem restoration further complicates the problems water resource planners face [80,82]. A panel on adaptive management for resource stewardship served as a committee to assess the Corp's methods of analysis and peer review for water resources project planning [83]. Restoration requires an understanding of wetland ecosystems. Our understanding of these systems is limited because of their complex nature and behaviour emblematic for complex adaptive systems (Section 2.1.2), which poses uncertainties for management [84].

In the last two decades, water planners in the United States and around the world are attempting to develop "comprehensive" water management plans [85,86]. These niche developments are based on a vision for comprehensive water management reflecting the guiding principles for integrated water resources management (IWRM) [82,87]. However, the implementation of an IWRM approach that fully accounts for the complexity of ecosystems in watersheds has yet to be realised. New management approaches such as adaptive water management have been proposed as a promising way to deal with complexity and the related uncertainties [88,89].

There are reports on relevant niche developments in the New Orleans region. Van der Voorn et al. [42], for instance, reported on a niche development around a vision on adaptive and integrated water management. This example coincides with other on-going regional niche developments, driven by

visions that promote integrated approaches for coastal restoration, wetland protection, and flood protection, which articulate a *change* towards increased disaster resilience realised through adaptation to climate change impacts. These niche developments promote a novel guiding principle, based on a learning-based approach as the key *guiding principle* for the fulfilment of new *goals* like dealing with the *assumed* complexities and uncertainties due to climate change.

More research is yet needed on the potential of these strategies and approaches to help addressing the types of changes and challenges. Several avenues for further research can be found in the literature. For example, Kashem et al. [90] evaluated the changing patterns of social vulnerability in New Orleans and integrated neighbourhood change theories with theories of social vulnerability. Govind [91] reported on the lesson from Katrina with managing SES in an uncertain future affected by climate change. It provides further insights as to the complementary nature of climate policy and resilience while galvanising New Orleans against future extreme events. Abadie [92] reported on an application of probabilistic weighting of Intergovernmental Panel on Climate Change scenarios to reduce sea level damage risk for New Orleans.

4. Discussion

4.1. Key Findings and Patterns

In the introduction of the paper, four transition periods were introduced which are confirmed by our historical inquiry. Another transition period (early 1800s–1889) was identified, which can be seen as the initial phase of the single purpose era as watershed management was essentially absent.

The inquiry shows that in the lower Mississippi five different periods can be identified in watershed management, which can be characterised by different guiding principles and societal functions. Results are summarised in Figure 2 and Tables 2 and 3.

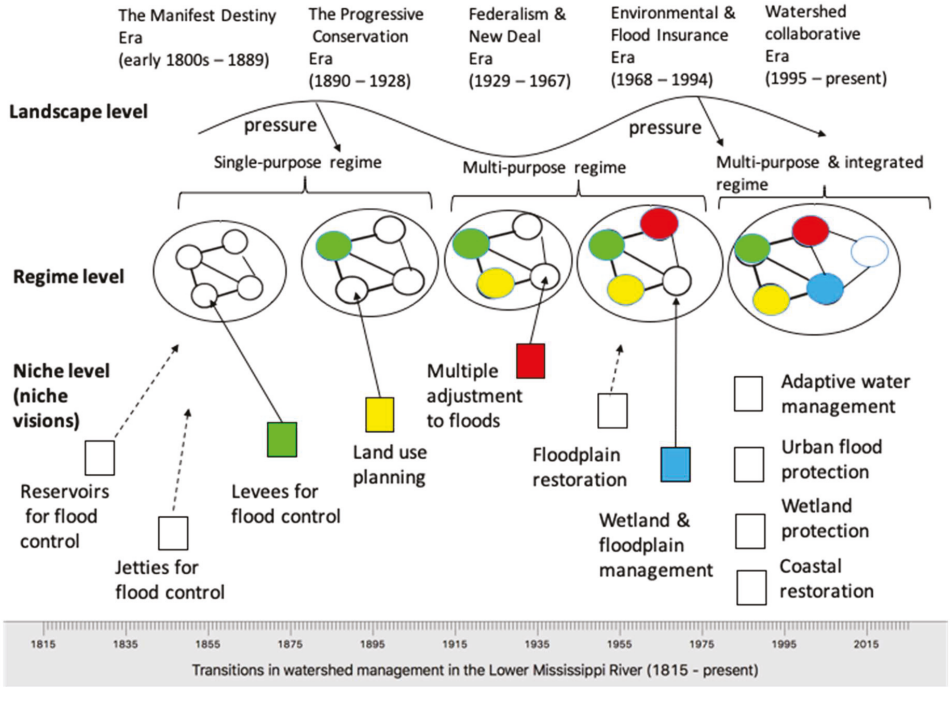

Figure 2. A chronological overview of transitions in watershed management in the Mississippi River.

Table 3. Summary table of niche visions that became part of the regime.

Criteria	Manifest Destiny Era (Early 1800s–1890)	Progressive Conservation Era (1890–1928)	Federalism and New Deal Era (1929–1967)	Env. & Flood Ins. Era (1968–1994)	Watershed Collaborative Era (1995–Present)
Niche vision					
Desired change	Secure navigation through cost efficient 'levee-only' flood control approach	Watershed as appropriate scale of management	Multiple adjustments to flood disasters	Integration of natural resources in floodplain & wetland management	Increased disaster resilience
Guiding principle					
New guiding principle(s)	Flood control through levees	Multi-purpose water management (systematic management of rivers)	Flood control engineering & multiple adjustments, flood insurance	Collaborative watershed management for integrated management	Learning based management approach
Actors					
Vision champion	A.A. Humphreys/	H. Hoover	G.F. White	J. Kusler	Not yet evident

Firstly, a key finding from the case study is that a cumulative pattern can be observed in which the number of societal functions increased with every transition, which led to a more extensive and complex water management regime after every transition. Whereas in the first era four functions were pursued, in the fifth era this had grown to nine functions. The water management regimes in the first two eras were single-purpose, succeeded by several multi-purpose water management regimes. Since the fifth era, the water management regime has become more integrated to strike a balance between economic and environmental objectives. At present, a transition is unfolding towards more adaptive water management regimes to better account for the complexity of SES and the related uncertainties in water management in the face of climate change. This may point to a difference to socio-technical transition research e.g., [22,93], in which the focus is on emerging technologies that provide new functions (e.g., smart phones) or provide an existing function in a more efficient or sophisticated way. By contrast, water management transitions are not driven by technological improvement, but rather mission driven. Since the 20th century, water management regimes have not only become more extensive, but also more integrated enabling managing and combining multiple and potentially conflicting societal functions. Possibly due to its public or government nature, there is also a larger discussion at play on which (public) tasks should be provided and the opportunities of new technologies is only one of the factors in a broader societal debate and political decision making see e.g., [94–96].

Secondly, external factors like landscape factors have also a major influence on the rise of a new niche vision, as they emerged as environmental, economic, social, and political pressures on the regime and created windows of opportunity for change. A similar pattern can be found in historical transitions in European land management see e.g., [65]. With regard to landscape factors, a distinction can be made between disruptive events and gradual developments. Disruptive events like flood disasters have been one of the major drivers for change. Flood disasters created windows of opportunities for new institutional developments (e.g., the development and enactment of Flood Acts), because these disasters revealed the shortcomings of dominant water management practices and the necessity for new water management solutions see e.g., [11,97]. Gradual developments that triggered change were technological, scientific, economic, and societal developments. For instance, the shift to levee-based flood control was based on new hydrological theories on river flows. The Great Depression and the subsequent New Deal programme favoured a shift to multi-purpose water resources management, which was possible through technological developments, such as concrete dam building design, and the willingness to invest in public infrastructures to mitigate the socio-economic decline due to the great depression. An example of a societal factor, is the regime response to increased environmental awareness that provoked a shift towards more environmentally sound water resources management.

However, there is no single factor decisive in niche-driven change, but it is rather the interplay of various factors triggering change see e.g., [26,98].

Thirdly, niches and niche visions seem to play an important role in revealing the shortcomings of the prevailing guiding principle for water management. For transitions to occur, emerging visions need to trigger disruptive changes in the dominant guiding principle for water management and the development and testing of a credible, alternative guiding principle to replace the old one, both of which have been the case in all transition periods. It is unlikely that incremental changes lead to a transition, but rather to a refinement of current practices see e.g., [39].

Fourthly, if there were several niche visions present, only one vision led to a transition. No evidence for hybridisation or integration of multiple niche visions was found, though there was clearly a struggle between competing visions and their supporting networks. This may suggest that the niche visions provided competing solutions that are complementary to the regime. The analysis does not give evidence whether it was especially due to the content of the vision, or due to agency, or both. In the first era, there was a scientific base for the emerging vision, whereas the niche vision in the second era was backed by emerging technologies for water engineering. During the third era, there were no competing niche dynamics, but the vision offered a real alternative to existing flood control practices. In the fourth transition period, increased environmental awareness, which is a landscape factor, enabled the uptake of the vision. This may suggest that new developments were not decisive for the uptake of vision but rather new knowledge developments from which new guiding principles for water management emerged. These principles led to new societal functions or refurbishment of existing ones.

Moreover, all visions provided guidance and image, but the level of guidance was determined in the way agency was provided by actors. The case shows that agency is key to the further diffusion of visions and niches. The case also shows that each niche vision can be related to key actors that can be seen as vision champions, who showed rule-breaking behaviour and leadership that inspired and mobilised others. Vision champions can provide agency and were found both outside and inside the watershed management regime. For instance, both White and Kusler acted initially from outside the regime (i.e., research niche), in which they were able to develop, freely express and further mature the novel vision. For instance, both Humphreys and Hoover first became leading figures in the water management regime from which they facilitated change as well as the diffusion of a new vision. The concept of vision champion has been useful for our analysis. The presence of a vision champion does not necessarily guarantee a successful adoption of an emerging vision. The case shows that some vision champions were more successful than their counterparts because they were successfully mobilising and creating networks leading to agency. Therefore, vision champions should be seen as embedded in larger networks, in which the type of membership, role, connections, and power of actors may influence successful adoption of a vision see e.g., [50,51].

4.2. Limitations of the Study

Overall, the relevance of our findings may be constrained by some limitations. Our causal narratives draw on secondary sources, which are second-hand interpretations of the events under study. These sources are one or more steps removed from these events and may be biased. The use of secondary sources in the study of historical transitions has been criticised [99,100], but we argue that it is still useful and allows for conclusions, though it should be noted that more detailed research into each transition using primary resources would be recommended for substantiating and validating our findings. This may lead to refining the starting and ending points of our transition periods, in which we described the landscape and regime factors that resulted in nonlinear changes in the water management regime. As causal narratives are by definition limited and narrowly defined, we are aware that other landscape and regime factors (e.g., indigenous knowledge or uses of rivers or the American history of slavery) may have intersected with emerging ideas and ways of thinking in water management.

From a methodological perspective, one could question the relevance of our findings to current transitions towards adaptive water management. Extrapolation of historical transitions into the future suggests that the future is a continuation of the past. Transitions are, in fact, heterogeneous, long-term effects of socio-technical and social-ecological change and contingent on factors such as time scale, place, and social, environmental, political, and economic context. Extrapolation may simplify history to a linear, causal process, which projects a narrowed view on the complex and dynamic nature of water management regimes that is driven by innovation to continue its existence. This complex reductionist view neglects the role of human agency that manifests itself around short-term socio-environmental dynamics as agents, visions, and niches continuously interact in transitions. We therefore reject the idea of linear history but rather argue for adequate historical analysis, which describes the past not just as it was meant to be with logic based on ex-post insights, see e.g., Ertsen [100]. Our framework offers a heuristic device or the basis for analysing niche-driven change in water management regimes and identifying recurrent patterns in water management transitions.

Another limitation is our focus on the interaction of visions and actors in niches and less on learning processes and knowledge development, which are key to vision development and niche formation. An evaluation of learning processes could provide other explanations of why some emerging visions were more promising than others and why some actors were more successful in building a supporting network for the vision. We argue that these aspects need to be investigated in light of landscape and regime factors. In doing so, we acknowledge the potential relevance of other explanations, theories of change and realities of the complex and diverse lived experience. Molle [101], for example, described the evolution of the concept of river basin and how it has been associated with various strands of thinking and sometimes co-opted or mobilised social groups or organisations to strengthen the legitimacy of their agendas. This study provides an alternative explanation on how interconnected and nested waterscapes have been managed by discontinuous nested political, administrative, and social levels in the US and western Europe. The relevance of this study lies in its focus on realignments of power structures between the local, regional, and national levels, which have not been included in our study. We argue that power structures could enrich our historical analysis, providing further insight into the way actors provided agency e.g., what strategies did actors adopt to shape transitions, what resources did they mobilise and deploy in realising these strategies, the role actors played in transitions and how they aligned their strategies and resources to achieve common goals. Furthermore, a complementary view on power structures is provided by Swyngedouw [102], who confirmed multidimensional relationships between the socio-technical organisation of the hydro-social cycle, the associated power geometries that regulate access to and exclusion from water, as well as the uneven political power relations that affect the flows of water.

5. Conclusions and Recommendations

In this paper, we have developed a conceptual framework for studying the interplay of visions and actors in niche-based change in water management regimes. The framework also emphasises the importance of agency not only in advocating and developing emerging visions and niches, but also in keeping the status quo. Vision champions and niche networks are important in initiating changes that depart from an existing water management regime, which eventually may lead to its transition, as well as advocating and substantiating emerging visions. Vision champions can be found outside and inside the existing water management regime.

Overall, we conclude that water management regimes change over time through transitions. They are preceded by niche developments, in which new visions emerge and mature. The study shows that only one of these visions becomes successful in guiding transitions, in which there is no single factor or decisive development. A transition is rather the result of the interplay of a range of factors at the landscape, regime, and niche level. From our historical inquiry, we conclude the following: (i) emerging visions play an important role in guiding transitions; (ii) agency enables the further diffusion of visions and niches; (iii) vision champions play an important role in transitions, but are

not decisive; (iv) each transition has led to an extension of the number of societal functions provided, which has led to more complex water management regimes in which functions are combined and integrated; and (v) external landscape factors are important, as they can lead to awareness and urgency in important decision making processes.

We consider our findings relevant to water management policy and transition studies. Our study provides a longitudinal study on water management transitions. It reveals the complexity of water management transitions, which are contingent on social, environmental, political, and economic factors. It enables water managers and policy makers to critically reflect upon the viability of past and current water management practices in light of vision development and experiments for adaptive water management in niches to acquire knowledge and experiences about new management practices and schemes for adaptive water management. Such niche developments need to be facilitated by water managers and policy makers to enable knowledge development and learning processes for crafting transition pathways to adaptive water management. From a research perspective, our study has relevance to transition studies, as it contributes to a better understanding of the role of visions, actors, and niches in water management transitions, which have been hitherto undertheorised in the transition literature. It demonstrates that water management transitions are not unidirectional developments, but rather path-dependent processes that may be affected by various drivers, including sudden events e.g., [65].

Regarding research recommendations, we identify the following future research avenues for transition research. Although our contribution is on the overall picture and patterns over a much longer period of time based on secondary sources, we would recommend follow-up research into primary sources for specific transitions that could shed more light on how networks emerged and the role of key persons, who can become key just because they are within a network of other actors and persons contributing in their way to the further development of the network.

In-depth research on specific transitions in the Lower Mississippi River is needed to substantiate and validate landscape and regime factors, as well as the starting and ending points of transition periods. Using primary sources can lead to more insight into other landscape and regime factors and their intersections that have been overlooked in this study. We recommend extending the research focus on evaluating learning processes and knowledge development in historical transitions and validating findings against alternative explanations and theories of change. Finally, since transitions are contingent on many factors, whether or not a transition has taken place is not a transparent matter. Neither are transitions comparable. A comparative, longitudinal analysis of other transitions cases is recommended to identify general patterns and context specific factors within different institutional contexts. A longitudinal research design is inevitable if one wants to identify whether a transition process took or is taking place, but also under which circumstances this happens. Longitudinal case studies have become a standard approach to the study of socio-technical transitions, where variables change qualitatively as well as quantitatively and where the aim is to trace processes of transformation. This methodology allows contingencies to be set against more systemic forces, and bringing to the fore the concrete, context-dependent knowledge in which different types of actors try to make sense of and participate in complex processes of change. Comprehensive transition analysis and country-comparative research on longitudinal case studies addressing multiple transitions in water management are limited, but warrant further investigation.

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Integrated Urban Water Management and Water Security: A Comparison of Singapore and Hong Kong

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Abstract: Integrated Urban Water Management (IUWM) has emerged in the past two decades as a promising approach to the application of Integrated Water Resources Management (IWRM) principles at the city-level. IUWM is expected to contribute to the achievement of multiple policy objectives, often including increased water security. This paper uses a case-based approach to study the impact of IUWM on water security, focusing on the influence of the level of institutionalization of IUWM within water governance at the city-level. Process tracing is applied to the cases of Singapore and Hong Kong, in which IUWM has been adopted but implementation and outcomes have diverged. We find that the depth of institutionalization, a difference between the two cases identified at the outset, has contributed to the achievement of better water security outcomes in Singapore as it has facilitated the development and implementation of a more far-reaching strategy. A supportive governance framework appears to amplify the impact of IUWM on progress towards water security and other policy targets.

