

Review

Water and Climate Governance in Deltas: On the Relevance of Anticipatory, Interactive, and Transformative Modes of Governance

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Abstract: Deltas worldwide have been experiencing pressures and challenges exacerbated by climate change. An explicit focus on deltas is lacking in various bodies of literature, although present in those bodies focusing on the resilience of social-ecological systems. However, overall, literature relevant for addressing water and climate governance in deltas is arguably still fragmented, leading to knowledge gaps and unexplored opportunities with regards to the development of delta-oriented governance strategies. To address this knowledge gap, we conducted a systematic literature review focusing on six bodies of literature relevant to delta governance up to and including the year 2019. The results show that scholarly interest in developing transformative pathways has increased sharply over the last few years. We derived seven key governance problems and five governance solutions for resilient deltas. We found that the predominant focus is still on technocratic approaches, with limited recognition of the political dimension and few forward-looking studies. In conclusion, we suggest stimulating the development and application of more anticipatory, transformative, and interactive modes of governance to help steer the transformation to resilient and sustainable deltas. We end with suggestions for systematic, interdisciplinary, and forward-looking empirical-analytical research.

Keywords: governance; water; climate; deltas; transformation; resilience

1. Introduction

A thorough understanding of governance in deltas is important and urgent, given the immense challenges and pressures on deltas' intertwined natural and social systems. Deltas are attractive and prosperous regions to live in due to the presence of abundant resources, such as fertile soil and land, abundant water resources, and rich biodiversity and ecosystems [1], although they cover only 0.56% of land area worldwide [2,3]. With over 339 million people living in river deltas in 2017 [4], deltas are highly populated and are important for the economy and development. However, around the globe, deltas are currently facing challenges that include an increase of unsustainable human and economic activities such as urbanization, industrialization, land use conversions, dam construction, and land subsidence. These conditions, coupled with climate change impacts such as sea level rise, as well as erosion, have increased the risk of disasters (e.g., storms and floods) in deltas around the world [5–8]. These pressures have disrupted community livelihoods and increased their vulnerability to future disturbances. In addition, our limited understanding of future complexity and uncertainty has challenging implications for governance structures and processes, which could hamper the effort to achieve resilience [9].

Problems in deltas are “wicked problems par excellence” [10], p. 63. Natural and anthropogenic climate change is the major threat in deltas. They have, in Rittel and Webber's terms, no stopping

rule, meaning that we do not know how much deltas can and should adapt. Therefore, there are no ultimate solutions to deal with problems related to climate change as it cannot be solved at once. Moreover, there is a need to acknowledge that the problem solving capacity in many deltas is limited (see, for example, [11,12]). This is, however, not a reason for doing nothing. On the contrary, there is an urgent need to develop, study, and assess modes of governance that have the potential to induce social change toward more sustainable deltas.

Most of the governance literature related to deltas is rooted in socio-ecological system (SES) literature [9,13], which focuses on adaptive governance and is geared to achieving resilience [14,15]. The literature on adaptive governance of SES has highlighted certain features of problems, including uncertainty, complexity, dynamics and diversity of natural and social boundary conditions, and cross-boundary scales [16,17]. Governance approaches relevant for delta governance are spread over different policy domains, including those of urban planning, flood risk governance, water quality governance, and economic development. Water and climate change governance is a dominant topic in the literature [18,19] and has been investigated through multiple lenses, including climate adaptation and flood risk management [20–22].

Our study aimed to address the knowledge gap that is still lacking in systematic empirical studies of governing wicked problems at the delta level. An overview of the existing state-of-the-art in literature is needed in order to inform systematic empirical assessments and at the same time allow for sufficient conceptual breadth. To develop such an overview, alongside the aim of obtaining insights into how various governance approaches could contribute to resilient future deltas, we conducted a systematic literature review of the literature that focuses explicitly on water and climate governance in deltas up to and including the year 2019. Section 2 describes the methods we used. Section 3 outlines governance-related problems and Section 4 outlines the governance-related solutions we derived from the literature review. Section 5 reflects on the findings, draws conclusions, and suggests directions for future research on governance in deltas.

2. Materials and Methods

Our methodology is based on a stepwise approach (see Figure 1).

Step 1: Defining research query. We used Scopus as the main database to search for scientific publications since it provides us a larger scope and numbers of hits as well as more complete results compared to other databases such as Web of Science. Our starting point was those publications with an explicit focus on governance and on stakeholder perspectives regarding the future for and resilience of delta areas in relation to water and climate change issues. The keywords were selected to find publications that had deltas as their unit of analysis and could reasonably be expected to address these deltas from a governance perspective. We defined the term “governance” as a process of more or less institutionalized interaction between public and/or private entities ultimately aiming to achieve collective goals [23]. In this context, “governance” should be related to water and climate and to creating opportunities needed for transforming deltas to enhance resilience.

