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# From Flow to Gate: Integrating Knowledge in Collaborative Governance of Cross-Border Estuaries—Comparative Insights from the Schelderaad and the Forum Tideelbe

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**Abstract**

Estuary governance exemplifies the challenge of decision-making under incomplete knowledge, thereby turning knowledge integration into a central practice of governance. Varying across cross-border governance settings, the forms of this integration try to respond to the persistent challenges of governing complex socio-environmental systems characterized by uncertainties and contested stakeholder landscapes. Tracing the pathway 'from flow to gate', this paper examines how knowledge integration unfolds within collaborative estuary governance, using a comparative case study of the Schelderaad (Scheldt estuary) and the Forum Tideelbe (Elbe estuary) as illustrative governance regimes. Empirical data were collected through document analysis, media sources, and semi-structured interviews with stakeholders from both examples. This study employs a novel three-phase conceptual lens to systematically assess contextual preconditions, integration processes, and resulting effects of knowledge integration in these settings. The findings highlight that effective knowledge integration depends not solely on technical expertise and institutional arrangements, but also on social dynamics, ultimately shaping the legitimacy and learning capacity of collaborative estuary governance. In this way, the comparative analysis highlights the relevance of context sensitivity, institutional anchoring, and the fundamentally social nature of knowledge integration, which can either foster shared understanding and cross-border learning or reinforce disagreement, mistrust, and conflict.

**Keywords:** estuary governance; cross-border governance; knowledge integration; collaborative governance; comparative analysis; Scheldt estuary; Elbe estuary



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## 1. Introduction

In highly dynamic and contested socio-environmental spaces such as estuaries, knowledge integration has emerged as an essential component to enhance governance and decision-making. Spanning cross-border scales, estuary governance is a puzzle of overlapping jurisdictions, distinct powers, and responsibilities divided among multiple authorities and spatial contingencies [1]. The Scheldt and the Elbe estuaries embody these multifaceted governance challenges: asymmetrical cross-border interdependencies [2,3], strong economic port dependencies [4], persistent use conflicts [1], and the simultaneous provision of critical ecosystem functions [5–7].

Based on the aforementioned challenges, adequate knowledge of environmental conditions has long been recognized as a basic ingredient for successful environmental governance, aiming to improve the understanding of socio-ecological systems [8,9]. However,

decision-making in estuary governance continues to be confronted by an incomplete understanding of system dynamics, their nonlinear interdependencies, and anticipated impacts from climate change [8,10–12]. To cope with these uncertainties, policy makers rely on knowledge systems to legitimize management measures taken. They have increasingly invested time and resources in the establishment of knowledge bases, which are institutionalized, centrally managed repositories that systematically collect, structure, and make relevant information and documents accessible for decision-making processes. Despite advances in long-term and system-level studies [13–16], knowledge production remains characterized by the circular reproduction of highly specialized, fragmented, and predominantly natural science and engineering perspectives [17]. Local knowledge is seldom taken into consideration. Estuary management history illustrates the limits of such technocratic perspectives: misjudgments and failures of human interventions occurred even when, for example, extensive hydrological data was available [18].

Since 2010, social science research on estuary governance has shifted focus from a technocratic perspective on knowledge transfer to more participatory approaches that emphasize stakeholder involvement, negotiation, and the integration of multiple forms of knowledge into governance processes [19]. As a result, collaborative governance arrangements have emerged that intentionally bring together state and non-state actors to synthesize and operationalize a broader spectrum of knowledge types. Collaborative governance refers within this context to "the processes and structures of public policy decision making and management that engage people constructively across the boundaries of public agencies, levels of government, and/or the public, private and civic spheres in order to carry out a public purpose that could not otherwise be accomplished" [20] (p. 2). Collaborative frameworks often describe knowledge as "the currency of collaboration," which provides social capital that enables the translation of stakeholder insights and motivation into joint understanding for collaborative action [20] (p. 16). Knowledge integration is, consequently, understood in this paper as a socio-institutional negotiation process: formalized, objectified knowledge enters a dynamic social arena where it is pluralistically reinterpreted, negotiated, and ideally reintegrated into decision-making processes and structures.