Keywords: Integrated Water Resources Management; Integrated Urban Water Management; urban water security; governance; Singapore; Hong Kong; process tracing

1. Integrated Water Management Approaches and Urban Water Security

Integrated water resources management (IWRM) is a well-established framework in the water sector which has been adopted by governments in all regions and at all levels of economic development. Defined by the Global Water Partnership as "a process which promotes the coordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems," it takes into account both human and ecological needs [1,2].

IWRM is often understood as a process which is expected to lead to desirable outcomes, rather than as a goal in itself, a perspective shared by this paper [1,3]. Goals, such as strengthening water security, increasing sustainability, and ensuring equitable access to services, are considered to be set separately in the policy design process.

IWRM is an approach that can be adopted at multiple scales. It is often associated with river basin-level management, but its principles can be applied at all spatial scales, from the local community to international level. In all cases, the system boundary for IWRM application will need to be identified and processes for interacting with government and nongovernment stakeholders outside the system boundary will need to be delineated to avoid duplication, interinstitutional competition, governance gaps, and an inability to address complex issues cutting across sectors [4–6].

The city is a promising level for the adoption of IWRM both theoretically and practically as it corresponds to existing administrative and political units and to the spatial reach of much existing

water infrastructure [7]. Indeed, integrated approaches in the urban water sector are the focus of a growing body of literature. A range of concepts have been proposed and considered for adoption, notably, Integrated Urban Water Management (IUWM) [8–10] as well as Sustainable Urban Water Management [11], Total Water Cycle Management [12], Water Sensitive Urban Design (Wong 2006) [13], and Integrated Urban Water Policy [14]. While these concepts have different emphases, they are all linked to the principles of IWRM and are driven by a common concern to shift water management from traditional, centralized engineering-focused approaches [10] towards water management as steering a partly self-organizing system [15].

Concretely, we take IUWM to imply the coordinated development and management of all water sources (ground, surface, storm water, recycled water, desalination, etc.), all stages of the water cycle (resource management, treatment, and distribution, and wastewater collection, treatment, and disposal), all uses of water and sources of demand, and the protection of the urban water environment and ecology, taking into account specific local characteristics [6,8,16]. Additionally, it may encompass the coordination of water with other sectors and policy areas, such as solid waste management, energy, and climate policies and urban design.

IUWM is argued to have the potential to deliver improved water security [3]; enhanced social, ecological, and economic sustainability at various scales [17–20], [7,21]; more resilient systems [20], environmental quality [22]; resource efficiency [23]; and economic development [15]. The multiplicity of objectives implies that trade-offs may need to be made [22].

However, IUWM is also associated with conceptual and practical challenges, including (1) difficulties in predicting the system effects of innovative solutions, (2) practical challenges in managing innovations in technologies and service provision strategies, (3) financial considerations, and (4) the effect of bias and advocacy on the promotion of technologies and management paradigms [10]. As Pahl-Wostl and coauthors (2011) [15] note, the sector is in transition with "theory way ahead of practice and even further ahead of the capacities (skills, knowledge sets, competencies, etc.) required to effect integrated adaptive regimes" (p. 846). The limited adoption of IUWM so far is due in part to existing institutions and regulations that constrain adoption and implementation of integrated approaches [11], as well as limited institutional capacity, particularly at local levels, technology lock-in, and path dependency [24,25]. Another factor highlighted in the literature is the dampening effect of the lack of public acceptance of IUWM technologies [26,27].

Empirical evidence on IUWM adoption suggests that the impacts on policy objectives have so far been limited. In a study of IUWM in Australian cities, van de Meene (2011) [7] found that IUWM practices are not mainstream, although there is evidence of localized schemes adopting IUWM technologies. Evidence on microlevel applications of IUWM within buildings or housing developments shows less impact on household water demand than initially expected [28]. Shuster and Garmestani (2015) [29] consider the impact on the provision of ecosystem services and find limited impacts due to weak interconnectivity of green infrastructure.

Like IWRM, IUWM and related approaches are often associated with governance reforms to integrate decision-making authority in a single body [3], which we refer to as the 'institutionalization' of IUWM. Integrated governance arrangements signal deeper institutionalization, compared to the shallower institutionalization of policy-led IUWM. However, governance changes are not a requirement and IUWM may be led through policy changes without institutional reorganization.

This paper uses a case-based approach to study the impact of IUWM on water security, focusing on the influence of the level of institutionalization of IUWM within water governance in the city. In doing so, the paper aims to add to the empirical knowledge base on IUWM by connecting the process and mechanisms of IUWM with the impact on policy objectives. Water security is by no means the only water policy objective, but it is one that has drawn increasing attention from policy-makers [30–33] as well as researchers, reflected in the number of academic papers addressing the subject [34,35], and thus forms the outcome of interest in this paper. Other policy objectives including sustainability and efficiency may be pursued alongside water security [36]. While IUWM and the objective of

increased water security are often considered to be compatible as both are integrative approaches which view water as a complex system with ecological and socioeconomic facets [3], some authors point to potential divergence between the two as IUWM does not necessarily address uncertainty [35] or equity [37] concerns.

The remainder of the paper is structured as follows. Section 2 presents the process tracing methodology including details of data collection and analysis. Sections 3 and 4 present details of the cases obtained via process tracing followed by the discussion of the results, and the conclusion in Sections 5 and 6.

2. Methodology

The paper adopts a comparative case-based approach for Hong Kong and Singapore, two cases among the small number of examples worldwide in which IUWM has been adopted at the level of the entire city to investigate the research question: Does deeper institutionalization of IUWM lead to greater water security?

The two cities are suitable candidates for analysis as they adopted IUWM more than a decade ago, which allows us to review implementation and impacts over a longer time horizon appropriate to the nature of the policy being studied. Singapore and Hong Kong share certain characteristics that would support the adoption of IUWM: they have high political and administrative capacity and strong incentives as they are both 'water insecure' in the sense that naturally available ground and surface water resources are far from adequate to meet the needs of residents and economic activities. Despite these similarities, including improvement in terms of specific water security indicators as well as overall water policy objectives, Singapore has consistently performed better than Hong Kong on water security indicators since the initiation of IUWM efforts (see Section 4.8). We hypothesize that the difference in the level of institutionalization of IUWM is the key factor influencing the water security outcomes in both cities.

The two cases provide a contrast in their approach to IUWM: in Singapore, IUWM was institutionalized through governance changes which unified all water-related policies under a single government entity, whereas in Hong Kong IUWM was policy-led and did not involve deep institutionalization through governance changes.

2.1. Process Tracing

Focusing on the level of institutionalization of water governance we conduct Process Tracing (PT) to compare and contrast the evolution of integrated water management in the two cities over time. Collier ([38], p. 824) defines PT as an "analytic tool for drawing descriptive and causal inferences from diagnostic pieces of evidence, often understood as part of a temporal sequence of events or phenomena." PT is deployed in social and political sciences to inductively explore the operation of a hypothesized causal mechanism linking selected causal condition(s) with the outcome of interest [39,40]. PT has three variants. For this analysis, we employ theory-building PT, which can be used under situations where either it is known that X and Y are related but the causal mechanism linking the two is unclear or unknown; or when the outcome Y is known but we do not know what caused it to occur. Existing theories are used to provide a basis for collecting evidence on which theories can further be built (George and Bennett, 2005). Theory-building PT is considered appropriate for investigating our research question as it allows for a structured analysis of the empirical material from the cases and detail the causal mechanism linking the level of institutionalization of IUWM (X) to observed water security outcomes (Y) in both cities.

Theory-building PT has been used to study a variety of issues such as foreign policy cases resulting in poor outcomes by high-level policy officials owing to conformity pressures [41], studying the role of radical right political parties on stripping of citizenship [42], and tracing care pathways to better understand the possible social reasons for maternal deaths in a city with good public and private health infrastructure [43].

For the two cases, we identified a significant policy change signaling the adoption of IUWM as the starting point for our analysis. In Singapore, we take the passage of the Public Utilities Act of 2001; in Hong Kong, we focus on the adoption of the Total Water Management Strategy of 2008. Details of these policy changes and why these were considered as critical starting points for IUWM in both cities are discussed in Section 4.

2.2. Data Collection

Data were collected for two decades, from 2001 to 2017. The data sources include secondary data on water management in Hong Kong and Singapore. Data were collected with particular attention to the development of urban water management strategy in both cities. Data were collected from official documents and websites from relevant government departments, including the Water Supplies Department, Drainage Services Department, and Hong Kong Observatory in Hong Kong, and the Ministry of the Environment and Water Resources, Public Utilities Board, and Urban Redevelopment Authority in Singapore. This body of data helped construct a historical timeline of events tracing the adoption of IUWM in both cities and changes in water security indicators. The next step was to look for evidence of specific parts of the theorized mechanism (IUWM) in action in both cases.

Key informant interviews were conducted with Government officials, utility managers, private sector, civil society organizations, and academics in both cities to elicit their views on water policy objectives, effectiveness of approaches adopted and timeline of key events. A total of 10 interviews were conducted in Singapore and 8 in Hong Kong in 2017 and Jan–Feb 2018. These interviews were coded for references to IUWM principles and mechanisms and were also used to help identify any additional factors outside the hypothesized mechanism of IUWM.

2.3. Analysis

The following steps are followed to apply process tracing to selected policy interventions (based on [44–46]).

Step 1: Defining and operationalizing key theoretical concepts

Based on the UN definition of water security [30], we define urban water security (outcome of interest) as:

The capacity of a city to safeguard sustainable access to adequate quantities of acceptable quality water to sustain livelihoods, human well-being, and socioeconomic development for its inhabitants.

While water security can be operationalized in many ways, we develop indicators of water resource adequacy and water source diversification based on their relevance to the Singapore and Hong Kong context. Details of indicator development are given in Section 4.8.

Level of 'institutionalization' of IUWM (causal conditions) is understood as the degree to which formal governance structures are adopted that integrate management of water across sources and uses at the city-level. Deep institutionalization refers to major governance changes to integrate management of the resource.

Step 2: Collecting Empirical Material

Step 2 involves the collection of relevant empirical material for the case. In this step, all literature and official documentation on the policy change is gathered in a specific sequence in an attempt to draw a systematic explanation leading to greater/lesser water security, the outcome of interest.

Step 3: Infer Observable Manifestations of an Underlying Causal Mechanism

In order to study the causal explanations leading from X to Y we need a hypothesis that goes beyond the historical and empirical aspects of the case itself, thereby connecting the case with plausible theoretical mechanisms. Existing literature can provide a starting point to identify systematic patterns

emerging from the empirical material, enabling inferences of observable manifestations of a plausible underlying causal mechanism.

Taking IUWM as a city-level application of IWRM principles, we consider the well-established IWRM planning cycle described by Global Water Partnership as a starting point for the systematic arrangement of the empirical material. Working iteratively with the case evidence, we adapt this framework to a simplified cycle of six steps: set policy goals; allocate authority/institutional reform; build stakeholder support; define strategy; implement; and monitor and evaluate. We add an additional step, 'modify and adapt,' following evaluation in order to take into account the inherently iterative and circular nature of IUWM. We need to adapt the cyclical process to a linear form for the purposes of the analysis so we consider one full process cycle, starting with setting of policy goals and finishing with an additional step of 'modify and adapt' (Figure 1).

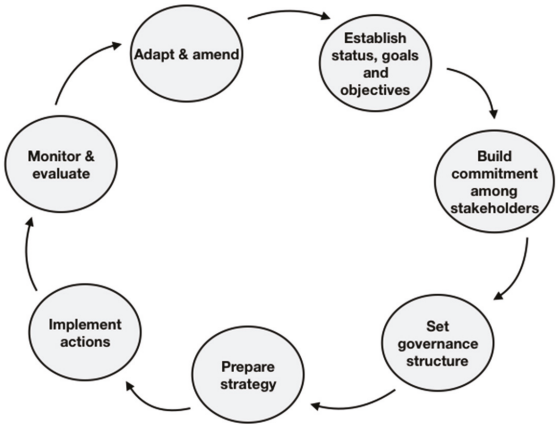

Figure 1. The Integrated Water Resources Management (IWRM) planning cycle [47,48]. (Adapted from Global Water Partnership. Integrated Water Resources Management Plans: Training Manual and Operational Guide, 2005.).

Step 4: Verifying the Presence of an Underlying Causal Mechanisms

The key informant interview records are used to verify the presence of IUWM as a causal mechanism and also to decipher additional factors that could have influenced water security outcomes in both cases.

3. Case Background & Drivers for the Adoption of IUWM

3.1. Drivers of IUWM in Hong Kong

Hong Kong is a territory of 1098 km^2 located east of the Pearl River Delta on the southeast coast of China. It has annual average rainfall of 2398.5 mm but experiences water scarcity due to high seasonal and interannual variability in rainfall, the absence of natural storage, and high population density [49]. In the 1960s and 1970s, Hong Kong residents experienced frequent water shortages [49]. These shortages prompted changes in water management to improve water supply security. Three major steps were taken to increase supply.

Firstly, an agreement was negotiated to import water from the Dongjiang River in Guangdong province in mainland China. The first contract was made in 1960 and it has been regularly reviewed, with price and volume raised gradually to HK$5.9 per cubic meter for an allocation of 820 million m^3/per year in the 2018–2020 period [50,51]. Declining water quality in the Dongjiang River became a concern for Hong Kong in the late 1990s. To address this, a dedicated aqueduct to transfer water to

Hong Kong from the upstream Dongjiang was built [49]. Since the completion of the aqueduct, Hong Kong officials consider that the quality of imported water has not been a high risk to water security.

Secondly, major investments were undertaken to develop the urban catchment. The two largest reservoirs in Hong Kong, Plover Cove and High Island, were built in the 1960s. They have a combined capacity of approximately 5 million m^3. The reservoir catchments cover approximately one-third of Hong Kong's total land area [49].

Thirdly, a seawater distribution network was constructed to provide water for toilet flushing. Since the 1960s, all new buildings constructed have two discrete plumbing systems, including a dedicated distribution system for sea water which is mostly used for toilet flushing. The system has been gradually expanded and by 2017 covered 85% of households. The seawater is provided free to households.

These policy interventions were successful in improving security of supply in Hong Kong and no supply restrictions have been imposed since 1982. However, since the 2000s, new challenges and policy goals have emerged which have led to the review of water policies. Economic and population growth in the Dongjiang basin has vastly increased abstractions, which has heightened the impact of flow variability and pollutant concentration [52]. This has led to stricter regulation of withdrawals by central and provincial governments [53]. Furthermore, competition between cities for Dongjiang water resources is expected to worsen in the future [52–55]. These developments prompted decision-makers in Hong Kong to consider new policies to increase supply and reduce demand under an IUWM framework.

3.2. Drivers of IUWM in Singapore

Singapore is a city-state with a territory of ~700 km^2. Although it has abundant rainfall of 2400 mm per year on average, like Hong Kong it faces severe water availability constraints due to the absence of major natural water storage, limited land area and a growing population [56,57]. When Singapore was founded in 1965, Singapore was largely dependent on imported water from Malaysia. An agreement signed in 1962 gave Singapore the right to draw a maximum of 1.14 million cubic meters per day (m^3/d) from the Johor River at a fixed price until 2061. Although the supply of water has been a longstanding contentious issue between the two countries and threats to restrict or renegotiate the agreements have resurfaced periodically, supply to Singapore has not been interrupted since the agreements were signed.

Local resources have been extended since the 1970s by enlarging the protected catchment and phasing out polluting industries like farming. Since the 1980s, the catchment has been extended to cover two-thirds of the island and significant investments have been made to increase reservoir capacity. The most recent major reservoir at Marina Barrage was completed in 2008.

Looking to the medium-term, there are increasing concerns about the availability and quality of imported water for Singapore. Although Johor has plentiful water resources, with total demand for all sectors making up less than one quarter of available surface water resources, a combination of climatic variability and water resource mismanagement has led to frequent water supply disruptions in Johor during periods of drought [58]. Water quality in the Johor catchments has also declined due to pollution [59] and rising salinity [58]. Shortages in Malaysia could also exacerbate social and political tensions, increasing supply risk associated with imported water. These supply constraints intersect with rising demand: total demand for water in Singapore is forecast to more than double from 2016 levels to approximately 4 million m^3/day in 2060, driven largely by non-domestic consumption [60].

4. Adoption of IUWM in Singapore and Hong Kong: Design to Implementation to Review

This section presents an empirical narrative of IUWM's adoption in Singapore and Hong Kong based on document analysis and interviews.

4.1. Set Policy Goals

In 2003, Hong Kong's Chief Executive announced the intention to develop an integrated water management strategy [61]. The policy goals were to ensure a reliable water supply for Hong Kong, to be prepared for climatic variability and to enhance Hong Kong's role as a good partner in the Pearl River Delta in promoting sustainable use of water. The strategy embodied the integrated and multi-sector tenets of IUWM. Preparatory studies found that existing sources, including imported supplies, were adequate to meet forecast demand up to the planning horizon of 2030, but climatic variability and other sources of uncertainty needed to be taken into account [62]. Policy options were to be evaluated in terms of reliability of supply, cost-effectiveness, environmental impact, and public acceptance.

Singapore's strategy to develop a diversified portfolio of water sources in order to reduce dependence on imported supplies and increase water security was first set out in the Water Master Plan of 1972 [63]. The strategy was taken forward by multiple government agencies implementing initiatives to increase reservoir capacity, enlarge the local catchment, and manage demand through leakage control and pressure management over the following decades.