We selected multiple relevant keywords, including empirical keywords and theoretical keywords. The empirical keywords (governance AND water AND climate AND future AND delta) were used to obtain the findings from diverse cases and real-life problems and helped us to set the scene of contemporary delta governance problems on the basis of specific examples derived from case studies (see the second bar of Figure 1). The theoretical keywords (adaptive pre/0 governance AND delta; interactive pre/0 governance AND delta; transformation pre/0 governance AND delta; reflexive pre/0 governance AND delta; transition pre/0 management AND delta; delta AND adaptation pre/0 pathways) were to obtain literature presenting key conceptual frameworks relevant from a governance perspective. These six theoretical keywords were selected as they are connected to important strands of SES governance literature, which is the key literature focusing explicitly on deltas.

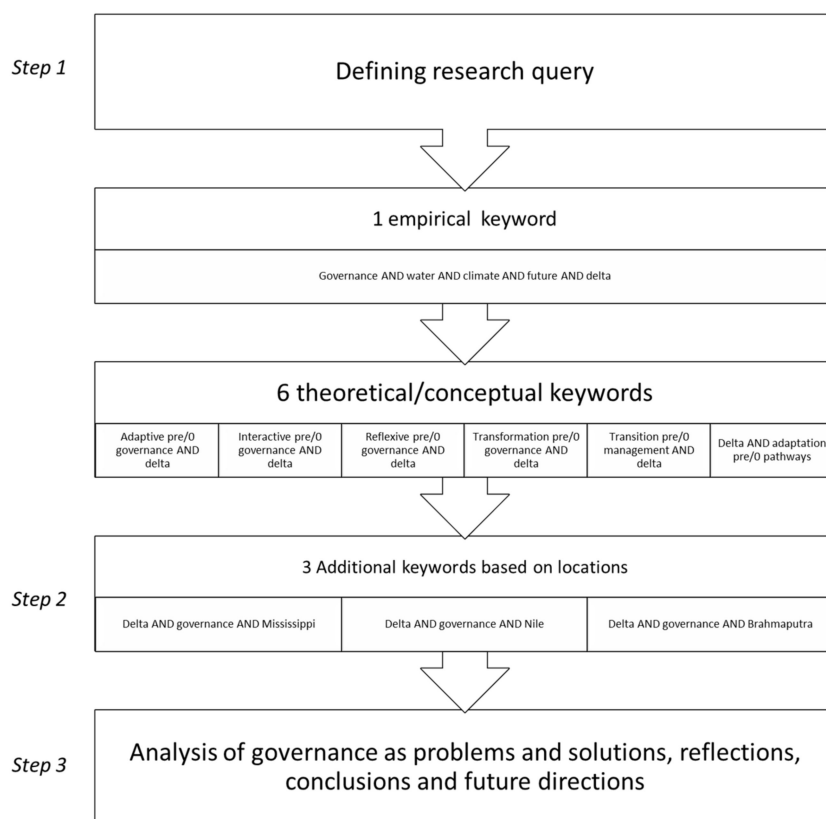


Figure 1. Methodological steps.

Step 2: Additional keywords. To deal with bias in the geographical distribution of the cases, we also defined three additional, separate sets of keywords referring to three major delta locations around the world (delta AND governance AND Mississippi; delta AND governance AND Nile; delta AND governance AND Brahmaputra) (see Step 2 in Figure 1). These geographical keywords were added because the empirical or theoretical keywords did not bring up much governance literature on the three deltas, even though we knew that these deltas are well documented. We suspect that the reason the search brought up so little literature on the Mississippi, Nile, or Brahmaputra has to do with different ways the delta is framed as a spatial reference in different countries and by different authors. The geographically focused search led us to more context-specific findings in terms of geographical scope.

Data were managed in two software packages: Mendeley desktop (.RIS) and Microsoft Excel (.CSV). Mendeley desktop is a scholarly reference manager program developed by Mendeley, a company based in London, United Kingdom, and Microsoft Excel is a spreadsheet program featuring tools to organize and analyze data, developed by Microsoft, a company based in Redmond, Washington. We used these two software packages to create an inventory of literature and identify the key lessons learned per paper. We sorted the papers manually by reading their abstracts to check that they satisfied the inclusion criteria and discarding papers that did not (approximately 400 papers from general keywords). In total, we identified 72 publication entries from the Scopus database that scrutinize diverse governance approaches and concepts or are case studies focusing specifically on delta contexts.

Step 3: Analysis, reflections, conclusions, and future directions. All sets of keywords were analyzed together. We analyzed the findings in two steps. First, we analyzed the key lessons contained in each paper and inductively categorized the common governance problems and solutions in deltas at an aggregated level with reference to selected key publications (see Sections 3 and 4). We confronted the findings with insights from key literature—beyond our search hits in Scopus—through additional search on other platforms such as Google Scholar and reference snowballing from existing databases

on specific governance problems and solutions that are not necessarily focused on deltas. We did so in order to ensure that the lessons learned would be embedded in the current state-of-the-art knowledge.