Although the assumption that 'good' knowledge automatically improves policy has been debunked as naive [21], collaborative governance is widely lauded for its potential to integrate diverse forms of knowledge and generate more contextualized, adaptive solutions for environmental problem-solving [22–25]. Research on the subject highlight persistent barriers such as conflicting and fragmented problem understandings, power imbalances, and institutional or cognitive constraints that limit effective integration [22,26,27]. Still, notable gaps remain in the understanding of the dynamic interplay between contextual conditions, the organizational and institutional embedding of knowledge and its integration within collaborative processes, and the resulting social, institutional, and contextual (feedback) effects. This is particularly evident in cross-border estuary governance, where knowledge integration is often considered as a promising means, yet empirical and comparative research on stakeholders' perceptions and experiences remains scarce.

This paper addresses this gap through a comparative case study analysis of two collaborative estuary governance regimes: the Schelderaad (Scheldt Council, Scheldt estuary) and the Forum Tideelbe (Tidal Elbe Forum, Elbe estuary). Drawing on existing concepts [19,20,28,29], the study develops and applies a novel three-phase conceptual lens for collaborative estuary governance that systematically distinguishes between the pre-collaborative, collaborative, and post-collaborative phases of knowledge integration. The guiding research questions are: How does knowledge integration function in the two collaborative estuary governance regimes? What do these cases reveal about how contextual conditions and institutional structures shape, embed, and are reshaped by knowledge

integration in collaborative governance? Methodologically, this study adopts a comparative case study approach [30], drawing on qualitative data retrieved from documents, newspapers, and semi-structured interviews with stakeholders related to and within the Schelderaad and Forum Tideelbe.

The study makes three key contributions to the existing research: (1) it provides an empirically grounded and detailed analysis of knowledge integration within collaborative estuary governance; (2) it refines existing concepts of knowledge integration by advancing the evolving field of estuary governance; and (3) it offers practical implications for environmental governance based on the empirical insights. The primary concern in this analysis is the elaboration of stakeholders' perceptions of knowledge integration. The concrete, real-time micro-dynamics of negotiation "at the table" and the reconstruction of detailed structure, assessment and interplay of various forms of knowledge are, therefore, outside of the scope of this work.

The article is structured as follows: Section 2 introduces a theory-based conceptual framework that focuses on three phases of knowledge integration in collaborative estuary governance. Section 3 outlines the comparative study design, while Section 5 presents the results that are discussed in Section 6. Section 7 concludes the article and summarizes further needs for future research into knowledge integration in collaborative estuarine governance contexts.

## 2. Conceptual Lens

A central contribution of this study is the development and detailed elaboration of three key phases of knowledge integration which extend and structure existing theoretical and empirical foundations while addressing previously underexplored sequential and processual aspects of knowledge integration. Drawing on the conceptual literature as well as my empirical observations, I suggest a theoretical lens that identifies three phases: (1) factors shaping knowledge integration in the pre-collaboration phase, (2) the dynamics and impacts of knowledge integration during collaboration, and (3) the outcomes and effects resulting from the process of knowledge integration in the post-collaborative phase. These three phases provide a conceptual lens and are an analytical and guiding structure for the present study.

Based on the research questions, this study focuses on the function of knowledge integration—not to be understood as the input and recombination of separate knowledge components, but as a shared social capital of understanding that is socially and collaboratively evolving and developing. Collaboration establishes an institutional space in which knowledge is embedded and interlinked within its contexts and is iteratively processed, assessed, reframed, rearticulated, and integrated within the perspectives, power, values, and judgments of a broad range of participants.