4.2. Build Stakeholder Support

In Hong Kong, no formal mechanisms of coordination have been established with other related government departments in Hong Kong. Notably, the Department of Drainage Services, which is responsible for wastewater and stormwater collection and treatment, was not directly involved in the preparation of the strategy. Public consultation has not taken place for the overall strategy but there has been consultation with localities where water reuse is piloted and on specific aspects of policy. In Singapore, policy direction came from the cabinet level, which promoted coordination between the different government departments involved. There was no extensive public consultation in the preparation of the IUWM plans but consultation has taken place on specific measures with expert advisors [64] and there has been public consultation on sustainability and climate strategies [65,66].

4.3. Set Governance Structure

In Hong Kong, responsibility for delineating the integrated strategy was conferred on the Water Supplies Department (WSD), the public agency responsible for the provision of water supply services. The government provided hierarchical direction to WSD. Separate agencies remain responsible for wastewater and stormwater management, environmental regulation, and climate-related policy and planning.

In Singapore, a unified national water agency, the Public Utilities Board (PUB), was established under the Public Utilities Act of 2001 and signaled the institutionalization of IUWM in Singapore. This Act conferred on PUB responsibility for all aspects of the urban water cycle: development and management of catchment; supply of drinking water; wastewater management; stormwater drainage; promotion of water conservation; and advising the government on water policy and management.

4.4. Define Strategy

The implementation plan for IUWM in Hong Kong is set out in the Total Water Management Strategy of 2008, which covers the period until 2030. This identified three additional sources of water: desalination, wastewater reuse, and recycling of gray water. However, the projected contribution of these latter three sources to overall supply was relatively small: 5% of projected demand in 2020 and 10% in 2030. A range of actions were also identified under the plan to manage freshwater demand, including public education on water conservation, introduction of a water efficiency labeling scheme, mains replacement, pressure management and active leakage control to reduce NRW and the extension of seawater for toilet flushing.

The main capital investment to increase supply envisaged in the plan was the construction of a desalination plant at Tseung Kwan O with a capacity of 135,000 m^3/day, with potential for future

expansion. The possibility of extending the catchment (water gathering grounds) was ruled out because of high costs and environmental risks.

PUB's 'Four National Taps' strategy set out the pathway for Singapore to increase self-sufficiency and reduce water supply risk through diversification [67,68]. The plan was developed over a number of years and announced publicly as a long-term action plan in 2010 [69]. The National Taps are imported water, local catchment, NEWater (as water reuse is known), and desalination. The share of each and target dates for achievement have been updated guided by high-level national policy direction. The current target, set in 2010, is to achieve total self-sufficiency in water supplies by 2061. Intermediate targets and development plans to achieve these targets are set by PUB [60,70–76]. Supply expansion comes mostly from reuse and desalination capacity as the local catchment is believed to be fully developed. There is also little potential to expand resource availability through reservoir extension or deepening because of space constraints and diminishing return on reservoir yield for a given level of rainfall and catchment size. Separately, the government also sets water conservation policy targets. In 2015, the government set a target to reduce per capita domestic demand to 140 lcd by 2030 [77]; this target was tightened in 2018 to 130lcd [78].

Key policy targets for the two cases are shown in Table 1.

Table 1. Policy targets in Singapore and Hong Kong.

	Targets for 2030	
	Singapore	**Hong Kong**
Proportion of supply from nontraditional sources	80% (85% in 2060)	10% (No target for 2060)
Household water consumption (liters per capita per day)	130	120 (10% reduction on 2016 level)

Source: WSD, 2008, PUB Annual Report 2015/2016: Singapore, 2016.

4.5. Implement

Singapore has proceeded with rapid implementation of large capital investments to increase water supply. The first NEWater plants were commissioned in 2003 [60] and capacity has been steadily expanded to 758,000 m^3/d by 2017. Investment in reuse treatment capacity has been complemented by very significant investment in a deep tunnel sewerage system which is expected to be completed in 2025. The consolidation of the sewerage and treatment system will reduce the land requirement for wastewater facilities and will increase the volume of input water for reuse plants [60]. Desalination capacity has also expanded rapidly. The first plant opened in 2005 and further plants have been commissioned every 2 to 3 years.

In Hong Kong, WSD has moved forward with the procurement of a desalination plant which is expected to be commissioned in 2022, a few years later than originally expected. WSD has moved ahead slowly with its exploration of water reuse compared to the timing set out in TWMS. At the time of writing, localized pilots had been conducted at Ngong Ping and Shek Wu Hui but reuse had not been adopted at scale. Future plans are cautious: 57,500 m^3/d of reclaimed water is expected to be supplied though dual networks after 2022 for nonpotable use only in districts which are located close to tertiary wastewater treatment plants and are not currently supplied with seawater [79,80]. Gray water recycling is also being piloted in one housing development area with a planned population of 25,000 [81].

Turning to demand management, a range of interventions including public education, mandatory water efficiency labeling for appliances and fittings and consistent phasing out of less efficient appliance models have been implemented in Singapore. Domestic water consumption has decreased slowly since 2006, but dropped significantly after the imposition of a tariff increase in 2017, the first tariff change since 2001 (Table 2). The reduction of leakage has been pursued through a large rolling pipe replacement program which has allowed PUB to maintain NRW of ~5% in the last decade.

In Hong Kong, actions to control demand include information and communications efforts, including an initiative to encourage households to reduce water consumption by 10 liters per month and a voluntary water efficiency labeling scheme. However, these efforts have had limited impact. Household consumption increased marginally in the 2010–2016 period, for which data are available, as shown in Table 2. This may in part be explained by the decision not to use price-based mechanisms to incentivize conservation.

Some progress has been made in reducing nonrevenue water (NRW) in Hong Kong. Leakage in the freshwater supply network from treatment plant up to the customer connection point has been reduced to 15.2% [82] through a large pipe replacement program implemented between 2000 and 2015, during which 3000 km of water mains were replaced, out of a total network length of 7700 km. However, when losses are measured to the point of consumption, NRW is estimated to be above 31% due to leakage inside properties and illegal use [83]. Legally, the utility is not responsible for plumbing within properties and so it has not addressed issues of poor internal plumbing and maintenance. Furthermore, leakage is estimated to be very high in the saltwater distribution network at 28.3% as a result of corrosion [84]. In Singapore, NRW was already low at the time of the introduction of IUWM and the low level of NRW has been maintained.

Table 2. Domestic/household water consumption (liters per capita per day).

	Per Cap Water Consumption (liters/cap/day)					**NRW (%)**	
	Hong Kong			**Singapore**		**Hong Kong**	**Singapore**
	Fresh Water	**Seawater**	**Total**	**Domestic**	**Household**		
2010	129	95	224	154		20% (est.)	5.2%
2011	130	96	225	153			5.0%
2012	130	96	226	152			4.7%
2013	131	97	228	151			5.2%
2014	132	97	229	150		15.2%	5.2%
2015	132	93	226	151	149		5.0%
2016	133	92	225		148		5.0%
2017					143		5.1%

Source: WSD, 2018 [69–76,80,85].

4.6. Monitor & Evaluate

Hong Kong's TWMS did not specify a regular monitoring and evaluation procedure. The utility reports to government annually on standard utility performance indicators apart from leakage. WSD issues annual reports which are available to the public and are reviewed by the government. However, these do not explicitly measure performance against the TWMS parameters. PUB also produces annual reports and reports on regularly on standard performance indicators, although the proportions of supply from different sources and reservoir storage capacity are not available to the public. PUB's performance is monitored by the Minister of Environment and Water Resources, who, in turn, reports to the Cabinet.

4.7. Modify & Adapt

The TWMS provided for a full review and revision after 10 years to cover the period up to 2040. The review commenced in 2017 but as of the beginning of 2019 had not been opened for public consultation or adopted. The revised strategy is expected to set out plans for increased source diversification and demand management under a range of scenarios, incorporating climate change uncertainty. In the meantime, strategy and policy announcements have been made on some aspects of

water policy. WSD has articulated a plan to control NRW through a 'Water Intelligent Network', which involves the creation of District Metering Areas and active leak detection by 2023.

The Hong Kong Government has set a new policy target to reduce domestic water consumption by 10% by 2030 from a base year of 2016 [86]. Planned interventions echo those previously adopted public education and campaigns and water efficiency incentives but do not include the use of price incentives.

Singapore's strategic plan is continuously updated to take into account developments in technology and government policies. In 2016, PUB set out additional plans to extend wastewater reuse to industrial wastewater and to reduce industry demand for treated water by incentivizing industrial units in coastal locations to use seawater for cooling processes [60]. New technologies are continuously identified and piloted to raise the efficiency of treatment processes. In particular, PUB supports the development of desalination techniques with a lower energy requirement and reuse technologies to raise recovery rates. PUB set its own target to meet future demand by doubling the amount of clean water it produces today by 2060 without using more energy [87].

4.8. Outcomes

We developed two indicators of water security to compare outcomes in the two cases: the adequacy of water resources to meet the needs of the territory's population and the diversification of water sources. These two indicators capture aspects of water resource scarcity, a major concern for the two cities. Unlike some commonly used indicators, they include the contribution of nontraditional water sources, which is a central part of the IUWM strategies in both locations. Firstly, we calculate an indicator of adequacy, A, by summing the total volume of water resources available for treatment and distribution from imported water, local catchment, recycled water, and desalinated water, scaled by population [88,89]:

$$A = \frac{\sum_{i=1}^{N} V_i}{P}$$

where V_i is the volume of water resources available from source i and P is the total population. There is considerable variation between the cases on this dimension. Singapore has seen substantial increases in adequacy of supplies since 2001, while Hong Kong has seen no significant change since the policy adoption in 2008 (Table 3).

The second indicator—source diversification—captures the degree to which a city is dependent on a single source of raw water [90]. As all sources of water are associated with risks, a more diversified portfolio is expected to increase security. The indicator is calculated based on the Herfindahl–Hirschman index, an index of concentration commonly used to measure the degree of competition in markets:

$$HHI = \sum_{i=1}^{N} S_i^2$$

where $S_i = \frac{V_i}{\sum_{j=1}^{N} V_j}$.

Scores on the index range from 1 to 10,000, with 10,000 reflecting the highest level of concentration, in this case, denoting total dependence on a single source of water.

This indicator shows a clear improvement in diversification in Singapore since the adoption of IUWM, against no discernible impact in Hong Kong. Fluctuations in the indicator over time for Hong Kong appear to be driven by rainfall variability.

Considering the outcomes of IUWM in terms of policy objectives, it is evident that Singapore has consistently met or exceeded targets for expansion of nontraditional water supplies. In Hong Kong, progress is being made towards 2030 targets, and although investment in desalination and reuse has been slower than planned, it would still be possible to meet 2030 targets. Less progress appears to have been made on water conservation. Evaluation is challenging because the performance indicators reported annually by WSD different from the indicators used in the TWMS. As household freshwater

consumption has remained around the same level over the past decade, limited progress has probably been made towards the 100 mcm reduction target. The government has indicated that leakage was reduced by ~4 percentage points between 2008 and 2014, which is equivalent to 38 mcm, less than half the 85 mcm target set for 2030.

Table 3. Water security indicators in Hong Kong and Singapore between 2001 and 2017.

	Resource Availability (m^3 Per Capita Per Year)		Source Diversification Index		Contribution of Nontraditional Sources (Reuse & Desalination) to Water Supply	
	Hong Kong	**Singapore**	**Hong Kong**	**Singapore**	**Hong Kong**	**Singapore**
2001	167.0	**105.3**	5860	**9050**	**0**	0
2002	159.0	118.9	6217	8150	0	10
2003	159.4	120.7	6256	8150	0	10
2004	137.2	121.3	7877	7818	0	7
2005	164.1	130.7	5977	6158	0	17
2006	166.2	126.7	5503	6158	0	17
2007	145.3	133.6	6718	5150	0	25
2008	**165.1**	126.7	**5532**	5150	0	25
2009	148.6	123.0	6423	5150	0	25
2010	148.2	138.0	6241	3950	0	40
2011	130.6	135.1	8010	3950	0	40
2012	145.1	130.2	6410	3950	0	40
2013	161.0	150.7	5422	2525	0	55
2014	145.0	148.7	6358	2525	0	55
2015	143.5	147.0	6480	2525	0	55
2016	160.5	145.1	5377	2525	0	55
2017	152.0	160.5	5663	2525	0	65

* Bold indicates year of intervention.

5. Discussion

5.1. Linking Institutionalization of Water Governance and Water Security

The Process Tracing reveals the similarities and differences in the approach taken by both cities to improve water security. The process of IUWM adoption in Hong Kong and Singapore is illustrated in Figures 2 and 3, respectively.

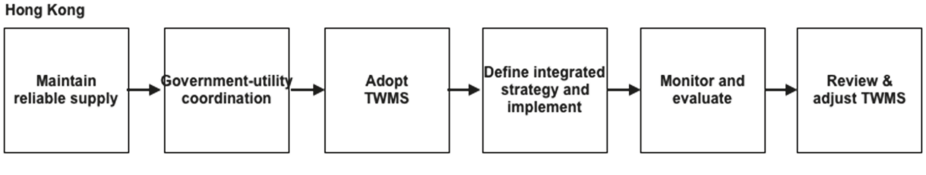

Figure 2. Process tracing adoption of IUWM in Hong Kong.

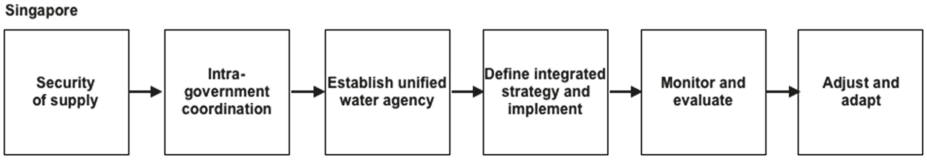

Figure 3. Process tracing adoption of IUWM in Singapore.

In both cases, the adoption of IUWM was supported by high-level political commitment and clear allocation of responsibility for strategy design and implementation to a single agency—PUB in Singapore and WSD in Hong Kong. In Singapore, high-level coordination between PUB and the agencies responsible for spatial planning, public housing, and the economic planning agency under the guidance of the political executive allowed for water security objectives to be taken into account across a range of related policies. Such coordination across related agencies was absent in Hong Kong, limiting the range of actions available to WSD to those under its direct authority. Deeper institutionalization in Singapore appears therefore to have facilitated the development and implementation of a more far-reaching strategy in Singapore compared to Hong Kong. In particular, PUB's authority over sewerage and drainage allowed for a whole-system approach to the development of reuse, including collection networks. By engaging in this technology on a large scale, average costs have been reduced and infrastructure development has been coordinated with spatial planning so that reuse facilities are located next to industrial customers to whom NeWater is supplied.

On the other hand, the initial motivation behind these approaches was also different in the two cases. The TWMS was motivated by two goals: to prepare Hong Kong to deal with uncertainties associated with climate change, especially low rainfall, and to enhance Hong Kong's role as a good partner of other municipalities in the Pearl River Delta in promoting sustainable use of water in the light of rapid growth in regional water demand [62]. In Singapore, the policy objectives were clearly focused on enhancing Singapore's water security by reducing its dependence on imported water sources.

Public consultation and public opinion do not appear to have played a major role in either case, either as an enabling factor or as a constraint. In both cases, interaction with the public has mainly taken the form of top-down education and information campaigns to encourage water conservation, and, in neither case, does this element of the strategy appear to have been particularly successful in reducing demand.

In the two cases, the elements of the strategy were similar: both aimed to optimize demand and supply through the development of multiple conventional and nonconventional water sources combined with demand management; they identified stormwater, wastewater, and desalination as potential water sources, and took into account cost-effectiveness and risk in options assessment. However, very limited information on comparative benefits and costs is made public in either case so more detailed analysis of the methods used and relative weightings in determining the mix of interventions is not possible. The adoption of desalination in both cases may indicate a relatively high weighting given to reducing risks associated with climate variability.

The intervention in Singapore began seven years before that of Hong Kong, so we would expect to see greater achievement in Singapore, especially considering the long lead times in water infrastructure investments. The earlier start notwithstanding, implementation in Singapore has moved considerably faster than in Hong Kong. The first reuse plants came online in Singapore in 2002, and the first desalination and reuse plants contracted under public–private partnership (PPP) were commissioned four and six years after the restructuring of the PUB, respectively. In Hong Kong, although a feasibility and pilot study on desalination had been completed before the adoption of TWMS [91], a contract had not yet been awarded for the plant by early 2019, and the expected date of the commissioning of the plant was set back to 2022. The unified structure of water management in Singapore and the authority of PUB to design and award PPP contracts may have contributed to more efficient procurement, alongside clearer targets which are discussed next.

One of the clearest differences between the cases is in the clarity and rigor of the monitoring and evaluation framework and process. In Singapore, public officials at all levels of the bureaucracy have clear performance-based incentives. In PUB, these incentives are tied to progress towards the targets set out in the organization's strategic plan and include development of nonconventional sources and operating efficiency. This contrasts with Hong Kong where individual advancement is not clearly linked to the achievement of strategic objectives.

At the organization level, both PUB and WSD are largely self-regulating. They set their own strategic objectives and report to government on these, primarily through annual reports. Neither Hong Kong nor Singapore has an autonomous regulatory agency that monitors the performance of the operator. In Singapore, the ability of political leaders to monitor PUB is facilitated by the clear specification of intermediate targets for source diversification, household water conservation, operational efficiency, etc. In Hong Kong, targets under the strategic plan were expressed as 'cumulative savings', but there is no direct relation between these targets and the indicators on which WSD regularly reports. Furthermore, the contribution of desalination to improved water security is not captured in the cumulative savings targets. As a result, it may be more difficult for government and the public to monitor and evaluate WSD's implementation of its own strategic plan.