Limitations: Our intention was to focus on scholarly publications explicitly oriented on deltas, (both inland, river, and coastal part of the deltas) and the topics of water and climate in order to find out the scientific state-of-the-art of literature on delta governance. We discarded the terms “river basin”, “catchment”, and “coastal areas” in our query because these keywords resulted in numerous hits, of which only a small proportion focused on integrated assessments at a delta scale. However, in the analysis, we were mindful of certain key aspects, including interchangeable spatial reference, potential upstream/downstream dynamics, and differing sectoral themes in governing water and climate topics in the deltas. Despite using strict inclusion and exclusion criteria, this study has some limitations. The specificity of the queries used may have resulted in some literature being overlooked. In addition, we also observed an issue of knowledge bias. An important observation is that existing governance studies in deltas are dominated either by cases in the Western world (e.g., the Dutch Delta) or uptake from Western expertise or knowledge. For example, the Dutch government and Dutch experts have influence in deltas around the world, including the Vietnamese Mekong Delta and the Nile Delta. We found that current delta governance studies are dominated by the cases of the Pearl River and Yangtze River Delta in China, the Dutch Delta in the Netherlands, and the Vietnamese Mekong Delta (see Table 1 and Figure 2).

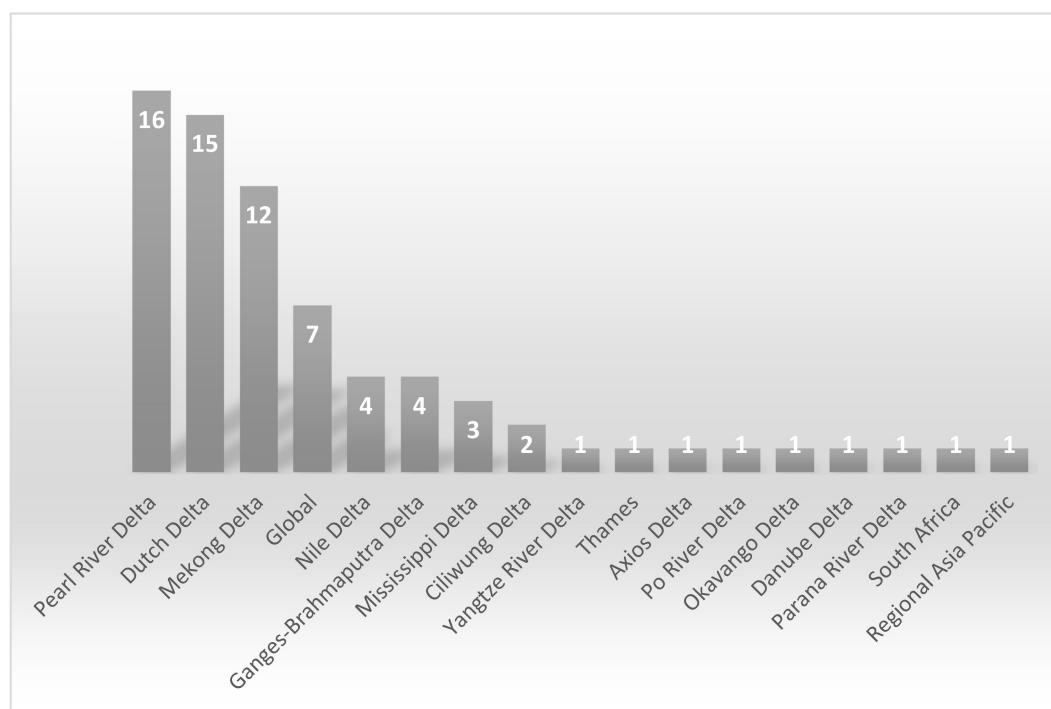


Figure 2. Number of delta cases documented in the literature, specified per delta.

Table 1. Geographical distribution of literature findings based on keywords.

Keywords	Geographical Distribution
Governance AND water AND climate AND future AND delta	Okavango Delta, Botswana; Dutch Delta, the Netherlands; Mekong Delta, Vietnam; Axios Delta, Greece.
Adaptive pre/0 governance AND delta	Dutch Delta, the Netherlands; Australia (including Bass Coast, Victoria); South African Delta, South Africa; California Delta, United States; Parana Delta, Argentina; Mekong Delta, Vietnam; Thames River, United Kingdom.

Table 1. Cont.

Keywords	Geographical Distribution
Interactive pre/0 governance AND delta	Dutch Delta, the Netherlands.
Transformation pre/0 governance AND delta	Pearl River delta and Yangtze Delta, China; Mekong Delta, Vietnam; Danube Delta, Romania.
Reflexive pre/0 governance AND delta	Global; Europe; Dutch Delta, the Netherlands.
Transition pre/0 management AND delta	Dutch Delta, the Netherlands.
Delta AND adaptation pre/0 pathways	Global; Dutch delta, the Netherlands; Mekong Delta, Vietnam; California Delta, United States; Thames River, United Kingdom; Jakarta–Ciliwung delta, Indonesia.
Additional keywords with specified locations: Delta AND governance AND Mississippi Delta AND governance AND Nile Delta AND governance AND Brahmaputra	Mississippi Delta, United States; Nile Delta, Egypt; Ganges–Brahmaputra Delta, India/Bangladesh.