Ansell and Gash [28], as well as Emerson and colleagues [20,29], have developed one of the most influential frameworks of collaborative governance. Their conceptual work has advanced the field considerably by structuring the institutional, relational, and procedural conditions under which collaboration emerges and evolves. Ansell and Gash [28], address knowledge indirectly and implicitly, while Emerson et al. [20] place greater emphasis on knowledge as one of the essential components of collaborative capacity for joint action. In their view, collaboration requires the aggregation, separation, recombination, and integration of information, which is followed by the generation of shared and new knowledge. My theoretical lens hence draws upon these theoretical foundations, which provide an abstract analytical structure, but it advances them by explicitly articulating the sequential and processual aspects of knowledge integration that earlier frameworks largely left implicit. Further, these theoretical foundations do not address the question of how knowledge

integration unfolds in domain-specific collaborations and how it could function in practice. To engage with this gap, I draw on the framework for analyzing collaborative estuary governance provided in Schick et al. [19], where the status quo of research on estuary governance is examined and, at the same time, a theoretically grounded and practically applicable framework is provided. Here, they operationalize the aspect of knowledge integration through a meta-synthesis of the knowledge types used in estuary governance, the practices through which they are exchanged and combined, and the institutional and social conditions shaping their uptake. To empirically enrich this approach, the analysis draws on insights from the growing body of research that explicitly examines knowledge integration in environmental governance. Its three-phase structure thus provides a transferable analytical approach for investigating knowledge integration in socio-ecological governance settings where uncertainty and contested knowledge prevail, such as river basin management, coastal governance, or planning for climate change adaptation.

**Phase 1: Pre-Collaboration**

Collaborative governance processes do not emerge from a void. They are shaped by environmental, system, and conflict-related contextual factors and preconditions. Recent research confirms the centrality of these factors for collaboration [27,31–33]. The distribution and specialization of knowledge [28] drive the need for collaboration, while collaboration itself serves as an adaptive institutional response to uncertainty in an environment where knowledge is limited [20]. Pre-collaborative factors influence practices of knowledge integration by determining the nature and urgency of the knowledge produced, the diversity of actors involved, the contextual needs that shape the collaborative agenda, and the aims to be achieved [34]. Structural preconditions, such as an incomplete understanding of estuarine systems and entrenched institutional routines within established policy-science processes and local knowledge systems, can enable but also constrain integration. In particular, the prior distribution and recognition of knowledge can play a decisive role, especially when conventional knowledge systems or institutional path dependencies limit the scope of integration of diverse knowledge types [26,35].

**Phase 2: During Collaboration**

Phase 2 focuses on the collaborative process, where knowledge integration occurs and is actively carried out. Here, the generation, sharing, integration, and management of knowledge is conceptualized as a core process and task in the collective pursuit of context-specific goals [20]. Collaborative processes allow for the systematic completion of incomplete knowledge and the reflexive consideration of contested evidence. They act as catalysts for the synthesis of diverse perspectives with the aim to create new ideas and understanding [20,28].

In this phase, evidence points to the need for access to diverging expertise by drawing on both expert and lay knowledge [20,26,36–38]. Going beyond the general engagement of participants in the generation of knowledge discovery and sharing, it is essential to consider the forms of knowledge relevant for the specific task to be performed within estuary governance (for an overview of general types of knowledge, see [35]). Empirical studies in the field particularly stress the value of local and ecological knowledge for understanding regional conditions and for reducing resistance to change [7,39,40]. The relevance of expert insight in scenario planning and assessment is also underscored in the literature, representing another knowledge dimension to be included in the process [41].

Bridging these often fragmented and sometimes conflicting bodies of knowledge represents a considerable challenge [22]. Further difficulties stem from structural, relational, and cognitive differences and barriers, such as high coordination costs and limited capacity to understand and translate different types of information [26,28,37,42–44]. Moreover, asymmetric knowledge and power imbalances at the science-policy interface [45], the

prioritization of technical or scientific over the local knowledge in the process [35,46], and persistent knowledge inequalities among stakeholders can jeopardize success of knowledge integration [29].