5.2. Insights for Implementation of IUWM in the Urban Context

It is difficult to select a policy initiative as being single-handedly instrumental for implementing an integrated management approach. Both cities adopted policies relevant to aspects of IUWM prior to the launch of the studied interventions, albeit fragmented or less institutionalized. Both have adopted new policy targets and adapted management over time. Thus clear start and endpoints are hard to discern. However, the cyclical nature of IUWM is reasonably well approximated by the linear process when an additional step of adaptation is included at the end of a cycle. In the Hong Kong case, the completion of a cycle and commencement of a new one can be clearly observed in the TWMS review.

Both Hong Kong and Singapore are found to have a rather top-down design and implementation with hardly any public consultation, and yet the interventions have been reasonably successful, especially in Singapore. Enhanced coordination with stakeholders, including end-users, forms a key principle of IUWM which has not been fully adopted in the IUWM cases studied here. This issue merits further investigation as the form and structure of communities in an urban context is very different from some river basin-dependent communities, and the scale of consultation very different for whole-city approaches compared to localized schemes, and thus different structures and forms of consultation might need to be developed.

Apart from water security, there are many other water policy objectives that governments might seek to achieve, such as equitable and affordable access to services, efficient resource use, and ecological sustainability. Each of these targets may be associated with one or several performance indicators. These aspects of performance have not been considered in this paper. Further investigation of these important goals is needed but is hampered by the absence of data. This is particularly the case for Singapore and Hong Kong where a significant proportion of water resources exploited in our cases are located in other jurisdictions.

Conceptually, the application of IWRM at urban and other scales is challenged by the task of delineating clear expected outcomes, both in theory and practice, and a method to allow trade-offs to be made between objectives, thus making it difficult to quantify the progress brought about by the adoption of such integrated approaches. While indicator-based methods are one way to resolve the issue, these have limitations in being all-encompassing, especially for broad concepts such as IWRM.

While the city seems to be a promising scale for tangible application of integrated wter management through IUWM because of the match between spatial administrative jurisdiction and the physical extent of urban water infrastructure, in the two cases studied here, as in many other large cities, the issue moves beyond city limits, physically as well as politically. Thus strategies need to be explored to enhance coordination between the city, its catchment, and the wider region, for example, between

Singapore and Malaysia to manage the Johor catchment, and for Hong Kong to be an active partner in the management of the Dongjiang basin. These issues of interaction between the water system and external factors outside the system boundary will be relevant whatever the scale at which IWRM is applied.

In terms of insights from application of process tracing as a method to investigate our research question, this analysis gives us empirical evidence that matches the stages of a generic IWRM planning cycle. Taking these results further, a theory-building PT can be nested as part of a larger mixed-method research design where the theoretical mechanism that is indicated is tested further using either theory-testing PT or set theoretic methods such as Qualitative Comparative Analysis. In this paper, we did not consider plausible alternative explanations as the focus was on collecting evidence on the institutionalization of IUWM and manifestation of IWRM as a plausible underlying mechanism at play influencing water security outcomes. A valuable extension to this work would proceed to theory-testing, wherein each part of the causal mechanism should directly and logically link to the next part and should be empirically measurable. Identifying evidence that a part of the mechanism happened because of the previous part, rather than for some other reason, requires eliminating plausible alternative explanations and observable manifestations of these.

6. Conclusions

The comparative case analysis between Singapore and Hong Kong indicates that deeper institutionalization is associated with stronger impacts on water security. Deeper institutionalization influences several stages in the planning cycle. First, it broadens the range of strategic options available. In Singapore, the integration of water and wastewater services in a single agency facilitates the adoption of water reuse at the scale of the entire city. Second, deeper institutionalization appears to support quicker and smoother implementation, suggested by the faster pace of infrastructure procurement in Singapore. Third, institutionalization makes it easier for higher levels of government and for the public to monitor performance, which may provide stronger incentives for implementing agencies to achieve policy targets.

The empirical evidence gathered as part of the process tracing exercise indicates the presence of stages within a generic IWRM planning cycle as the overall theoretical mechanism behind observed water security outcomes. This analysis can be taken further to test IWRM as the operating causal mechanism by ruling out other alternative hypothesis that could influence water security in both cities.

In this analysis, we have considered IUWM to be a process and have attempted to draw a distinction between the process and the policy goals that it is intended to achieve. The process tracing approach can help to draw this distinction. As a process, IUWM cannot itself guide policy-makers in weighting objectives or in addressing the possible trade-offs between them. The adoption of integrated management strategies at the city-level is feasible and compatible with the goal of water security. However, the link between IUWM and water security is not automatic as the Hong Kong case shows, and IUWM may be adopted primarily as a strategy to achieve other goals. As each city will apply different weights to water policy objectives, more empirical evidence is needed on the adoption of IUWM across countries and regions to improve our understanding of the objectives to which it contributes most effectively. Furthermore, the conceptualization and operationalization of water security as an outcome variable can differ from city to city as per the choice of indicators that are found to be most relevant to the city context.

While the comparison presented here suggests that deeper institutionalization of IUWM, clear objectives, and a strong monitoring and evaluation framework, alongside a clear allocation of authority may lead to more rapid and significant improvements in performance, further cases would need to be considered before drawing clear conclusions for policy design. Setting clear objectives and identifying indicators to monitor progress towards them may itself be a difficult and contested matter, and may lead to delays in the adoption or adaption of IUWM strategies, as appears to be the case in Hong Kong at the time of writing. Institutionalization further could be operationalized differently in different

contexts. In both Singapore and Hong Kong, for example, citizen engagement and consultation did not feature strongly as an influencing factor, which may not be the case in other cities.

In terms of generalizability of the application of process tracing for studying integrated approaches to water management at other scales, the challenges of setting system boundaries in space and time and the presence of confounding factors, mentioned in Section 5.2, need to be considered. Addressing these challenges can form avenues for further work to improve our understanding of IWRM and its impacts at local, river basin, or national scales.

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How to Sustain Fisheries: Expert Knowledge from 34 Nations

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Abstract: Ensuring productive and sustainable fisheries involves understanding the complex interactions between biology, environment, politics, management and governance. Fisheries are faced with a range of challenges, and without robust and careful management in place, levels of anthropogenic disturbance on ecosystems and fisheries are likely to have a continuous negative impact on biodiversity and fish stocks worldwide. Fisheries management agencies, therefore, need to be both efficient and effective in working towards long-term sustainable ecosystems and fisheries, while also being resilient to political and socioeconomic pressures. Marine governance, i.e., the processes of developing and implementing decisions over fisheries, often has to account for socioeconomic issues (such as unemployment and business developments) when they attract political attention and resources. This paper addresses the challenges of (1) identifying the main issues in attempting to ensure the sustainability of fisheries, and (2) how to bridge the gap between scientific knowledge and governance of marine systems. Utilising data gained from a survey of marine experts from 34 nations, we found that the main challenges perceived by fisheries experts were overfishing, habitat destruction, climate change and a lack of political will. Measures suggested to address these challenges did not demand any radical change, but included extant approaches, including ecosystem-based fisheries management with particular attention to closures, gear restrictions, use of individual transferable quotas (ITQs) and improved compliance, monitoring and control.

Keywords: ocean governance; fisheries management; ecosystem-based management; overfishing; sustainable fishing

1. Introduction

For the second half of the twentieth century, scientific and technological endeavours focused on finding new fisheries to exploit and more efficient and effective ways of harvesting. This was possible as developments in vessel and gear design, navigation and positioning systems and means to detect fish (e.g., depth-sounders) became more accessible to the common fisher [1]. These scientific and technological advances led to a dramatic increase in global fishing effort. Such developments also allowed fleets to exploit more distant resources to the point where the only unexploited fishery resources were those that remained physically inaccessible, for example under sea-ice [2]. For much of this period, much of the sea was treated as a common resource with many fish stocks exploited with little restriction and only a few with strict governance, setting conditions for a "tragedy of the commons" [3]. In recent decades, there has been increasing awareness of the need for global political action on natural resource management, as evidenced by the Rio Declaration on Environment and Development in 1992 [4] and by such initiatives as the Oxford Martin Commission for Future Generations, launched in 2012 by an interdisciplinary group of organisations [5].

By the latter decades of the twentieth century, it became apparent that the substantial increase in fishing capacity was leading to overexploitation and, in some cases, collapse of fisheries [6,7]. Overfishing, with associated ecosystem shifts, is a major threat to the marine environment. More than half of the world's marine fish stocks are considered to be either overexploited or fully exploited with no room for further expansion [8]. Although stocks have been fished for a number of centuries, the sheer number of global stocks that are currently below sustainable exploitation levels is unprecedented [8,9]. Failure to understand and sustain ecosystem processes, including human impacts upon them, continues to cause major biodiversity loss in many places around the globe [10–14]. As a result, a number of scientific initiatives are directed towards developing and applying methods to better measure, predict and monitor sustainable yields of key fish stocks, in both national and international waters [15,16].

1.1. Public Demand for Marine Management

Over at least two decades, there have been increasing calls from scientists, nongovernmental organisations (NGOs) and the public at large for better management of marine ecosystems. These calls have partly been based on scientific research that has revealed the myriad ways that fishing activities (along with climate change, terrestrial runoff and other anthropogenic processes) impact the overall health of marine ecosystems [9,17,18]. Increased environmental awareness has led to calls for attention to ecosystem-focused approaches to management, variously termed the Ecosystem Approach to Fisheries (EAF) [8], Ecosystem-Based Fisheries Management (EBFM) [19], or cross-sectoral Ecosystem-Based Management (EBM) (i.e., spanning all marine sectors, not just fisheries) [20].

Despite an increase in scientific knowledge and management efforts on overexploited fisheries and marine systems, there are still ecosystems and fish stocks showing no or little sign of recovery. It is recognized that impacts on the marine environment from fishing pressure might, in some cases, be more severe than first thought [21]. This calls for fisheries to be governed and managed holistically, needing a combination of environmental, biological and socioeconomic research to provide robust marine governance and management strategies to ensure a sustainable marine environment. The gap, however, between science and policy has been acknowledged [22,23], as has the fact that governance and management decisions are not always based on the best science available [24].

1.2. The Management Challenge: Predicting Uncertainties

Apart from fishing pressure, marine ecosystems and fisheries are also subject to other effects of human activity, such as climate change, ocean acidification and related biophysical impacts, habitat loss and impacts from terrestrial land use, such as land-based sources of pollution and litter [12,25,26]. A key challenge is to predict the long-term effects of these cumulative anthropogenic impacts and to form appropriate management strategies [27]. Without appropriate knowledge and understanding of the ecosystem supporting fisheries, and the communities in which fisheries are embedded, it is likely that management will fail [28].

The complexity of governing and managing fisheries in a socioeconomic context was illustrated by the 2009 Nobel Prize in Economics. The Nobel Prize was shared between Dr Ostrom, whose research was based on the assumption that people in a community can create successful agreements (and compliance) for managing common use of natural resources, such as fisheries [29], and by Dr Williamson, who presumed that natural resource management needs a top-down management approach because individuals ultimately cannot trust one another [30].

Another challenge (at times the largest challenge) for fisheries and environmental managers is a lack of political will to use and implement recommendations based on scientific findings. This challenge can reflect and reinforce the 'science–policy gap' [22]. Although scientists may make management recommendations based on their findings, ultimately management decisions are made by government officials and politicians. Importantly, these decisions are not driven only by scientific knowledge of the stock and dynamics of the ecosystem in which a fishery is embedded, but also by a range of political agendas and economic, social and cultural considerations. While scientists may be frustrated with

this reality, it is important for them both to accept that they are only one voice at the decision-maker's table, but also not to shy away from objectively presenting the scientific evidence.

Given that there are many environmental, biological and socioeconomic factors that ultimately affect the state and health of the oceans, and that these drivers vary in time and space, decision-makers increasingly ask whether there is sufficient scientific information and knowledge of ecological functions and processes to implement an ecosystem approach to marine and fisheries management [31]. Successful marine management needs careful integration across sound scientific knowledge, development and implementation of management instruments and compliance tools. Even though there are many ecological processes to understand further, it is widely recognised that we do have sufficient scientific information to start implementing EBFM in many places around the world [32–34].

One challenge to implementing EBFM is that ocean resources are often managed sector-by-sector, i.e., coastal and terrestrial development, water management, environment conservation and primary industries (including fisheries) are each managed by separate jurisdictions [31]. The different set of goals and objectives within each sector may have implicit trade-offs so that fisheries managers often need to navigate and respond to conflicting objectives and incentives involving two or more government agencies [35,36] or interest groups. Clearly, if there is a negative impact on marine habitat due to fishing gear as well as from toxic terrestrial run-off, then both the fishing sector and the land-use sector need to take appropriate actions to prevent further habitat degradation [37]. Implementing EBFM, or EBM, requires a governmental organisational structure that matches this holistic view of ecosystem-based management. This does not immediately dictate an overarching, all-encompassing regulatory body, but it does necessitate communication (and where possible harmonisation of requirements) between agencies.

While defining the final scope of an ecosystem-based management governance system is beyond the scope of this paper, providing information on the current state of play is important to understanding what steps are still required to achieve solid advances. This research explores the main issues influencing the sustainability of fisheries. It draws on data derived from an international survey of fisheries experts, using the elicited responses to (1) identify the main issues in attempting to ensure the sustainability of fisheries, and (2) address how to begin to bridge the gap between scientific knowledge and the governance of marine systems, from the point of view of fishery management experts. The survey data were analysed to explore expert insights, opinion and understanding on the challenges to sustainable fisheries, the efficacy of tools used to manage fisheries and the complexity of interactions in fishery socioecological systems.

2. Methods

2.1. Data Collection

We targeted marine experts from around the world, primarily scientists and natural resource managers. Our survey was designed to elicit knowledge from marine scientists, managers, fishers and policy-makers. The intention was to gather specialist knowledge and experience in relation to sustaining fisheries. The survey was implemented by inviting experts to share their knowledge and experiences at the 6th World Fisheries Congress in Edinburgh, 8–11 May 2012. Attendees were invited to sit down at a booth and take part in the web-based survey. If an individual did not have time to conduct the survey when approached, they were given the opportunity to complete the survey in their own time either online or via a hard-copy of the survey. In total, 549 persons were invited to participate in the survey, resulting in 168 fully completed surveys (20 more provided partial completions that were still sufficient for inclusion in the analysis), giving a 34% response rate.

2.2. Analysis

The questions and a summary of the answers are presented in Appendix A. Given small sample sizes when respondents were broken down by category, for some questions, the responses from

fisheries/natural resource managers and policy-makers were aggregated into a 'managers/policy makers' group. For the same reason, variables measured on five-point response scales were, in some cases, converted into a three-point scale. For example, the five-point 'satisfied-dissatisfied' scale was in some cases collapsed into the categories 'satisfied', 'neutral' and 'dissatisfied', by combining 'satisfied' with 'very satisfied', and 'dissatisfied' with 'very dissatisfied'.

Statistical analyses, including crosstabulations, were conducted using SPSS (Version 25.0., IBM Corp, Armonk, NY, USA). No corrections were made. The statistical independence of pairs of variables was analysed using the 2-factor G-test for independence at a 95% significance level.

3. Results

3.1. Demographics

The respondents were from 34 nations, representing scientists, fisheries managers, fishers, policy-makers, NGOs and others. Forty (40) respondents were from Australia, as the survey was trialed there before presenting it at the World Fisheries Congress.

Seventy-one percent of the respondents were male, and 60% of the respondents were 35–64 years old (Appendix A). Forty-two percent of the respondents had a Doctoral degree, 28% a Master's degree, 14% a 3–4 year university degree, and the remainder did not hold a degree, but all had completed high school (Appendix A). The majority of the respondents were scientists (Figure 1), with fifty-nine percent of the respondents holding a degree in marine science and 20% in environmental science. Other respondents had degrees in business, law, economics and social sciences (Appendix A).

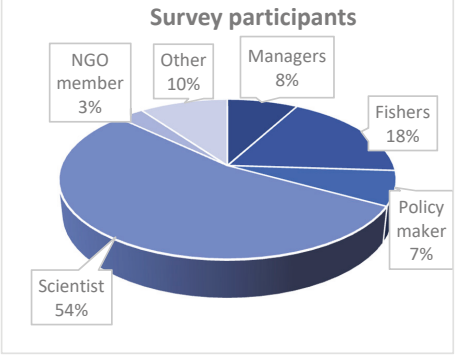

Figure 1. The breakdown of respondents by profession (n = 177). 'Other' includes consultants, economists, social scientists, lawyers and students. NGO, nongovernmental organization.

The majority of the respondents spanned middle-executive management positions, and represented pelagic, demersal, coastal and crustacean fisheries (Figures 2 and 3). The respondents represent experience and knowledge from fisheries deemed to be sustainable as well as from overfished, collapsed, recovering and exploratory fisheries (Figure 4). Of the respondents, 47% worked with national management agencies, 24% with international management and 15% at universities (Appendix A).