3. Lessons Learned from Literature on Governance Approaches in Deltas: Governance as a Problem

We sorted the papers on the basis of the key governance-related issues. During the review process, we noticed that many of the papers presented the common governance-related problems as well as solutions associated with water and climate issues in deltas (see Section 4). This section unpacks the seven key governance problems presented in Table 2. These are the result of an inductive aggregation of the findings contained in the literature we studied.

Table 2. Key governance problems identified in the literature *.

Governance Problem	Key Literature Sources that Document the Problem
Conflicting political and geographical scales	[23–27]
Conflicting timescales	[23,25,28–33]
Conflicting interests	[19,34–37]
Lack of agreement on allocated responsibilities	[38–42]
Ineffective regulatory instruments	[43–47]
Adverse policies that marginalize local communities	[48–51]
Uncertainty relating to the social system	[31,37,38,52–55]

* The full list of search hits can be found in the annex submitted as a Supplementary Document.

3.1. Conflicting Political and Geographical Scales

Conflicting political and geographical scales here mainly refer to the conflicts among different administrative entities [23,24,29]. Problems associated with conflicting geographical scales often occur when multi-level governing actors (national to local or transnational) have competing political agendas and priorities, which oftentimes creates a coordination problem (see, for example, [23]). The literature we reviewed often mentioned issues related to the path dependency created by the legacy of existing governance modes, including the issues of centralization and decentralization. The issue is relevant here, as it influences how power is exercised across different spatial levels. The two cases from China and Vietnam discussed below show the domination of national actors operating in the higher spatial hierarchy. This has caused dilemmas of scale mismatch at the local level, which is the level suffering the most from climate change impacts.

The first example is the case of Suzhou region, located in the burgeoning Yangtze river delta in China. Like many coastal regions in China, Suzhou region is experiencing rapid economic development, which has become a driver of conflict over land use, especially between the conservation of agricultural land versus industrial and urban development. The modes of governance currently in operation are centered at the national level. The national government demands the transfer of farmland property rights and more land to be made available for construction and enterprises [26]. This has clearly affected governance practice at the local level, as it is challenged by problems such as displacement of

people due to loss of land resources. Since the evaluation and promotion of individual civil servants is controlled by the Communist party, the local governments (i.e., the “kuai” or the territorial jurisdictions) and local officials must comply with national policy and are constrained by the system to focus on business as usual and economic interest as the ultimate goal [26].

Another case in point is that of Can Tho City in the Vietnamese Mekong Delta. Like the Suzhou region, this delta city is also burgeoning. The problem highlighted is the dilemma faced by local governments and stakeholders who wish to respond to local hazards but have limited and constrained local capacity and steering power [27]. Vietnam has always been ruled by communism, with the state having a strong role. The economic function is tightly regulated by the national government. However, the current mechanism of representation, such as the people’s committee in Vietnam, still lacks capacity and local resources though under pressure to invest in development and efforts to reduce disaster risks. The plans made and actions taken in Can Tho City simply mirror the national regulations emanating from the National Strategy for Disaster Risk Reduction. This gives rise to a challenge on the ground, as cities and regions are locally diverse in terms of risk profile and governance capacity [27].

3.2. *Conflicting Timescales*

Governing actors often operate in a different timeframes in order to achieve specific aims relating to governing certain problems [25,28,30]. Urgent short-term problems in deltas are prioritized over long-term planning due to several factors, including constrained timeframes of national policy and project cycles, and lack of sustained capacity to support long-term interventions (see also Section 3.3). These factors made it difficult to mainstream long-term climate change policy into short-term development agendas [33]. Two case studies of Jakarta, Indonesia, and Po River Delta strongly reflect this issue of conflicting timeframes.

In the case of Jakarta, Indonesia, the current policy is skewed toward flood protection measures that mostly aim to address short-term, urgent problems associated with loss of economic assets. This has become a major obstacle to the adoption of practices that explore other flood risk management approaches and adaptive planning for climate change adaptation issues over longer time frames [31]. Another case illustrating the problems of conflicting timescales is that of the exploitation of the Manila clam in Sacca di Goro Lagoon, Po River Delta, Italy. There, aquaculture activities have resulted in high local revenues. However, the current management practices in the deltaic areas including the lagoons focus predominantly on the promotion of well-being and the multiple benefits and use of the landscape. These practices have failed to address the longer term issues that are crucial for producing these benefits by assuring the health of ecosystems in order to sustain ecosystem services in the long term [32].

3.3. *Conflicting Interests*

The involvement of a diversity of actors will lead to a diversity of interests to reconcile [19]. Conflicting interests could occur due to the problems and the goals of actors being framed differently, especially in the policy arena [36]. Although the different interests of diverging actors are not a problem per se, the challenge is to arrive at consensus to achieve common goals while also being able to adapt to climate change in the face of uncertainty [37].