Considering these challenges, successful knowledge integration holds collective benefits, ranging from general knowledge exchange among actors [47], collective learning [42,43], and social learning [34], to shared understandings of the environmental systems and the development of trust [28,29,35,48]. However, these benefits are mutable and may be diminished or even lost over the course of collaboration. The success of knowledge integration in this phase ultimately hinges on achieving a balance between productive collaboration dynamics, the challenges posed by structural and relational barriers of knowledge integration, and the aims to be accomplished.

**Phase 3: Post-Collaboration**

Phase 3 addresses the outcomes and effects that arise from knowledge integration in collaboration. Knowledge itself and the effective integration of diverse, relevant knowledge(s) into collaboration, deliberations, and decisions hold the potential to improve legitimacy both within and beyond the collaborative process [20]. Emerson et al. [20], point out that third-order effects arise when collaboration adapts either indirectly—in response to changes in the system context—or directly—through a new round of knowledge generation. Such a process of adaptation can foster agreement among participants about which types of knowledge are most relevant to be considered for a given problem [28]. Studies demonstrate that, when knowledge is contextualized in this way, it enables the development of problem-specific solutions that are far more likely to gain public acceptance than the exclusive reliance on abstract or decontextualized forms of knowledge as often presented by the sciences [22].

Prior works consistently demonstrate that knowledge integration is increasingly considered a success condition in estuary governance [49,50] because a solid knowledge base for dealing with the cumulative and nonlinear characteristics of estuary systems is key to ensure effective governance [6]. Ultimately, implementing shared knowledge in practice is highly dependent on strong governance structures [5]. At the same time, research points out that there is a risk of mistrust: the exclusive consideration of nature, science-, or engineering-based approaches is often accompanied by limited acceptance or even the rejection of scientific knowledge by stakeholders [51].

Importantly, the social side of knowledge integration connects people and organizations across diverse knowledge systems, facilitating co-creation and generating procedural co-benefits such as building trust and lowering transaction costs [35]. The true potential of knowledge integration, therefore, lies not simply in collecting knowledge, but in conceiving it as a basic ingredient within participatory and social processes to foster an enduring and dialogic relationship among science, administration, and local actors [51]. Institutionalized and socially anchored knowledge integration that merges knowledge(s) and develops at least partial agreement and acceptance produces effects reaching far beyond immediate collaboration under consideration. Stakeholders not only expand their estuarine, administrative, and local knowledge, but also transfer and embed this expertise into their individual lifeworld and organizational routines, giving lasting meaning to participation while also strengthening ongoing and possible future commitment.

## 3. Methodology

This study applies an international comparative governance approach [30], which emerged as a distinct subfield within comparative public administration [52–54]. Diverging from the mainly quantitative comparative studies in the collaborative governance field

(e.g., [32,55]), the paper draws on advanced qualitative methodological impulses from comparative political sciences [56] and higher education research [57,58].

The methodological design follows a qualitative small-n logic, combining elements of a Most-Similar-Systems Design (MSSD) based on two collaborative estuarine governance regimes [20,28], and a Most-Different-Systems Design (MDSD) regarding the evolution of knowledge integration dynamics within embedded subunits [59–61]. This combination allows for a nuanced analysis by identifying which governance mechanisms remain stable across similar estuarine contexts (MSSD), while also exploring how diverse contextual conditions, external and internal structures, and practices influence knowledge integration (MDSD).

The Schelderaad and the Forum Tideelbe were selected due to their marked differences in institutionalization. The Schelderaad represents a long-established, formally embedded governance regime, while the Forum Tideelbe is a comparatively recent and more loosely structured regime. Both are situated within broader European policy environments. Examining these cases enables a systematic analysis of how comparable governance challenges are addressed under both shared and not shared contextual conditions, and how strategies for knowledge integration differ, influencing collaborative processes and outcomes.