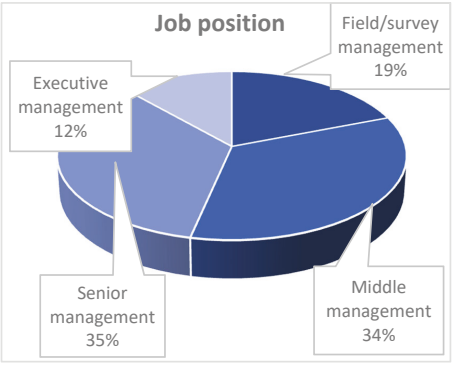

Figure 2. The job position held by respondents (n = 146).

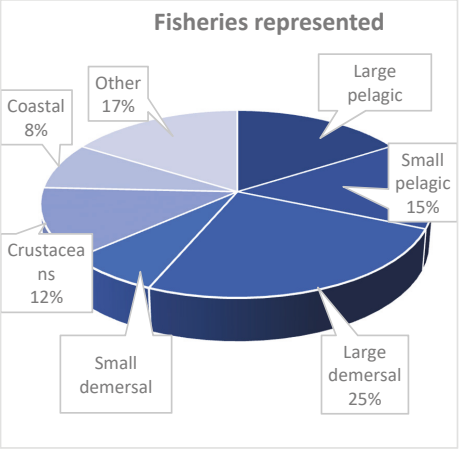

Figure 3. The fishery types covered by survey respondents. 'Other' includes shark, inland, aquaculture and shellfish (n = 143).

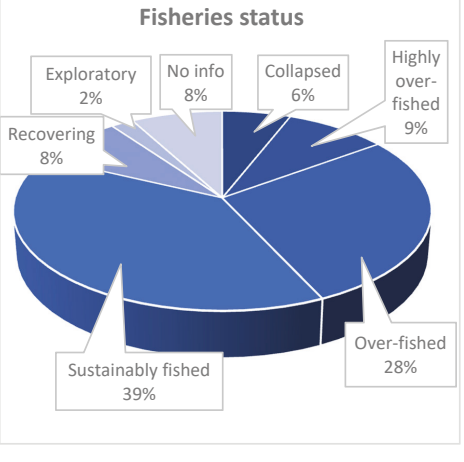

Figure 4. The status of the fisheries the respondents are working with (n = 172).

3.2. Anthropogenic Effects on Fisheries and Marine Systems

Overfishing, climate change and habitat destruction were believed to be the three threats most affecting fisheries, both at national and global scales (Figure 5). There was no significant difference among the responding groups as to whether or not they perceived the same 10 threats as major threats to national and world fisheries (G = 10.191, df = 9, p = 0.335), where G is the likelihood-ratio, df the degree of freedom and p the probability value.

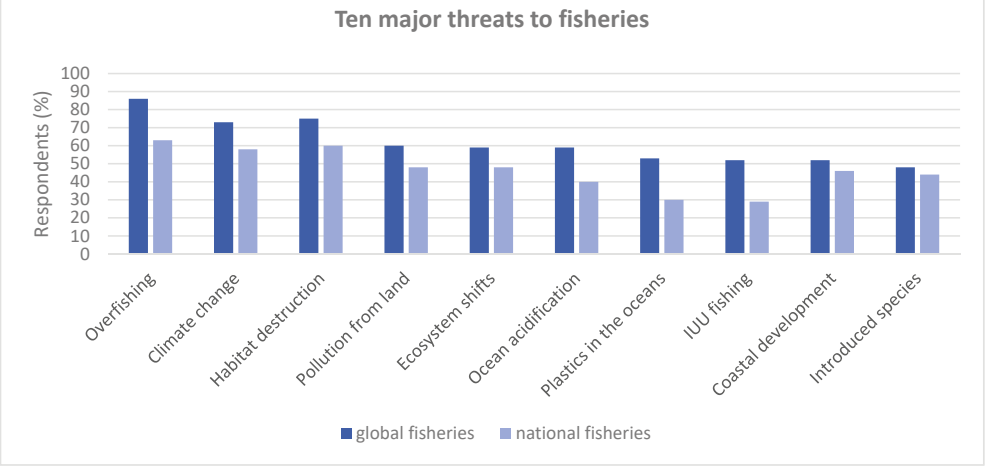

Figure 5. The 10 major threats to national and global fisheries (n = 164).

Overfishing was believed to be a major threat to world fisheries by 79% of the managers, 92% of the policy-makers, 79% of the scientists and 84% of the fishers (Figure 5). Notably, 69% of the policy-makers and scientists said they believe that illegal, unreported and unregulated (IUU) fishing is not a major threat to national fisheries, while 78% of the fishers said they think it is.

Fifty-eight percent of all respondents believed climate change to be a major threat to national fisheries, while 59% believed that ocean acidification is a major threat to world fisheries and 40% to national fisheries. Seventy-two percent of the fishers said they think habitat destruction is a major threat to the marine environment for world fisheries, while only 13% said it is a threat to national fisheries. Forty-one percent of the scientists believed land-based pollution is a major threat to fisheries, compared to 84% of the fishers, 85% of the policy-makers and 79% of the managers. Of all the respondents, 46% said plastic is a major threat to world fisheries (57% of managers and 62% of the scientists) and 30% said it is a major threat to national fisheries.

Despite the divergence in views in the earlier question pertaining to whether IUU is a threat to international or national fisheries, there was no significant difference among the responding groups on how they viewed the specific aspects of IUU fishing (G = 61.275, df = 45, p = 0.054). Corruption was seen as the main aspect of IUU fishing (66%), with 55% of respondents believing that there is insufficient compliance in place to combat IUU fishing (Figure 6). Sixty-four percent said they believe IUU fishing is a problem within their fishery, and of those 43% said they think IUU fishing amounts to 6–30% of the total catch (Appendix A). When specifically asked about IUU (rather than ranking it against other threats), on a global scale, 99% of the respondents believed that IUU fishing is a problem and 65% estimated the global level of IUU fishing to be between 31–60% of the total catch worldwide (Appendix A).

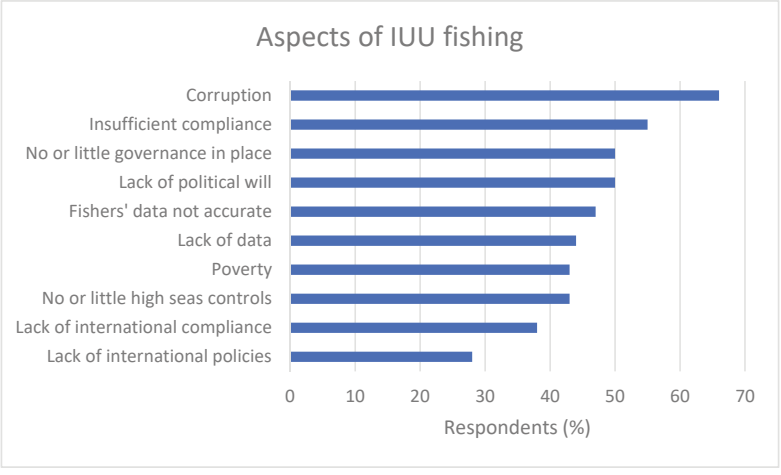

Figure 6. Key aspects of illegal, unreported and unregulated (IUU) problems identified by the respondents.

3.3. Fisheries Governance and Management Affecting Fisheries and Marine Systems

On the question of what the three main challenges to fisheries are, the following four factors ranked the highest: a lack of political will (56%); not enough compliance with regulations (33%); overfishing (29%); and stock assessment and monitoring (28%) (Figure 7). There was no significant difference among the responding groups regarding which of the four factors were seen as the main challenges to managing fisheries (G = 23.409, df = 15, p = 0.076). Despite compliance being listed as a major challenge to sustainability, 90% of the fishers and 66% of the scientists said there is already enough compliance.

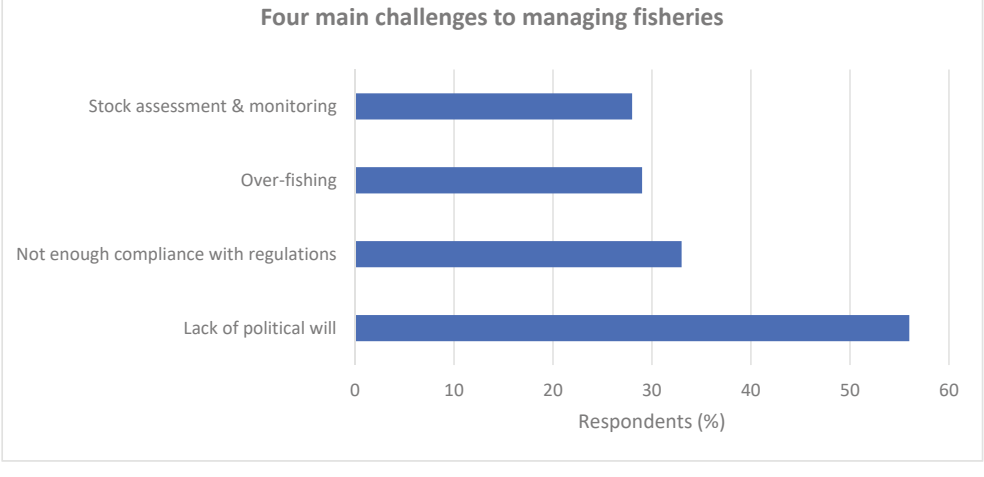

Figure 7. Expert opinions on four main challenges to managing fisheries (n = 174).

Fifty-five percent of the respondents believed that, during the course of their careers, they have seen major changes in fisheries management, such as increased input from scientists and industry, and stakeholder collaboration (Figure 8).

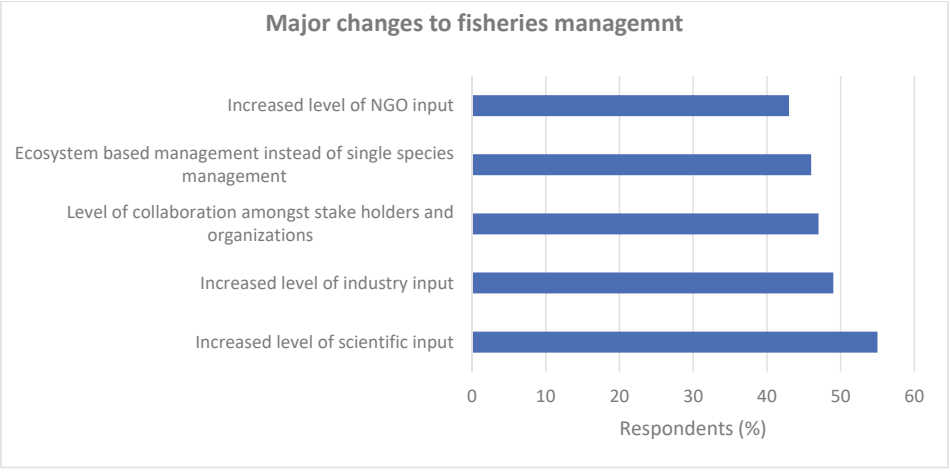

Figure 8. Major changes that have occurred in fisheries management during the respondents' careers in fisheries (n = 109).

More of the respondents were satisfied than dissatisfied with the planning and implementation of the EBFM processes. However, when considering the results of EBFM, a greater number of respondents were neutral, out numbering those who were satisfied or dissatisfied (Figure 9). When looking to the fisheries they knew best, 60% of the respondents said that the fishery they worked with has implemented (EBFM) (Appendix A), or a similar holistic approach to governing fisheries, though 50% said they were unsure as to whether the implementation of EBFM has been successful (Figure 10).

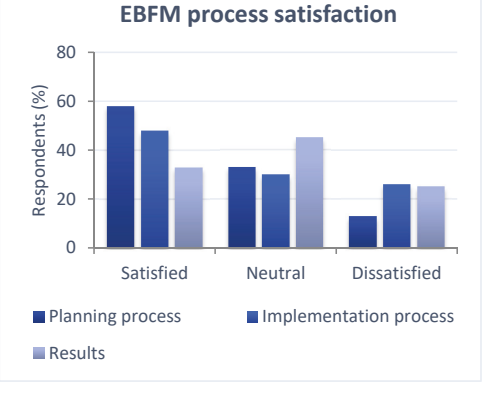

Figure 9. Measuring how satisfied the respondents were with the whole Ecosystem-Based Fisheries Management (EBFM) process (n = 104).

There was no significant difference among the responding groups in terms of their satisfaction with the planning processes associated with implementing EBFM ($G = 11.358$, $df = 10$, $p = 0.33$), with 73% of the managers, 67% of the policy-makers, 47% of the scientists and 50% of the fishers being satisfied. Thirty-eight percent of the scientists and 50% of the fishers were neutral. When it came to taking the step of implementing EBFM, there was also no significant differences among the responding groups on how they felt regarding this implementation process ($G = 21.174$, $df = 15$, $p = 0.131$), with approximately 50% of both the scientists and fishers being neutral.

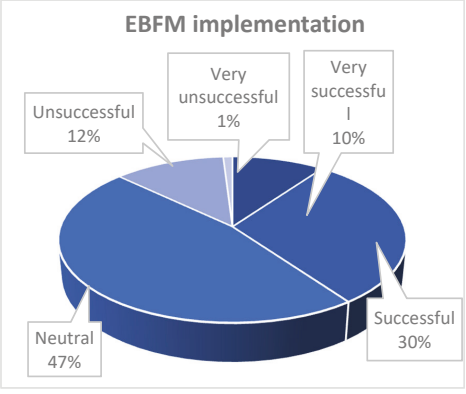

Figure 10. The perception of those respondents who said the EBFM process has been implemented regarding how successful the process had been (n = 107).

Sixty-four percent of the managers and 58% of the policy-makers were satisfied with the results of implementing EBFM, compared with 31% of the scientists, 46% of the fishers and 0% of the NGOs (Table 1). About as many scientists as managers thought the implementation process of EBFM had been unsuccessful (Table 1) and about as many fishers as scientists remained neutral as to whether the EBFM implementation process had been successful (Table 1).

Table 1. The level of success for the implementation process of EBFM per responding group (% within each responding group. n = 108).

	Managers	Policy-Makers	Scientists	Fishers	NGOs
Very successful	0%	15%	11%	11%	0%
Successful	64%	31%	20%	35%	0%
Neutral	18%	39%	50%	54%	67%
Unsuccessful	9%	15%	19%	0%	33%
Very unsuccessful	9%	0%	0%	0%	0%

Once EBFM is in place (often in an adaptive management context), it is important to know if it is proving successful. When asked about this, there was no significant difference among the responding groups regarding how satisfied they were with the results of EBFM ($G = 16.571$, $df = 10$, $p = 0.084$): 55% of the managers were satisfied, compared with 23% of the scientists (Table 2). Of the fishers, 65% were neutral and 67% of the NGOs were dissatisfied (Table 2). Figure 11 shows that EBFM is challenging to implement, mainly because the process is highly complex.

Table 2. Satisfaction among the responding groups regarding results of the implementation of EBFM (% within each responding group. n = 104).

	Managers	Policy-Makers	Scientists	Fishers	NGOs
Very satisfied	0%	25%	2%	8%	0%
Satisfied	55%	17%	21%	23%	33%
Neutral	27%	33%	41%	65%	0%
Dissatisfied	9%	25%	29%	4%	67%
Very dissatisfied	9%	0%	7%	0%	0%

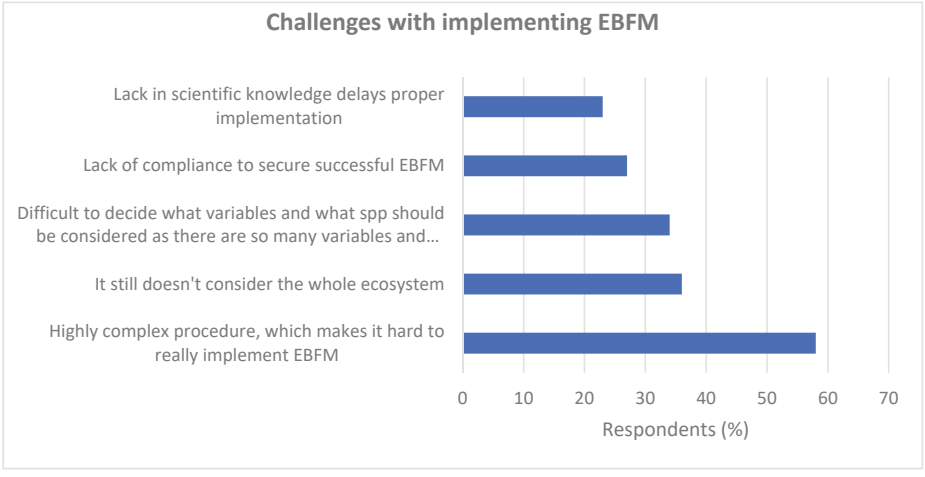

Figure 11. Implementing EBFM is a complex task (n = 83).

There was a significant difference among the responding groups regarding which tools are most efficient for implementing EBFM (G = 44.226, df = 20, p = 0.001). Respondents viewed good science, Marine Protected Areas (MPAs), individual transferable quotas (ITQs), gear restrictions and stakeholder participation to be the five most efficient tools for Ecosystem-Based Fisheries Management (Figure 12).