Two studies, one comparing the Netherlands and England and one focusing on the United States, can be seen as useful case illustrations. A study conducted by Restemeyer et al. [34] compared Rotterdam in the Dutch Delta and London in the United Kingdom in terms of the policy framing of adaptability and of uncertainty. Both the Netherlands and the United Kingdom focus on complexity and uncertainty as major features of deltas, with the framing of policy interests using economic thinking as the basis for adaptive delta management, especially in flood risk management strategies. Both cases show that the conflict of interests became manifest when the operationalization of adaptability was put on the table. The interests of those in power were to deal with financial uncertainty—for example,

to guarantee that there will be sufficient financial resources for future interventions. Whether these resources will be mobilized remains an open question [34].

A study conducted by Woodruff [35], using a foresight for governance perspective, highlighted different priorities and interests between local communities and national and state governments. Focusing on 44 local climate adaptation plans in the United States, Woodruff showed that local communities in 19 states, including California and Mississippi as two large deltas, prioritizes the notion of sensitivity and adaptability, instead of the climate projections and vulnerability assessments. Therefore, setting priorities that would relate to local communities, including local government and civil society organizations, would assist a national priority to develop future adaptation planning [35].

3.4. Lack of Agreement on Allocated Responsibilities

Lack of agreement on allocated responsibilities between governance actors comprises a fourth key challenge that was discovered in the literature. A plurality of governance actors potentially dilutes tasks and responsibilities and makes it difficult to hold to account those who are in charge of governing [41,42]. Key literature presents lessons from the history of dike reinforcement in the Netherlands and the projects that were established as a response to flood events in 1993 and 1995. These projects have triggered a shift from a traditional—mainly centralized—governance approach to polycentric governance systems, to water safety [40]. Additional actors became involved, making the actor base more diverse and creating the challenge of having to integrate diverging values and competing spatial claims, with the result that an urgent need arose for the national government to take control of coordination [40]. In addition to the challenges of integration, due to institutional path dependency, the Netherlands was also faced with the difficulty of developing the flexible arrangements crucial for adaptation to climate change [39].

Another case in point is the California Federal Bay-Delta (CALFED) program in the California Delta, United States, which reflects the case of a collaborative delta network beyond governmental agencies. CALFED is known as a “leading edge experiment in collaborative planning” for the management of the Bay Delta, California. In the initial development stage of the network, it became clear that there were difficulties in allocating the political responsibilities of such a substantially funded initiative. A centralized model was preferred in order to assure the implementation of agreements and the political accountability of the CALFED program. The drawback, however, is that a centralized body could potentially hinder innovations and complicate bureaucracy [48].

3.5. Ineffective Regulatory Instruments

Regulatory instruments here refers to instruments such as legislation, permits, directives, codes, and standards. Their effective enforcement is crucial for the governance of water and climate issues in deltas, providing guidance and direction of strategies and the implementation of legitimate actions (see, for example, [46,47]). Regulatory instruments are not effective when they do not appropriately address the problems and are not implemented properly.

One illustration of the problem of ineffective regulatory instruments is found in the context of the Dutch Delta. In this case, the challenge lies more in policy implementation than in policy development. The Dutch implementation of the EU Water Framework Directive (WFD) is a case in point. The EU WFD is known as an ambitious directive covering many aspects that could assure good status of water, including the development of a river basin approach and the involvement of other policy sectors (e.g., environment, spatial planning, agriculture, traffic, and transport). The limitation of the Dutch context, however, lies in the tasks and objectives having to be fulfilled by a very large number of relevant water bodies, institutions, and policy sectors. The diversity of actors could potentially harm the effectiveness of instruments that will fit in with current national water legislation [44,45].

A second case is that of the Nile Delta in Egypt, where the community experienced water quality problems. The agricultural, domestic, and industrial activities are believed to be sources of water pollution that threaten the water and environmental quality in the lower reaches of the Nile River.

Fragmented water quality monitoring is believed to be hampering the efforts to improve the water quality in the Nile River. Several initiatives were developed in the 1980s and early 1990s in order to manage this problem, including an integrated national water quality monitoring network. Although this network has improved water quality management in Egypt, it has been hampered by weak law reinforcement and lack of awareness of the urgency of the problem [43].

3.6. Adverse Policies That Marginalize Local Communities

A sixth key governance problem addressed in the literature is adverse policies that marginalize local communities. Many of the problems of delta policies are related to distributive effects that manifest themselves in the stage of policy implementation. They include the issues of fairness and justice, especially when dealing with the most vulnerable communities [50,51].

A first case in point is the California CALFED Water Program [48], which addresses the question of what constitutes a successful collaboration. The fact that multiple actors have been involved in the program gives the impression of a high degree of legitimacy. However, on closer inspection, there turned out to be strong barriers to collaborative governance, which led to exclusion of stakeholders without access to representative democracy, especially local and marginalized communities. Participation and inclusion in controversial decision making is, in some cases, becoming a rubber stamp for the government to avoid the collaborative arrangement and justify the choices to revert to an authoritative state [48].