To ensure analytical rigor and empirical depth, three complementary data sources were triangulated: (1) policy and legal documents, (2) newspaper articles from national, state, and regional outlets, and (3) semi-structured interviews with stakeholders. Data for both cases were collected and analyzed from April 2022 to July 2025. Both the Schelderaad and the Forum Tideelbe were approached as case studies within a comparative research design. However, the Forum Tideelbe case was investigated in greater detail, benefiting from easier field access and language proficiency. The Schelderaad case, although methodologically robust, was limited by contextual and linguistic constraints. Nonetheless, substantial efforts were made to overcome these limitations: a dedicated research stay in the Netherlands enabled researcher familiarization, as well as basic Dutch language training. Policy documents, legal records, and media articles were systematically reviewed to provide institutional, contextual and discursive background for both cases. These sources were cross-checked against interview data to ensure consistency while any discrepancies were documented and analyzed to capture contested perspectives. The extent and focus of the document and media analysis varied between cases, depending on source availability and research needs. Coverage was particularly extensive in the context of the Forum Tideelbe [19,27].

The main component of the research design consisted of semi-structured interviews. In total, 8 interviews were conducted with 9 participants in the Schelderaad and 15 interviews with 27 participants in the Forum Tideelbe. The number of interviews reflects the size and composition of the two cases (20 for the Schelderaad; 50 for the Forum Tideelbe), ensuring adequate coverage of all stakeholder groups and their respective roles guaranteeing thematic saturation. Stakeholder sampling followed a criteria-driven approach [62] (pp. 88–93), ensuring adequate representation of all relevant stakeholder groups. For the Schelderaad, the General Secretariat of the Benelux Union facilitated field access by providing a list of stakeholder participants and by enabling participation in the Scheldt Symposium and Schelderaad meetings. For the Forum Tideelbe, the Ministry for Environment, Climate, Energy, and Agriculture of Hamburg (BUKEA), which administered the Forum, supported field access by providing stakeholder lists and facilitating participation in meetings.

This form of asymmetric comparison is methodologically legitimate, as Krause (2016) argues as cases can be considered comparable even with varying investigatory depth, provided that comparative dimensions and research interests are clearly defined [63]. Following a small-n logic, comparability was ensured through clearly defined analytical

dimensions and the application of the same conceptual lens to both cases, rather than through identical quantities of data. The richer interview base in the Forum Tideelbe case provided additional contextual nuance, whereas the Schelderaad case still offered sufficient empirical coverage to address the aspect of knowledge integration.

The interview analysis constitutes the primary analytical focus of this study and provides essential insights into stakeholder roles and interactions within knowledge integration processes. For referencing purposes, interviews are abbreviated as "S" (Schelderaad) and "FT" (Forum Tideelbe), followed by a sequential number (e.g., S/FT 1). In cases involving particularly sensitive content, indirect speech was used, or anonymized references (e.g., S/FT X) were applied. All interviews were recorded, transcribed verbatim, and coded using the MAXQDA 24 software.

The interview data were analyzed using qualitative content analysis (QCA) following Schreier [64], Mayring [65], and Gläser and Laudel [66–68]. Guided by this conceptual lens, I employed an analytically robust yet flexible approach that combined deductive and inductive coding in an iterative process. Categories and analytical phases, including the three-phase model, emerged through the interplay of data analysis and conceptual reflection. Coding in the German case was conducted collaboratively by two researchers, ensuring ongoing discussion and alignment of category definitions to secure inter-coder consistency; in the Dutch case, coding was reflexively cross-checked by the author through memo-writing and comparison with the German coding framework. Linguistic and interpretive bias was minimized through bilingual validation of the presented quotes.