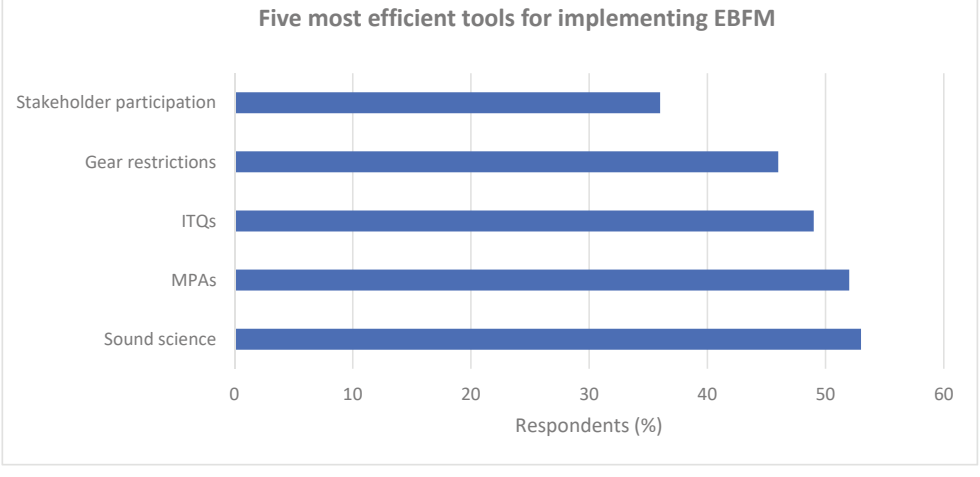

Figure 12. Participants' responses to the five most-efficient regulations for Ecosystem-Based Fisheries Management (n = 121). ITQs, individual transferable quotas.

3.4. Improvements Needed to Obtain and Maintain Sustainable Fisheries

For the question on what type of organisation would be optimal for implementing EBFM, 83% believed that a mix of a top-down and bottom-up management is optimal (Appendix A). When it came to what more is needed to sustain fisheries, 72% of all respondents answered they believe a stronger political will is needed to achieve successful ecosystem-based management (Figure 13).

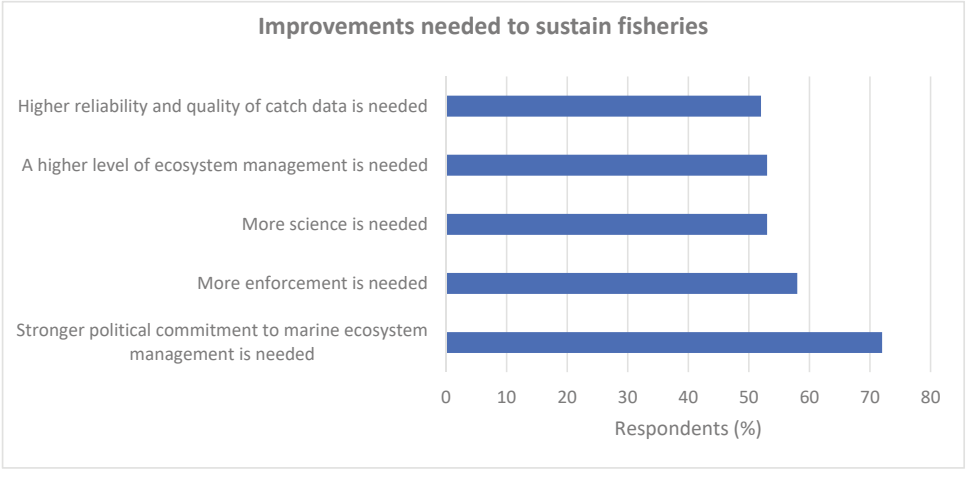

Figure 13. Improvements needed to obtain/maintain sustainable fisheries (n = 165).

There was no significant difference among the responding groups regarding which improvements are needed to sustain fisheries (G = 5.747, df = 20, p = 0.999), with all groups identifying the same mix of factors. However, this congruence did hide some differences in detail. Amongst managers, a clear majority (79%) stated that stronger political will is needed. A majority of managers (60%) also said they think more enforcement is needed; this latter result is in sharp contrast to the 25% of fishers who felt the same way. Overall, 53% of the respondents believed that more science is needed in order to obtain and maintain sustainable fisheries (Figure 13).

The majority of the respondents were supportive of input controls, such as by-catch reduction devices, size limits, spawning and spatial closures, regional zoning, seasonal closures and gear restrictions (Figure 14). The majority of the respondents also showed support for output controls, such as total allowable catch (86%), individual transferable catch (69%) and bag limits (69%) (Appendix A).

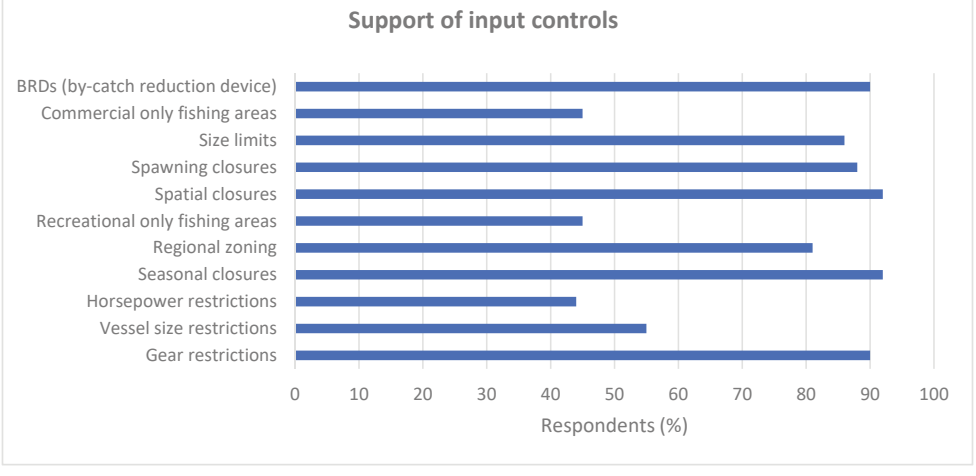

Figure 14. The level of support for several input controls shown by marine experts (n = 162).

When it came to monitoring and assessing stocks, Catch Per Unit Effort (CPUE) was the most common method used for measuring fish abundance (Figure 15), although logbook data was considered a close second.

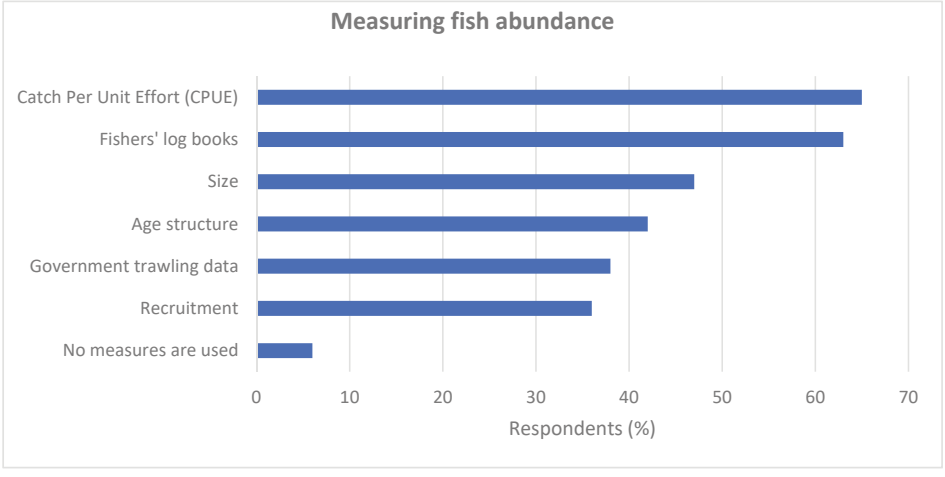

Figure 15. The prevalence of different approaches to measuring fish abundance.

Experts were asked to identify what they see as the main challenges to sustainable fisheries and what management tools would be generally useful for combatting challenges in fisheries (Table 3). Interestingly, while the challenges included things that are beyond the scope of fisheries management alone (e.g., land-based pollution or plastics), all of the suggested tools are classical fisheries management tools. When asked the question regarding why regulated fisheries are still faced with overexploitation, the highest ranking responses were: (1) the need for more scientific information; (2) existing science not being used to its fullest; and (3) a lack of political will. There was no significant difference to these three reasons among the responding groups ($G = 2.001$, $df = 10$, $p = 0.996$). The vast majority of all responding groups (regardless of background) said that the lack of political will is a major reason why regulated fisheries are still faced with overexploitation (Table 4).

Table 3. Ten main challenges and ten main tools for sustaining fisheries (n = 133).

Ten Fisheries Challenges	Ten Tools for Sustain Fisheries
Overfishing	Seasonal closures
Climate change	Total Allowable Catch (TAC)
Habitat destruction	Size limits
Pollution from land	Spatial closures (e.g., MPA)
Ecosystem shift	Ecosystem-Based Fisheries Management (EBFM)
Ocean acidification	Spawning closures
Plastics in the oceans	Mesh size
IUU fishing	Individual Transferable Quota (ITQ)
Coastal development	By-catch reduction device
Introduced species	Regional zoning

Table 4. Major reasons for why regulated fisheries are still faced with overexploitation.

	Managers	Policy Makers	Scientists	Fishers	NGOs
Not enough scientific information	72%	54%	78%	73%	80%
Scientific knowledge is not fully being used	64%	67%	53%	62%	20%
Lack of political will	93%	92%	74%	84%	80%

3.5. Socioeconomic Situations Affecting Fisheries and Marine Systems

Forty-two percent of the respondents said fish as a protein source is not important for survival in their country, 7% said it was, and 23% considered fish vital for some regions (Appendix A). However, when questioned on how important fishing is as a main source of income, 65% of the respondents said fishing is the major economic activity for a few regions, 42% said fishing is a vital source of income for some regions and 37% said that fishing is somewhat important as a main source of income for the country as a whole (Appendix A). Regarding subsides, 52% of the respondents said that fisheries subsidies are available in their country, 34% said there are no subsidies and 14% did not know (Appendix A). Of those who said there are subsidies in their country, 88% said they have fuel subsidies, 35% have employment subsidies, 26% have lower interest rates on bank loans and 15% said they have subsidies related to culture. Sixty-five percent of the respondents believed that subsidies contribute to overcapacity of the fishing industry (Figure 16).

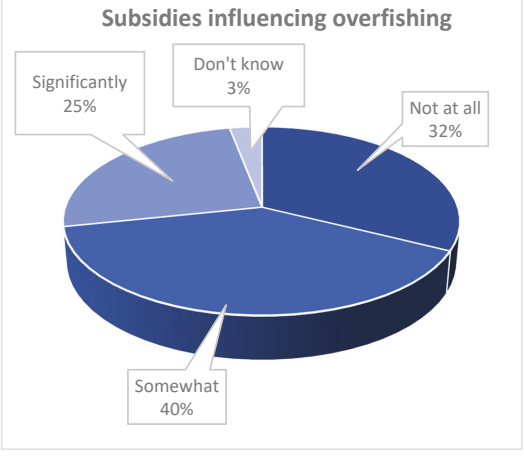

Figure 16. Respondents' belief regarding whether subsidies contribute to overcapacity of the fishing industry (n = 87).

There was particular support amongst the respondents for economic incentives, such as fishing access agreements and fishing vessel buy-backs by the government (Figure 17).

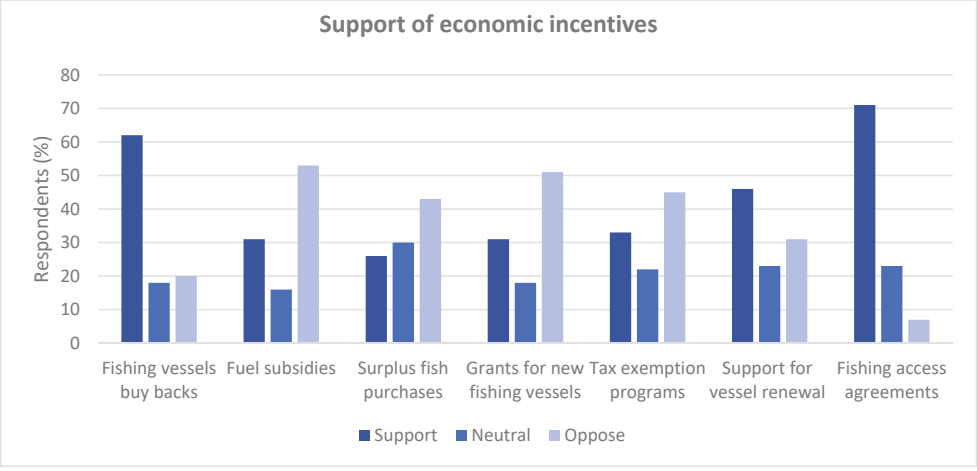

Figure 17. Experts showed large support for fishing vessel buy-back schemes and fishing access agreements (n = 168).

Fifty-one percent of the respondents were not able to estimate the cost of management for the fishery they work with (Appendix A).

4. Discussion

Results from the survey demonstrate that the respondents have had extensive experience in the fisheries management process, including both science and management. The respondents had formal qualifications and/or experience; with 42% having Doctoral degrees, 28% Masters degrees and almost half of the respondents having senior or executive roles in fisheries. The coverage was also global, representing 34 nations in total. While we acknowledge the sample sizes were uneven, with more scientists answering than any of the other respondents, there was congruence in many results, suggesting that perceptions held by fisheries scientists and managers may not actually be that different. Indeed, in many cases, fishers also held similar attitudes, though there were some notable differences (e.g., on the need for additional enforcement). In following up on why it proves so hard to access the opinions of managers, let alone policy-makers (who were an even smaller respondent group), it became clear that they lack opportunities to gather and share information in the same way as provided by scientific conferences. Funding such travel is often hard to do. In improving the state of fisheries globally—sharing insights into what has and has not worked—it appears that there is a fundamental need for the creation of a fora, or a conduit, for information sharing amongst these managerial and policy groups.

4.1. Threats and Challenges in Sustaining Fisheries

This analysis clearly confirmed that sustaining fisheries is a complex challenge, but the experts also offered their opinions as to how to combat the issues involved, which are generally consistent with the literature on how to sustainably manage fisheries [37–40]. The respondents considered the 10 main threats to fisheries to be overfishing, climate change, habitat destruction, pollution, ecosystem shifts, IUU fishing, ocean acidification, costal development, land-based pollution and introduced species. These same threats were considered important at national and global scales. This shows that the threats and challenges to sustaining fisheries are similar around the world; a finding consistent with existing scientific literature [8,41–43].

4.2. Management Tools in Sustaining Fisheries

Although the analysis highlights an extensive range of challenges in achieving sustainable fisheries, it also shows that the respondents believe there are many existing tools for addressing these obstacles and supporting sustainable fishing. Just as the main challenges and threats to sustaining fisheries were viewed similarly around the world, so too the list of potential tools was consistent across respondents from differing backgrounds and nationalities. While overfishing was seen as a major threat to sustaining fisheries (nationally and globally), the majority of all responding groups said it is not a challenge to manage. Given concern over the magnitude of the problems facing "small scale" fisheries and the difficulties of achieving successful management in locations with few regulatory resources [44], this is a surprising response. However, this may be because the respondents primarily work in fisheries with a range of regulations in place, with compliance and enforcement mechanisms already implemented to combat this challenge and so they have directly experienced the management of overfishing. This result may highlight a tacit bias in the work—people working in less well-resourced fisheries are unlikely to have had the means to visit the Congress where the survey was undertaken—and future follow-up on this work should endeavour to address this gap.

Tools identified as useful in sustaining fisheries included sound science, input controls (gear restrictions, seasonal closures, spatial closures, spawning closures, by-catch reduction device, size limits and regional zoning), output controls (bag limits, ITQs, Total Catch Limits (TACs)), a mixture of top-down and bottom-up organisation, stakeholder participation, fishing access agreements and fishing vessels buy-backs, effectively taking an integrated or ecosystem approach. In particular, the vast majority of all responding groups viewed good science, MPAs, ITQs, gear restrictions and stakeholder participation to be the five most efficient tools for Ecosystem-Based Fisheries Management. All of these tools are consistent with what have been recorded as good supporting tools for sustainable fisheries in other research [39,45–47].

More of the respondents were satisfied than dissatisfied with the EBFM's planning and implementation processes. More were, however, neutral regarding the results of the EBFM, reflecting in part the complex nature of the EBFM process. Management tools might be put in place, but it may take a long time before any results are seen. These approaches may be introduced when the system has been overfished and shifted to a state where restoration may take a lengthy period [48–50]. More managers than any other responding group said they believed the EBFM implementation process was a success. About the same number of managers, policy-makers and scientists said they believed it was unsuccessful. Possibly, there were different expectations among the various responding groups, where the managers saw it as a success in itself that such a large management process had been adopted and implemented by the government in the first place; while the scientists may have been more cautious (neutral) because any biological success was yet to be seen. More managers and policy-makers said they were satisfied with the results of EBFM than the scientists and fishers, although all responding groups showed a cautious element to any success, the fishers more so than any other group. Again, the expectations are likely to differ among the various stakeholders, as implementing EBFM unavoidably involves trade-offs in meeting all biological, economic and social goals [51], which will differ between the different groups.

Given the growing focus on the implications of a high level of marine pollution [52–54], it might be surprising that only just over half of the respondents answered that they believe land-based pollution is a major threat to the world's fisheries and 46% said plastic is a major threat. This might be due to the fact that the survey was undertaken in 2012 when there was not as much scientific reporting on plastics in the ocean [55]. It was particularly noteworthy though that, despite pollution and plastics being identified as threats, few, if any, of the suggested tools put forward are likely to have a significant role in combating these issues. This indicates that, while awareness of the issue is growing, focus is still on the classical threats and long-established tools.