In the case of Danube Delta in Romania, the silencing and marginalization of local groups in the delta governance process is a product of history [49]. Romania is described as a country experiencing a “late transition” from the socialist to the post-socialist era. The socialist legacies have a high degree of path dependency, making it more difficult for local marginalized communities to actively and meaningfully participate in decision making [49]. In the meantime, these communities are experiencing severe consequences to their livelihoods, including consequences stemming from unsustainable foreign development projects that put their sources of income at risk [49].

3.7. Uncertainty Relating to the Social System

A seventh governance problem is uncertainty. Uncertainty is a prominent feature of climate change problems where “there is no unique and complete understanding of the system to be managed” [55]. In the climate change literature, there are few studies of problems related to uncertainty, especially in relation to the social systems and implications of a certain policy decision. One key challenge stressed in the literature is the contribution of political views to skepticism and polarization relating to climate change [53]. These political views can lead to unforeseen changes in socio-economic systems and political regimes [54].

The literature that discusses uncertainty and deals with it most explicitly is that on adaptive pathways. The effectiveness of adaptive pathways relies on the responsiveness of governing actors, and therefore it is argued that political vision is paramount [56]. Such visions should, for example, make clear to what extent climate change impacts will be tolerated on longer time scales [56].

Political vision also relies on the optimization of opportunities to combine certain policy objectives and achieve win-win situations [31]. According to the adaptive pathways concept, the triggers to change from one pathway to the other fall into two types: technical and political. When determining the triggers for changing certain responses/pathways, public officials may wish not to specify specific trigger values because of their political implications [38]: for example, preserving ecologically vulnerable coastal areas in exchange for conversion to highly economic industrial or aquaculture land [57]. Problems most often occurred when uncertainty was ignored or strategies to cope with uncertainty were absent [37]. Hence, the unpredictability of political processes is a key source of deep uncertainty about the social system and remains a challenge to address.

4. Lessons Learned from the Literature on Governance Approaches in Deltas: Governance as a Solution

In addition to governance problems, the literature we assessed also contains findings from which we derived five governance solutions: stimulating collaborative, reflexive learning, and partnerships; enhancing the role of boundary organizations; balancing interactive policies with integrated priorities; enabling livelihood transformation; and strengthening long-term planning, including adaptive responses (see Table 3). It is important to note that these solutions are discussed relatively separately from the policy problems, and hence the solutions in the current section do not correspond one-to-one with the problems discussed in the previous section.

Table 3. Key governance solutions identified in the literature *.

Governance Solution	Key Literature Sources That Document the Solution
Stimulating collaborative, reflexive learning, and partnerships	[17,48,58–61]
Enhancing the role of boundary organizations	[40,62–67]
Balancing interactive policies with integrated priorities	[29,40,57,68–71]
Enabling livelihood transformation	[49,72–74]
Strengthening long-term planning, including adaptive responses	[31,38,56,75–82]

* The full list of search hits can be found in the annex submitted as a Supplementary Document.

4.1. Stimulating Collaborative, Reflexive Learning, and Partnerships

Climate and water issues in delta management can be categorized as wicked problems (see Section 1), in which complexity and uncertainty feature prominently. A key factor for dealing with these wicked problems and achieving successful delta governance is reflexive monitoring to anticipate changes. In this context, reflexive governance is useful to understand which changes are needed and under which circumstances. In the context of SES, reflexive governance mainly deals with feedback loops and with the mobilization and use of knowledge for reflection on the current governance approach's potential redirection for improvement [58,60,61] in water management, natural resource management [61], and climate change adaptation [58,60].

Learning processes pertain to the effects of specific physical interventions, but also to their strategic, tactical, and operational management [17,59]. Furthermore, robust and flexible institutions require a certain degree of redundancy and experimentation. However, the learning mechanisms within and among institutions need to be transparent to gain trust and to focus on a programmatic approach combining short- and long-term goals. In the case of the CALFED program (see also Section 3.1), Kallis et al. [48] emphasized the need for double- and triple-loop learning as key processes in the CALFED program in terms of governance experiments aiming to enhancing collaborations in the Bay Delta. Studies on these forms of higher order learning reveal that instrumental "single-loop" learning focusing on the most effective and efficient ways to reach certain agreed upon ends must be complemented with reflexive monitoring and evaluation that will enable social and policy learning that, in turn, will enable collaborative governance [48].

4.2. Enhancing the Role of Boundary Organizations

A boundary organization is key for negotiating with multiple social worlds, facilitating interaction between scientific and political tasks, and achieving productive policy-making (see, for example, [65–67]). Studies reflecting on the case of the Dutch Delta program have found that boundary organizations could facilitate interactive forms of governance and science policy interactions through radical innovation, experimentation, and the facilitation of cooperation [40], as well as by creating a sense of urgency [62]. The conditions for boundary organizations' success reported in the literature are that they must produce accepted, undisputed science and use both formal and informal forms of interaction in the translation and communication strategy. The use of tailored and responsive wording with a view to meeting

Cash et al.'s criteria of credibility, salience, and legitimacy is crucial [62,64]. Boundary organizations could help to set the framing right and increase the sense of urgency to trigger actions [63]. In 2008 (two years prior to the launch of the Dutch Delta Program), a committee responsible for developing the Delta Program in the Netherlands reframed the climate change problem as a threat to economic prosperity and flood safety [63].