Section 5 is organized around inductively developed categories, which serve in the following as section headings to highlight the main themes. In Section 6, findings are systematically related back to the three analytical phases, providing a focused and theory-informed interpretation of each case and aspect. This approach ensures methodological rigor, allowing for context-sensitive and unexpected insights, and facilitates a nuanced comparative and detailed understanding of how knowledge integration functions in collaborative governance regimes.

## 4. Case Description

This paper addresses—as already outlined—two cases of collaborative estuary governance regimes: the Schelderaad and the Forum Tideelbe. Both cases employ divergent approaches to the institutional anchoring of knowledge integration and exemplify the challenges of cross-border estuary governance in the Scheldt and Elbe, two of the most significant North Sea estuaries. The Scheldt estuary stretches from Vlissingen (Netherlands) upstream to Ghent (Belgium), the Elbe estuary extends from Cuxhaven on the North Sea coast inland to Geesthacht, integrating the federal states of Hamburg, Schleswig-Holstein, and Lower Saxony (see Figure 1).

Both collaborations operate within historically evolved multi-level governance systems characterized by distributed responsibilities and tasks stemming from international, European, and national legislation and policy [69]. For both estuaries, the Birds Directive (2009/147/EC), the Habitats Directive (92/43/EEC), the Water Framework Directive (2000/60/EC), the Marine Strategy Framework Directive (2008/56/EC), and the Flood Risk Management Directive (2007/60/EC) are legally binding and strongly shape management practices. However, the way these directives are transposed into national legislation is left to the discretion of individual EU member states. This results in significantly different implementation of these directives at both national and regional levels, which in turn directly influences spatial planning, nature conservation, water quality, flood protection, and the sustainable use of the estuaries [11,70,71]. In addition to strict EU requirements, particularly in the areas of nature compensation and infrastructure development, there

is a strong mutual dependency on cross-border management issues such as navigation, sediment management, and flood protection. This interdependence has fostered a strong incentive for collaboration in both cases [72].