4.3. Management Constraints in Using More Science

Fisheries management in the majority of industrialised nations is said to be science or evidence-based, even if science-based advice is not always followed in the political process [56]. This analysis showed 'not using scientific knowledge to its fullest potential' to be the main constraint for effectively and efficiently implementing ecosystem-based fisheries management, together with: (1) a lack of compliance; (2) IUU still being a major global issue; and (3) political will.

The management of marine systems in general, and fisheries in particular, is highly complex and a story of information paucity. It is very difficult to estimate even the abundance of target species. In some regions, it is even difficult to precisely determine what has been extracted from the ocean, let alone the effects on dependent species or species not directly impacted by fishing [57]. The reason why science is not being used to its fullest is interesting. Is it because of a disconnect of science and management? In Australia, having fisheries scientists work closely with but ultimately sit apart from the management agency has been a successful approach, as the participatory processes in place there allow for communication, while the 'distance' has helped increase trust in science and motivation of scientists by all stakeholders. In other regions, the organisational disconnect has led to barriers to information uptake. In these latter instances, because scientists belong to a separate organisation, they are treated more as a consultant and thereby not fully integrated in the management process, leading to critical communication failures. An example of this is where scientists from the International Council for the Exploration of the Sea (ICES) advise the Oslo Paris Commission (OSPAR), the Helsinki Commission, the Baltic Marine Environment Protection Commission (HELCOM), the North East Atlantic Fisheries Commission (NEAFC), the North Atlantic Salmon Conservation Organization (NASCO) and the European Commission (EC) [58]. Yet, despite all of these channels, the decisions have still been largely political, leading to overfishing within the European Union [59–62]. More recently, there have been significant efforts to reverse this, though it has only been patchily effective; the Mediterranean, in particular, still has a majority of its stocks in an overfished state [63].

An alternative example is found with the Commission for the Conservation for Antarctic Marine Living Resources (CCAMLR). CCAMLR has its scientific committee with its working groups fully integrated in the organisation advising the commission at the annual meetings. Many participants are a part of both the scientific commission and the commission [64–67]. This science-based commitment to ecosystem-based management has, since 1982 (when CCAMLR was founded), contributed to the recovery of previous overfished stocks, and sustainable management of the Southern ocean ecosystems, including fisheries [39,68,69].

4.4. A Brief Comment on Cognitive Inconsistencies

With the growing accessibility of literature regarding human cognition, it would be remiss of us not to note how the perceptions reported in this survey may be effected by common cognitive biases and fallacies [70,71]. We are not trained professionals in the field of psychology, so will not go into depth, but the results for IUU appear to be a stand out example of such biases in action. There is clear recognition that IUU is a problem, with almost complete consensus on this point across respondents. However, it appears that the perception of the magnitude of the problem is strongly influenced by an optimism bias (with far fewer respondents thinking it is a problem in their own fishery) and by biases to do with framing (it is seen as more of an issue when asked directly about IUU rather than in general bundled with other risks) and uncertainty (as the true magnitude of the problem is typically unknown and so may be discounted as a result). In addition, the fact that the suggested solutions for sustainable fisheries include a list of existing tools, many of which have been in use in fisheries for centuries, suggest that there may be a strong endowment effect, with experts sticking strongly to tools they are already heavily invested in without necessarily looking for new alternatives. This is worth additional research to verify. If confirmed, it would open up new research paths; if falsified, then it would reassure all stakeholders that we already have at hand all the tools we need to achieve sustainable fisheries.

4.5. Political Will to Match Biological Challenges

The survey showed that, despite implementation of EBFM and increased levels of input from science, industry and NGOs, sustaining fisheries remains a challenge. The main challenge when managing fisheries was said to be a lack of political will. We note that policy-makers represented just 7% of the respondents, and the issue of sustaining fisheries due to a lack of political will might have been viewed differently had there been more policy people participating in the survey. Indeed, knowledge brokers who span the science–policy interface caution that policy-makers can become frustrated with scientists who fail to appreciate the many sources of information and many pressures that must be navigated by policy-makers when making a single decision [72]. Political advisers and politicians must also consider political, social, cultural and economic matters.

The challenge to managing fisheries ranked second by the respondents was a shortage in compliance and regulations, stock assessments and monitoring. This might not come as a surprise as there are high costs involved for scientific assessments and controlling regulations [73]. In linking the top two challenges, the challenge found regarding the lack of compliance may reflect a lack of general political and social will to fund and implement required management controls [70]. Politicians may be more inclined to act on issues more important to the voters (who have concerns extending well beyond fisheries), and perhaps, at times, they do not either fully appreciate the seriousness of the marine issues or the need for long-term sustainable plans that span many election cycles.

However, what might not be high on the political agenda today may change with building public awareness, which in turn may demand better management of natural resources [71]. The United Nations' Ocean Conference for implementation of Sustainable Development Goal 14 ('Conserve and sustainably use the oceans, seas and marine resources for the sustainable development') is an example. This conference was held in June 2017, with 193 nations making a commitment to a set of measures aiming to increase the resilience of ocean health. These pledges have been accompanied by over 1400 voluntary commitments. Together, these commitments can be seen as a global commitment (raised from increased scientific and public pressure) for politicians to better manage marine life. Given increased consciousness of environmental issues among the public since this survey was conducted [72,73], it would be interesting to conduct a similar survey today to see if there is a perception of a stronger political will today to sustain fisheries.

5. Conclusions

This study reinforces the magnitude of the challenges in sustaining fisheries. It identified key issues underpinning the use of an ecosystem management approach, such as complexity, the high degree of connectivity, difficulties associated with observing ocean processes and monitoring flora and fauna. The fact that 99% of the respondents believed that IUU fishing still is a global problem and 65% estimated the global level of IUU fishing to be between 31 and 60% of the total catch worldwide is, naturally, a major concern. Tools identified as useful in sustaining fisheries included sound science, gear restrictions, seasonal closures, spatial closures, spawning closures, by-catch reduction device, size limits and regional zoning, bag limits, ITQs and TACs. The study indicated that the common position of the respondents is that the use of a mixture of top-down and bottom-up organisation and institutional forms is important to success, as is the importance of stakeholder participation. However, implementing these solutions will come with new challenges, especially when implementing them at scales aligning with the magnitude of participation in "small-scale" (often poorly resourced) fisheries in developing nations. The survey also highlighted the impact of fishing access agreements and fishing vessels buy-backs as tools to constrain effort. Again, these are things that may work more effectively for industrial than some artisanal fisheries.

This research illustrated a clear perception of a need for a higher political will and commitment to combat challenges, such as IUU fishing, habitat destruction and climate change, both nationally and globally. More research and long-term monitoring to assist managers in prioritization resources was also identified as a particularly important need. It was clear from the analysis that the widely

held belief by those experts in charge of the world's fisheries that, to recover from overfishing and fisheries collapse (and to minimise the future risk of such events), scientific input must be matched with the same level of political commitment, including implementing science-based fisheries and conservation measures.

It is also worth noting that human cognition is not infallible. When asked directly about illegal, unreported and unregulated fishing, 99% of the respondents saw it as a global issue; however, when put against other challenges, close to 70% of the policy-makers and scientists believed that is not a major threat to national fisheries, despite the fact that almost 80% of the fishers said they think it is. This suggests that there is a gap in the discourse and management of IUU fishing that likely needs closer consideration or discussion.

This analysis showed that there is the strong perception that scientific knowledge is not being used to its fullest potential and that in turn is the main constraint for effectively and efficiently implementing ecosystem-based fisheries management. Is the challenge then a lack of political will only, or is this a reflection of the make-up of respondents: scientists frustrated with a perceived lack of political appreciation? Perhaps there is a greater need to establish science-management networks that meet regularly, to train a new generation of scientists who have direct industry and regulatory body experience (spending time in both as well as academia before completing their training), as well as a need for scientists to communicate science in a more pedagogical way?

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Appendix A

Fisheries Governance Survey, with responses

Q1. Threats to the marine environment: For each of the potential marine threats, please tell if you believe there is no threat, a minor threat or a major threat.

Responses to the Fisheries Governance Survey are Presented in the Order the Questions Appeared in the Survey Instrument. I Have Read the Information Above and Consent to Participate in This Study. I am over the Age of 18 Years. Answer	Response	%
Yes	188	100
No	0	0
Total	188	100

No threat

Question	National Fisheries	World Fisheries	Total Responses
Pollution sourced from land	9	4	13
Eutrophication	19	16	35
Anoxic events	23	20	43
Ocean acidification	14	8	22
Introduced species and pests	5	5	10
Dead marine zones	25	14	39
Energy exploration	33	21	54
Ecosystem shifts	11	5	16
Habitat destruction	8	0	8

Question	National Fisheries	World Fisheries	Total Responses
Plastics in the oceans	23	12	35
Coastal development	14	16	30
Overfishing	12	0	12
Climate change	6	3	9
IUU fishing	9	1	10

Minor threat

Question	National Fisheries	World Fisheries	Total Responses
Pollution sourced from land	83	65	148
Eutrophication	95	76	171
Anoxic events	95	78	173
Ocean acidification	79	61	140
Introduced species and pests	91	79	170
Dead marine zones	92	83	175
Energy exploration (oil, gas, etc.)	87	84	171
Ecosystem shifts	74	63	137
Habitat destruction	57	41	98
Plastics in the oceans	94	62	156
Coastal development	75	61	136
Overfishing	49	32	81
Climate change	63	46	109
IUU fishing	40	14	54
Other, please specify	4	5	8

Major threat

Question	National Fisheries	World Fisheries	Total Responses
Pollution sourced from land	78	98	176
Eutrophication	56	65	121
Anoxic events	48	53	101
Ocean acidification	65	96	161
Introduced species and pests	72	78	150
Dead marine zones	46	63	109
Energy exploration (oil, gas, etc.)	45	63	108
Ecosystem shifts	78	97	175
Habitat destruction	98	123	221
Plastics in the oceans	49	87	136
Coastal development	76	85	161
Overfishing	103	141	244
Climate change	95	119	214
IUU fishing	47	86	133
Other, please specify	13	19	32

Q2. In your experience, what are the three main challenges of managing fisheries? Please add a brief description.

Answer	Response	%
Lack of political will	98	56%
Not all stake holders are involved	34	20%
Not enough compliance with regulations	57	33%
Fisheries are very complex to manage	29	17%
International cooperation is needed	25	14%
Over-fishing	51	29%

Answer	Response	%
Lack of knowledge in fish behaviour	11	6%
High amounts of by-catch and discard	30	17%
Poverty	14	8%
Stock assessment and monitoring	49	28%
Need to track trading of fish products	12	7%
Growing human population (food security)	22	13%
Take high levels of uncertainty into account when setting quotas	12	7%
Ecosystem management	24	14%
Consider socio-economic implications in poorer regions	21	12%
Impacts of climate change	20	11%
Amount of IUU fishing is underestimated	37	21%
Stakeholder agreements	19	11%
Other	39	22%

Q3. In what country do you work?

Answer	Response	%
Argentina	2	1%
Australia	40	24%
Bangladesh	1	1%
Canada	5	3%
China	1	1%
Czech Republic	1	1%
Denmark	1	1%
France	4	2%
Germany	2	1%
Greece	1	1%
Iceland	4	2%
India	1	1%
Indonesia	2	1%
Ireland	1	1%
Italy	3	2%
Japan	3	2%
Kenya	1	1%
Mexico	3	2%
Mongolia	1	1%
Namibia	5	3%
Netherlands	3	2%
New Zealand	2	1%
Nigeria	5	3%
Norway	2	1%
Philippines	2	1%
Saudi Arabia	1	1%
South Africa	5	3%
Spain	1	1%
Sweden	8	5%
Tanzania	1	1%
Turkey	2	1%
Uganda	1	1%
United Kingdom	30	18%
United States	21	12%
Total	170	100%

Q4. What is your role in fisheries?

Answer	Response	%
Fisheries manager/Natural resource manager	14	8%
Fisher	31	18%
Policy maker	13	7%
Scientist	96	54%
NGO member	5	3%
Other, please specify	18	10%
Total	177	100%

Q5. Where do you work?

Answer	Response	%
National management	40	34%
Sub-national management	15	13%
Community/Communal/Indigenous	2	2%
International	28	24%
University	17	15%
Other, please specify	15	13%
Total	117	100%

Q6. What position/level do you work at now?

Answer	Response	%
Field management	28	19%
Middle management	50	34%
Senior management	51	35%
Executive management	17	12%
Total	146	100%

Q7. What fishery or fisheries are you involved in? If you work with several fisheries, please pick one fishery. Should you wish to give information about more than one fishery, please take the survey again?

Answer	Response	%
Large pelagic	23	16%
Small pelagic	22	15%
Large demersal	36	25%
Small demersal	10	7%
Crustaceans	17	12%
Shellfish	2	1%
Inland fishery	3	2%
Aquaculture	4	3%
Coastal	12	8%
Shark	1	1%
Other	13	9%
Total	143	100%

Q8. How would you best describe the fishery you work in?

Answer	Response	%
Collapsed	10	6%
Highly overfished	15	9%
Overfished	49	28%
Sustainably fished	67	39%
Recovering	14	8%

Answer	Response	%
Developing/exploratory	4	2%
No information	13	8%
Total	172	100%

Q9. How many years of experience do you have in fisheries?

Answer	%
0–3 years	16%
3–5 years	10%
5–10 years	11%
10–15 years	14%
15–20 years	17%
20–25 years	17%
More than 25 years	15%

Q10. What are the major changes that have occurred in fisheries management during your career with fisheries? Multiple answers possible.

Answer	Response	%
There are no major changes	8	7%
Increased level of scientific input	60	55%
Increased level of industry input	53	49%
Increased level of NGO input	47	43%
Environmental versus fisheries department	40	37%
Level of collaboration amongst stake holders and organizations	51	47%
Increased number of staff	8	7%
Increased number of scientists	26	24%
Amount of resources (money, staff)	18	17%
Ecosystem based management instead of single species management	50	46%
Dealing with pollution (e.g., terrestrial run-offs like fertilizer, soil turbidity)	16	15%
Other, please specify	20	19%

Q11. In the last 5–10 years, have resources (such as funding, staff, research, equipment) for management overall:

Answer	Response	%
Increased a lot	5	4%
Increased a little	49	39%
Stayed about the same	35	28%
Decreased a little	25	20%
Decreased a lot	12	10%
Total	126	100%

Q12. Has the fishery you work with implemented Ecosystem-Based Fisheries Management (EBFM) or a similar holistic approach to governing fisheries?

Answer	Response	%
Yes	104	60%
No	68	40%
Total	172	100%

Q13. How well do you consider the overall implementation process of EBFM, or similar management approach, to have gone?

Answer	Response	%
Very successful	11	10%
Successful	32	30%

Answer	Response	%
Neutral	50	47%
Unsuccessful	13	12%
Very unsuccessful	1	1%
Total	107	100%

Q14. How satisfied are you with the Ecosystem-Based Fisheries Management process?

Question	Very Satisfied	Satisfied	Neutral	Dissatisfied	Very Dissatisfied	Total Responses
Planning process	11	47	33	9	4	104
Implementation process	8	40	30	23	3	104
Results	7	26	45	21	4	103

Q15. Briefly describe your experience with the implementation of EBFM.

Answer	Response	%
It still doesn't consider the whole ecosystem	30	36%
Lack in scientific knowledge delays proper implementation	19	23%
Highly complex procedure, which makes it hard to really implement EBFM	48	58%
Lack of compliance to secure successful EBFM	22	27%
Time consuming	19	23%
Difficult to decide what variables and what species (spp). Species should be considered as there are so many variables and spp in an ecosystem	28	34%
Insufficient compliance	10	12%
It has worked very well	6	7%
Improvements can already be seen	15	18%
It has been a satisfactory process	11	13%
Other	11	13%

Q16. How do you view the role of governance and management to fisheries in your country as well as worldwide? For each of the following variables, please say if you believe there is a need for more or less of the following variables.

Highly needed

Variables	National Fisheries	World Fisheries	Total Responses
Stronger political will to manage fisheries	98	131	229
Improved conservation measures	68	107	175
Enforcement of regulations	69	112	181
Change of governance structure	57	86	143
More money	59	81	140
More staff	51	74	125
More research	71	98	169
More international collaboration	83	116	199
Managing Illegal, Unreported and Unregulated fishing (IUU)	76	128	204

Somewhat needed

Variables	National Fisheries	World Fisheries	Total Responses
Stronger political will to manage fisheries	36	27	63
Improved conservation measures	56	46	102
Enforcement of regulations	50	39	89
Change of governance structure	58	55	113
More money	76	63	139
More staff	70	59	129

Variables	National Fisheries	World Fisheries	Total Responses
More research	65	51	116
More international collaboration	48	31	79
Managing Illegal, Unreported and Unregulated fishing (IUU)	47	30	77

Satisfactory as it is

Variables	National Fisheries	World Fisheries	Total Responses
Stronger political will to manage fisheries	19	5	24
Improved conservation measures	28	4	32
Enforcement of regulations	38	9	47
Change of governance structure	35	11	46
More money	28	10	38
More staff	38	19	57
More research	23	8	31
More international collaboration	21	9	30
Managing Illegal, Unreported and Unregulated fishing (IUU)	32	3	35

Less needed

Variables	National Fisheries	World Fisheries	Total Responses
Stronger political will to manage fisheries	8	3	11
Improved conservation measures	10	3	13
Enforcement of regulations	3	1	4
Change of governance structure	8	1	9
More money	3	2	5
More staff	6	2	8
More research	3	0	3
More international collaboration	7	2	9
Managing Illegal, Unreported and Unregulated fishing (IUU)	1	0	1

Q17. Why do you believe, on a global scale, we are still facing fisheries overexploitation in regulated fisheries? Drag and drop your rankings.