4.3. Balancing Interactive Policies with Integrated Priorities

Interactive policies and integrated priorities are discussed in the application of the interactive governance concept that originated from the field of public administration. The focus in interactive governance is on unpacking societal problems and opportunities [29]. Interactive governance scholars put their main emphasis on the interaction process between natural and social sub-systems and governance systems [68,69]. The interactive governance concept also crops up in other fields and topics, including coastal management, fisheries [70,71,83], and disaster risk reduction [57].

The application of the interactive governance approach in a delta context, however, is very limited. We found that only one interactive governance paper addressed governance problems and opportunities with an explicit focus on deltas [40]. The Netherlands' efforts to upscale dike reinforcement projects had triggered a shift from a traditional governance approach, where government is a single authority, to a multi-actor governance system with water safety as a selected priority. According to Wiering and Driessen, a key driver of this change in river and delta management to ensure water safety has been a combination of transparent guidelines and interactive policy implementation, which was complemented by a clarified division of labor, conducive early stage participation, and stability and transparency [40]. This study also found that speedy legislative processes helped to deliver a quick response in the aftermath of widespread floods in northwestern Europe [40].

4.4. Enabling Livelihood Transformation

Enabling livelihood is the crucial key to transformation in the context of a social-ecological system and resilience. A robust, sustainable livelihood provides "layers of resilience" to deal with "waves of adversities" [72,84], including external disturbances due to climate change impacts. To transform delta governance to sustainability, a fifth key governance solution is to explicitly address the livelihood of its community [49,73,74].

Policies relevant for deltas have often been found to marginalize the governance practice at the local level and to undermine livelihoods (see Section 3.5). Transformative governance literature addresses this challenge. Smith et al. [73] mention that in the Mekong Delta, a livelihood perspective is important when it comes to enabling the transformation process with the goal of creating future-proof livelihoods. Therefore, they argued that a livelihood perspective should serve as the basis for adaptation frameworks to safeguard unsustainable practices in the future. By focusing on issues such as livelihood and wellbeing, maladaptation will be less likely and broader decision-making frameworks that support the resilience of the social-ecological system will be facilitated [73]. The livelihood angle for transformation has also been taken on board when studying the transformation of power and knowledge with regard to the governance of the Romanian Danube Delta [49] (see also Section 3.5).

4.5. Strengthening Long-Term Planning, Including Adaptive Responses

Issues such as climate change and its associated impacts are long-term policy problems and therefore require long-term planning and investments [75,82]. The long-term planning for adaptive responses is one of the key foci of the adaptive pathways literature. Attributed to several scholars [56,76,77,79], the concept of adaptive pathways is rooted in the perspective of adaptive policymaking. The adaptive policymaking perspective provides a stepwise approach that includes the development of a basic plan as well as contingency plans that should aid adaptiveness and transformability in response to new information and changing planning paradigms. Adaptive planning provides a tool for establishing different trajectories of adaptive policy decisions in order to avoid or

prevent actual “tipping points” by inventing flexible pathways to address uncertainty. In addition, adaptive pathways literature also emphasizes the importance of a sequencing of actions over time, and of addressing potential lock-ins and path dependencies, which is of crucial importance when monitoring current systems [38]. Through a wide range of plausible future scenarios, robust and flexible actions can be planned and reassessed in terms of their response to changes [31]. When robust decisions are applied together, insights can be obtained into conditions under which problems occur and are juxtaposed with trade-offs [79].

Several scholars have applied adaptive pathways in various empirical case studies in coastal areas and deltas to identify possible sets of pathways based on different problems. For example, coastal protection measures are perceived to be effective to cope with a future sea level rise of 2–5 m. However, beyond 5 m of sea level rise, retreat would be the best strategy [78]. In addition to these insights, for deltas, a more functional adaptation strategy based on ecosystem restoration and optimization of ecosystem functions was studied. The ecosystem’s function to increase the system’s resilience received special attention [78]. Ibáñez et al. proposed the idea of “rising grounds” or vertical aggradation using sediment traps, instead of “rising dikes”, and suggested the combination of gray and green approaches and ecological engineering as one of the best adaptation strategies in most deltas for high-end scenarios of SLR [78].

A case study conducted in Ho Chi Minh City, which lies in the Vietnamese upper stream delta, analyzed the problem of flooding that affects the economy. The traditional and dominant mitigation measures have always been perceived as technocratic, focusing on building a ring dike that will protect the inner city but will produce risk in the rural areas. Adaptive pathways thinking has helped to identify a combination of measures, including dry proofing, elevating land, and combination of hard and soft infrastructure, as a basis for designing adaptation pathways for the future [81]. In addition to the physical measures, non-structural approaches, including developing coping capacity to effectively respond to flooding, were also proposed as among the best options for the future delta [80]. Such approaches focus on understanding the effect of coping capacity on long-term adaptation responses in flood risk management, including by elevating property ground floors. This could postpone the tipping point at which dikes are no longer effective [80].