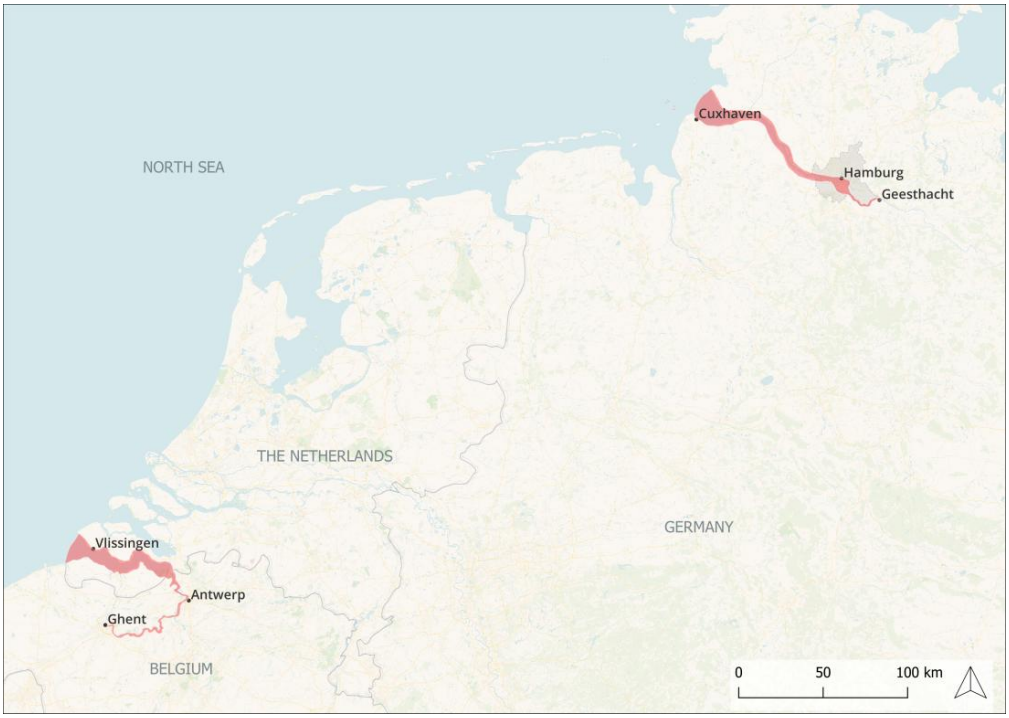


**Figure 1.** Study areas: the Scheldt estuary (from Vlissingen to Ghent) and the Elbe estuary (from Cuxhaven to Geesthacht). Basemap: © OpenStreetMap contributors, styled with CartoDB.

Both cases further face similar contextual challenges, including hierarchical and fragmented governance structures and deep-rooted economic dependencies on major upstream ports: Antwerp (Europe's second largest port) and Hamburg (Europe's third largest port). Nautical constraints and ongoing maintenance dredging at these locations sustain high market demand. Additionally, multi-stakeholder landscapes in both regions are marked by persistent socio-ecological conflicts [2,4]. The analysis reveals how these similar contextual challenges generate comparable demands for collaborative knowledge integration. However, the institutional responses and the structuring of collaborative knowledge integration processes diverge in the two cases.

### *4.1. Schelderaad (Scheldt Estuary)*

The Scheldt estuary is a transboundary region governed by the Netherlands and Flanders, the Dutch-speaking region of Belgium. Governance is shaped by asymmetrical interdependencies, as the main navigational channel to Antwerp runs mostly through Dutch territory, requiring all maritime traffic to pass through the Netherlands. This has necessitated ongoing coordination and negotiation, particularly over fairway deepening, and has strained Dutch-Belgian relations over the Scheldt for centuries, dating back as far as the 17th century [3,73]. Due to this multitude of functions, the Scheldt estuary is a stage for a broad range of stakeholders and conflicting interests. Especially in the past decades these diverging interests led to extremely tense and complex decision-making processes and accompanying implementations [72]. After centuries of conflict, the Dutch and Flemish adopted a shared Long Term Vision (LTV) for the Scheldt estuary in the early 2000s. The VNSC (Flemish-Dutch Scheldt Commission), established in 2008 after the 2005 Treaty on Cooperation, coordinates cross-border management between the Netherlands

and Flanders. This collaboration is formalized through multiple treaties and memoranda, and consists of a political college, an official college, and an executive secretariat. The VNSC oversees LTV implementation, balancing shipping accessibility, flood safety, and ecological resilience [74–76].

The Schelderaad, established in 2014, serves as the official advisory body to the VNSC and plays an active role in shaping future policy directions. It brings together approximately 20 stakeholder groups, including regional and local authorities, port actors, employer organizations, agricultural organizations, and environmental NGOs, with participation on a voluntary basis. The chair and secretariat are provided by the General Secretariat of the Benelux Union. At least twice a year, the Schelderaad meets in plenary to discuss key policy themes, provide recommendations to the VNSC, and facilitate stakeholder dialog through formal sessions and additional working groups if required. This participatory format supports an integrated governance strategy for the Scheldt estuary and promotes joint decision-making across national borders and sectors [74,77].

Research in the VNSC is carried out by a strong network of experts and institutes that frequently collaborate to provide advice and answer questions concerning the physical and ecological functioning of the estuary. Knowledge is actively disseminated to stakeholders engaged in joint fact-finding, and through the Schelderaad, stakeholders are able to influence the research agenda [78].