Question	Major Challenge	Some Challenge	Minor Challenge	No Challenge	Total Responses
There is not enough scientific information.	43	74	40	4	161
Scientific knowledge is not being used to its fullest.	90	49	21	2	162
Lack of political will.	133	25	10	0	168
There needs to be stricter laws and regulations.	74	63	24	4	165
There needs to be more compliance and enforcement of laws.	109	45	11	1	166
Management is focused on species rather than eco-based management.	81	58	20	5	164
General public does not care enough about sustainable fishing to make it worthwhile for politicians to make it a priority.	68	60	31	7	166
Fish abundance is too complex to predict.	39	70	50	7	166
Lack of formal harvest strategies	44	66	45	7	162
Environmental variables affecting fisheries abundance are too complex to measure and predict.	50	66	39	9	164
Commercial fishers have too much influence.	54	62	31	16	163
There is not enough scientific expertise to interpret scientific data on management level.	47	54	50	13	164
Lack of political knowledge on marine and fisheries related issues.	87	55	17	3	162
Other	18	2	0	0	20

Q18. What management tools are being and should be used to manage the fishery you work in?

Question	Tools Being Used	Tools That Should Be Used	Total Responses
Total Allowable Catch (TAC)	116	53	169
Individual Transferable Quota (ITQ)	66	47	113
Seasonal closures	104	68	172
Regional zoning	66	46	112
Spatial closures (e.g., MPA)	95	63	158
Spawning closures	69	60	129
Size limits	99	70	169
Commercial only fishing areas	19	23	42
Recreation only fishing areas	23	28	51
Ecosystem based management	67	73	140
Bag limits	38	36	74
Mesh size	75	53	128
Trawling net size restrictions	59	34	93
Fishing vessel size restriction	38	25	63
Horsepower restrictions	26	20	46
Tabu/Taboo	9	9	18
Bottom trawling is banned	34	33	67
Other gear restrictions	65	29	94
Fishing vessels buy backs by government	16	15	31
Fuel subsidies	35	18	53
Surplus fish purchases	11	22	33
Grants for new fishing vessels	18	12	30
Tax exemption programs	13	14	27
Vessel construction, renewal and modernization	20	15	35
Fishing access agreements	25	23	48
By-catch reduction device	59	46	105
Other	9	13	22

Q19. In your work, who is and who should be involved in the fisheries management process?

Question	Who is Involved?	Who Should be Involved?	Total Responses
Fisheries managers	148	86	234
Natural resource managers	75	80	155
Fishers	103	103	206
Politicians	130	67	197
Scientists	133	95	228
NGOs	80	78	158
The public	35	69	104
Local communities	36	79	115
Other	3	6	9

Q20. Here is a range of input controls used in fisheries management. Do you support/oppose the concept of?

Question	Strongly Support	Support	Neutral	Oppose	Strongly Oppose	Total Responses
Gear restrictions	105	43	16	1	1	166
Vessel size restrictions	51	40	38	30	4	163
Horsepower restrictions	38	35	50	35	5	163
Seasonal closures	107	45	12	2	0	166
Regional zoning	87	47	25	3	0	162
Recreational only fishing areas	42	33	56	24	6	161
Spatial closures	105	47	12	1	0	165

Question	Strongly Support	Support	Neutral	Oppose	Strongly Oppose	Total Responses
Spawning closures	109	37	14	1	0	161
Size limits	100	42	20	2	1	165
Commercial only fishing areas	38	36	58	28	0	160
BRDs (by-catch reduction device)	100	48	12	2	0	162

Q21. There is a range of output controls used in fisheries management. Do you support/oppose the concept of?

Question	Strongly Support	Support	Neutral	Oppose	Strongly Oppose	Total Responses
Total Catch Limits (TACs)	100	43	22	2	1	168
Individual Transferable Quotas (ITQ)	75	41	40	7	5	168
Bag limits	71	44	45	4	1	165

Q22. In your experience in fisheries, do you support/oppose the concept of?

Question	Strongly Support	Support	Neutral	Oppose	Strongly Oppose	Total Responses
Fishing vessels buy backs by government	40	64	30	25	9	168
Fuel subsidies	33	19	26	36	52	166
Surplus fish purchases	13	30	50	38	34	165
Grants for new fishing vessels	31	21	30	35	50	167
Tax exemption programs	29	26	36	31	44	166
Vessel construction, renewal and modernization	34	43	39	16	35	167
Fishing access agreements	57	61	38	7	4	167

Q23. How much do you estimate the fishery you work with costs to manage annually (US dollar)? Costs include research, management, subsidies.

Answer	Response	%
<US$500,000	11	7%
US$500,000–1 million	18	11%
US$1–$2 million	6	4%
US$3–5 million	16	10%
US$6–15 million	6	4%
US$16–20 million	6	4%
US$21–30 million	1	1%
US$31–40 million	1	1%
US$41–50 million	1	1%
US$51–60 million	2	1%
US$61–70 million	1	1%

Answer	Response	%
US$71–80 million	0	0%
US$81–90 million	2	1%
US$91–100 million	2	1%
US$101–150 million	1	1%
US$151–200 million	2	1%
US$200–250 million	1	1%
>US$ 250 million	4	2%
Local currency, if you wish	0	0%
Don't know	86	51%
Total	167	100%

Q24. Do you know how much revenue your fishery provide annually?

Answer	Response	%
Yes	39	31%
No	87	69%
Total	126	100%

Q25. How many fishing vessels operate within your fishery?

Answer	Response	%
1–5	19	13%
6–25	33	23%
26–50	22	15%
51–75	13	9%
76–100	5	4%
>100	50	35%
Total	142	100%

Q26. How many fishing vessels are registered in the country where you work?

Answer	Response	%
1–10	5	9%
11–30	1	2%
31–60	2	4%
61–100	2	4%
101–200	3	5%
201–400	3	5%
401–600	6	11%
601–1000	2	4%
1001–2000	8	14%
2001–5000	9	16%
5001–10,000	5	9%
10,001–20,000	7	13%
>20,000	3	5%
Total	56	100%

Q27. In your country, how important is fishing as a main food source of protein?

Answer	Response	%
Overall survival depends on fishing	12	7%
Vital for some regions/areas	39	23%
Somewhat important	46	27%
Not important for survival	71	42%
Total	168	100%

Q28. In your country, how important is fishing as a main source of income?

Answer	Response	%
Overall income depends on fishing	8	5%
Vital for some regions/areas	70	42%
Somewhat important	61	37%
Not important for income	27	16%
Total	166	100%

Q29. In your country, are there regions where fishing is the major economic activity?

Answer	Response	%
Yes, many regions	29	18%
Yes, a few regions	107	65%
Yes, one region	5	3%
No	24	15%
Total	165	100%

Q30. In your country, are there regions or areas where fishing is the major food source of protein?

Answer	Response	%
Yes	68	41%
No	96	59%
Total	164	100%

Q31. Are subsidies provided for fishers in the country in which you work (including fuel rebates, low interest loans, employment, buy-backs, reduced tax)?

Answer	Response	%
Yes	87	52%
No	56	34%
Don't know	23	14%
Total	166	100%

Q32. What type of subsidies are there?

Answer	Response	%
Fuel	75	88%
Lower interest on bank loans	22	26%
Employment payments from the government	30	35%
Cultural subsidies	13	15%
Other, please specify	22	25%

Q33. Do you believe these subsidies contribute to overcapacity of the fishing industry?

Answer	Response	%
Not at all	28	32%
Somewhat	34	39%
Significantly	22	25%
Don't know	3	3%
Total	87	100%

Q34. Who should carry the real cost of fish products? Costs include governance, management, research and monitoring of fisheries.

Answer	Response	%
Fishers	113	69%
Consumers	112	69%
Government	104	64%
Don't know	14	9%

Q35. The fishery I work with has:

Answer	Response	%
A single species management approach	57	37%
An ecosystem management approach	87	56%
Don't know	12	8%
Total	156	100%

Q36. In your experience with fisheries, which five (if any) fisheries management and governance regulations are the most efficient for Ecosystem-Based Fisheries Management?

Answer	Response	%
Food and Agriculture Organization of the United Nations code of conduct	7	6%
MPAs	63	52%
ITQs	59	49%
Gear restrictions	56	46%
Stakeholder participation	43	36%
Good science	64	53%
Co-management	30	25%
Closures	28	23%
No bottom trawling	25	21%
Stakeholders' education	23	19%
Size limits	10	8%
More legislation	8	7%
Assessment of implementations	25	21%
Spawning closures	11	9%
Mesh size	11	9%
TAC	31	26%
Monitoring	30	25%
By-catch Reduction Device (BRD)	35	29%
Other	20	17%

Q37. What type of organisation do you believe would be optimal to ensure successful Ecosystem-Based Fisheries Management (or the alike management)?

Answer	Response	%
Top-down management (centralised governance)	11	7%
Bottom-up management (communal, local)	13	8%
Mix of top-down and bottom-up management	132	83%
Don't know	7	4%

Q38. Decision making process; information and decisions. For the following statements, please indicate if you agree or disagree.

Question	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Total Responses
In your role, the scientific information is easy to understand, interpret and apply.	23	74	18	47	2	164
You have an appropriate amount of information (scientific or otherwise) to make sound fisheries management decisions.	27	63	38	31	4	163

Question	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Total Responses
You consider there are robust mechanisms to deal with assessing uncertainty.	13	64	29	56	2	164
You believe you can influence final fisheries management decisions.	15	65	27	40	16	163
You believe the current decision making process of your fishery is adequate for sustainable fisheries.	10	57	28	50	17	162
Do you believe the current decision making process of your fishery is adequate for an overall sustainable marine biodiversity?	10	45	34	56	17	162
Comment	1	1	0	2	1	5

Q39. What information or decision-making processes would you like to see more of when making fisheries or ecosystem management decision?

Answer	Response	%
Use of indicators in decision-making process	31	21%
More research about ecosystem processes and functions	41	28%
Politicians need to understand the science	62	42%
All stake-holder involvement	56	38%
Industry compliance of regulations	23	16%
Supporting fishers with knowledge and implementation of regulations	23	16%
Holistic objectives; marine and socioeconomic issues	34	23%
Use of EBFM models	29	20%
Decreasing IUU fishing	28	19%
Integrating fishing and environmental policies	44	30%
Political commitment	52	36%
Management transparency	56	38%
Other	13	9%

Q40. What variables are considered and should be considered when setting fisheries quotas?

Question	Variables That Are Considered	Variables That Should Be Considered	Total Responses
Size structure of the stock	117	81	198
Age structure of the stock	101	81	182
Catch data	122	73	195
Catch Per Unit Effort (CPUE)	106	67	173
Life history traits	60	86	146
Maximum Sustainable Yield	80	68	148
Maximum Economic Yield	37	52	89
Climate change	23	101	124
Recruitment	90	92	182

Question	Variables That Are Considered	Variables That Should Be Considered	Total Responses
Abundance	104	71	175
Mortality	94	73	167
Effects on the ecosystem	41	103	144
Other, please specify	7	16	23
Other, please specify	2	4	6
Other, please specify	2	2	4
Don't know	5	3	8

Q41. If any, what resources would you like to have more of in order to improve sustainable fisheries and marine biodiversity?

Answer	Response	%
Resources are already adequate	15	9%
Scientific knowledge	107	65%
Enforcement mechanisms	75	45%
Legal expertise and advice	35	21%
Collaboration amongst stake holders	105	64%
Collaboration amongst governmental departments	81	49%
Administration staff	10	6%
Other, please specify	20	12%

Q42. How would you assess management of the fishery you are involved in?

Question	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Total Responses
Current management is sufficient to ensure the long-term sustainability of fishery	19	55	20	50	16	160
There needs to be stricter regulations on commercial fishing	25	46	29	50	9	159
There needs to be stricter regulations on recreational fishing	17	37	53	41	12	160
Current commercial fishing regulations are adequately enforced	14	53	29	49	17	162
Current management is sufficient to ensure the long-term sustainability of overall biodiversity	14	30	31	65	21	161
There are too many regulations	8	33	34	74	10	159
The regulations are too complex to manage, monitor and measure successfully	12	35	28	70	13	158

Q43. I would like to get some information on how satisfied you are with various aspects of your job. How satisfied are you with.

Question	Very Satisfied	Satisfied	Neutral	Dissatisfied	Very Dissatisfied	Total Responses
Level of access you have to scientific fishing data	27	80	17	37	4	165
Number of other managers working with you	11	54	61	29	1	156
Resources to manage in the best way you know	11	46	47	44	6	154
Collaboration with scientists	25	73	20	40	3	161
Getting messages across to the decision makers	7	37	28	70	20	162
Decisions based on scientific expertise	8	54	31	56	14	163
Level of influence you have on decision making	7	43	34	64	15	163
Level of application of your work	14	50	42	41	12	159

Q44. Do you believe that illegal, unreported and unregistered (IUU) fishing is a problem for your fishery?

Answer	Response	%
Yes	100	64%
No	57	36%
Total	157	100%

Q45. How much of the total catch in your fishery do you believe is due to illegal, unreported and unregistered fishing?

Answer	Response	%
None at all	4	4%
Less than 5%	11	11%
6–15%	20	21%
16–30%	21	22%
31–40%	14	15%
41–50%	15	16%
51–60%	6	6%
61–80%	0	0%
More than 80%	5	5%
Total	96	100%

Q46. Do you believe that illegal, unreported and unregistered (IUU) fishing is a problem within your country?

Answer	Response	%
Yes	107	66%
No	55	34%
Total	162	100%

Q47. How much of the total catch in your country do you believe is due to illegal, unreported and unregistered (IUU)?

Answer	Response	%
None at all	0	0%
Less than 5%	7	7%
6–15%	23	22%
16–30%	39	38%
31–40%	13	13%
41–50%	13	13%
51–60%	3	3%
61–80%	3	3%
More than 80%	3	3%
Total	104	100%

Q48. Do you believe that illegal, unreported and unregistered (IUU) fishing is a problem in some parts of the world?

Answer	Response	%
Yes	137	99%
No	1	1%
Total	138	100%

Q49. How much of the total catch world-wide do you believe is due to illegal, unreported and unregistered (IUU)?

Answer	Response	%
None at all	0	0%
Less than 5%	0	0%
6–15%	3	2%
16–30%	25	19%
31–40%	36	27%
41–50%	32	24%
51–60%	19	14%
61–80%	15	11%
More than 80%	4	3%
Total	134	100%

Q50. What are the key aspects of these IUU problems?

Answer	Response	%
Corruption	80	66%
Lack of data	53	44%
Poverty	52	43%
No or little governance in place	61	50%
No or little high seas controls	52	43%
Lack of international policies	34	28%
Lack of international compliance	46	38%
Fishers' data not accurate	57	47%
Growing human population	34	28%
Lack of political will	61	50%
Trawlers entering MPAs	11	9%
High demand for high-valued fish species	24	20%

Answer	Response	%
Recreational fishers	11	9%
Large black market	34	28%
Insufficient compliance	67	55%
Not enough awareness of the consequences	19	16%
Habitat destruction	23	19%
Other	7	6%

Q51. What approaches does your organisation use to measure fish abundance?

Answer	Response	%
No measures are used	10	6%
Catch Per Unit Effort (CPUE)	103	65%
Size	75	47%
Recruitment	58	36%
Fishers' log books	100	63%
Government trawling data	61	38%
Age structure	66	42%
Other, please specify	31	19%

Q52. What improvements are needed to obtain/maintain sustainable fisheries?

Answer	Response	%
No improvements are needed	10	6%
Stronger political commitment to marine ecosystem management is needed	119	72%
More regulation is needed	38	23%
More science is needed	88	53%
More enforcement is needed	96	58%
Higher reliability and quality of catch data is needed	85	52%
A higher level of ecosystem management is needed	88	53%
Consumers drive the market and are responsible for buying sustainable seafood	61	37%
Other	12	15%

Q53. How old are you?

Answer	Response	%
18–25	7	4%
26–34	31	19%
35–54	99	60%
55–64	25	15%
65 or over	3	2%
Total	165	100%

Q54. What is the highest level of education you have completed?

Answer	Response	%
Less than High School	0	0%
High School/GED	8	5%
Some College	6	4%
2-year College/University Degree	8	5%
3–4-year College/University Degree	24	14%

Answer	Response	%
Master's Degree	47	28%
Doctoral Degree	71	42%
Professional Degree (JD, MD)	4	2%
Total	168	100%

Q55. What is your degree in?

Answer	Response	%
Marine science	89	59%
Environmental science	30	20%
Business and Management	11	7%
Economics	4	3%
Law	4	3%
Political science	5	3%
Social science	5	3%
Other (please specify)	10	7%

Q56. What is your gender?

Answer	Response	%
Female	47	29%
Male	117	71%
Total	164	100%

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