5. Reflections, Conclusions, and Future Directions

As distinctive geomorphological landscapes, despite their abundant resources, deltas are currently facing wicked problems due to exposure to extreme changes that will be exacerbated in the future. Deltas are also highly prone to diverse and multiple hazards and are socially and economically vulnerable to disasters. In addition, administrative complexity is increased since deltas are integrated ecosystems interacting with biophysical and social systems from upstream fluvial areas to downstream coastal and marine areas. Deltas do not correspond with administrative boundaries, which will make it more challenging to achieve effective governance approaches. Our study aimed to address the knowledge gap that systematic empirical studies of governing wicked problems at the delta level are still lacking. It has taken a first step toward a more systematic, integrative, and coherent approach to such wicked problems in deltas.

This paper has revealed that although the literature has produced relevant insights, the number of studies that focus explicitly on governance in deltas is relatively limited. The literature that does explicitly address deltas as the main unit of analysis is highly diverse and fragmented, both conceptually and empirically. The fragmented nature of the literature is due to diverse factors, including fragmentation of the empirical scope and diversity of the contributors’ disciplinary backgrounds. In addition, we found conceptual fragmentation, which might be caused, among other factors, by diverging views on whether resilience or sustainability should be the normative end goal of delta governance. From the literature, we extracted seven governance problems and five governance solutions relevant for addressing these governance-related problems, as discussed in the previous sections.

Identifying these has provided a fruitful starting point for a more concerted effort toward developing knowledge on delta governance strategies. However, we observe two challenges that should be addressed if this concerted effort materializes. First, governance problems and solutions are discussed in separate bodies of literature, while in reality they are strongly interlinked. A large part of the literature can be said to have a normative orientation and cannot easily be operationalized into empirical-analytical research approaches. Second, we found that there is increasing interest in future-oriented approaches to the water and climate governance issues in deltas. However, most studies focus on the incorporation of scenarios and adaptation pathways into policy agendas (see, for example, [38,56,76–79]). Very few have discussed forward-looking governance approaches that are focused on the uncertainty and dynamics of social systems, power relations, and policy implementations based on real-life experiences on the ground, which forms a prerequisite for appropriate future-oriented governance strategies.

On the basis of the abovementioned findings, we argue that future research should focus on systematic, interdisciplinary, forward-looking, and empirical-analytical studies to contribute to a robust empirical knowledge base. This knowledge base should help enrich and complement literature that has a more technocratic focus. Future studies should incorporate systems thinking to deal with complexity and uncertainty and should also integrate insights from relevant disciplines—including legal studies, environmental governance, ecology, environmental economics, climatology, physical geography, and urban and regional planning. To understand the process- and future-oriented images of delta transformation and resilience, we also argue that concepts from the fields of anticipatory governance [85–88], transformative governance [89–92], and interactive and integrative modes of governance [29,40,69–71,93,94] would be useful.

The concept of anticipatory governance would be useful as it underlines the importance of steering or governing in the present to engage, adapt, or shape uncertain futures [87,88]. In governing an uncertain future, the transformation process is crucial to enforce systemic, fundamental changes. This idea corresponds very well with the transformative governance concept, which has an explicit focus on societal and behavioral change to achieve certain goals [92], whether the change process happened incrementally or rapidly [91,92]. Due to the uncertainties of biophysical and societal system-to-be-governed and lack of capacity of governance systems to identify the problems and solutions, the process of incremental changes is often perceived as more feasible. Such incremental changes ideally focusing on small wins that can cumulate towards more radical transformation in the future [92,95]. This process, however, will require deliberate interactions between multiple systems, including socio-ecological systems, as well as within governance systems, including between actors and institutions, policy instruments, and actions, which became the focus of interactive governance scholars [29,40,69–71]. Issues such as inter-organizational relations, coordination, fragmentation, mainstreaming, coherence, integrated management, and landscape governance are some of the foci of the interactive and integrative governance concept and are important to investigate when dealing with incremental efforts [93,94].

In conclusion, we argue that empirical-analytical approaches are crucial to inform more normative approaches, since the former will have to inform, scrutinize, and operationalize the latter. Such empirical-analytical work can include comparative studies that will enable learning between and within world delta regions (e.g., continents, countries, delta cities, urban agglomeration) (see, for example, [31]). Our assessment is that the opportunities to produce such integrative studies are greater larger in the context of highly developed regions such as Europe, whereas these studies are most urgent in the context of the Global South, particularly in Southeast Asia. This paper offers relevant lessons learned that are crucial for the formulation of future delta governance strategies. Thus, we call for future studies to empirically support or test these narratives and to narrow the focus and limit to a specific case, so that such case studies can be used as illustrations.

Supplementary Materials: The following are available online at <http://www.mdpi.com/2073-4441/12/12/3391/s1>: Figure S1: Prisma 2009 flow diagram, Table S1: Prisma 2009 checklist, Table S2: List of papers in the database

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