### *4.2. Forum Tideelbe (Elbe Estuary)*

The Elbe estuary is a transboundary region encompassing the Federal State of Hamburg, a city-state, as well as parts of the Federal States of Schleswig-Holstein and Lower Saxony. Governance reflects asymmetrical interdependencies, particularly focusing on the Port of Hamburg and the political influence exerted by Hamburg. This results in trilateral, fragmented, and closely interwoven negotiation and cooperation on issues such as sediment management, sediment disposal, and identification of compensation areas. The variety of functions and interests present in the estuary connects a broad spectrum of stakeholders, spanning ecological, economic, and port-related priorities. In recent decades, the convergence of competing interests has resulted in a challenging decision-making environment, most evident in major infrastructure projects and associated legal disputes. These contexts reveal how systematic knowledge about the estuary is produced mainly in sectoral and fragmented ways by state-run institutes, with certain studies becoming highly contested and sparking public debate during projects such as the 9th Elbe deepening [4,12,78].

The Forum Tideelbe operated between 2016 and 2020, and was preceded by the Dialogue Forum on River Engineering and Sediment Management (2013 to 2015). Coordinated by Hamburg's Ministry BUKEA, it brought together over 50 stakeholders from the Elbe estuary region, involving representatives from Hamburg, Schleswig-Holstein, and Lower Saxony. The Forum included both state and non-state actors, ranging from municipalities and federal agencies to port industries, fisheries, agriculture, tourism, recreation, and environmental NGOs. It was conceived as an informal and participatory dialog platform with the goal to support the sustainable development of the Elbe estuary. Its organizational structure included symposia, plenary sessions, a steering committee, and working groups. The Forum's activities included organized meetings, expert hearings, and joint analysis of ecological and hydromorphological data, with emphasis on formulating solutions to control tidal dynamics and restoring high-value tidal habitats. Its main outputs were recommendations for targeted measures, such as those for Haseldorfer Marsch, which were submitted to political bodies for consideration, as the Forum Tideelbe itself did not have formal decision-making authority [79]. Unlike the Scheldt case, it did not have a dedicated, institutionalized knowledge infrastructure or independent funding for commissioning

research. Instead, it relied on consultancy and technical expertise from federal agencies and regional authorities, utilizing studies and data available.

## 5. Results

In this section, I first empirically examine the contextual characteristics of cross-border collaboration that play a significant role in knowledge integration. Second, I analyze the forms of knowledge integration, as well as their effects on collaborative processes. Finally, I address the evolving dynamics and limitations of knowledge integration within the present cases' contexts. A theoretical reflection and interpretation of the results will be provided in the discussion.

### *5.1. Schelderaad: National Identity, Blame Shifting, and Patterns of Finger-Pointing*

In the Scheldt region, I observed that collaboration is undermined by a high number of conflict situations strongly related to national identity. I refer to these as blame shifting and finger-pointing. The interviews reveal that the stakeholders in the Schelderaad strongly identify with their respective national identity, whilst also sharing the understanding that collaboration is both necessary and widely accepted. This is reflected in statements such as "there is a need to collaborate" (S 5) and "this estuary, it belongs to both of us" (S 4). Yet, Flemish stakeholders frequently emphasized that they engage in cooperation primarily for the sake of the Dutch. In one example, an interviewee remarked that such collaboration is "a Dutch thing", describing it ironically as "this kind of circus" (S 4). Although the Netherlands and Flanders share a common language, considerable differences remain in their political systems and in the perspectives on the supposed commonalities. As one interviewee noted: "We speak the same language, but we have different views, different political systems" (S 3). This quote refers to an overarching linguistic unity, yet historically evolved governance differences, and, above all, the contrasting viewpoints, perspectives, and positions.

This preexisting Dutch–Flemish dichotomy emerged repeatedly throughout the interviews, displaying patterns of blame shifting and finger-pointing among participants. Each side emphasized that it is doing more or is further ahead, while attributing lack of foresight, insufficient contributions, and misplaced priorities to the other country. This is reflected in quotes like "from the other side, more action should be taken" (S 8) or an interviewee's self-portrayal as having "done [their] homework" (S 4) in concrete areas of action such as flood protection, dike safety, or ecological restoration.

I found these instances of finger-pointing primarily in connection with differences of governance and decision-making processes between the countries. The Dutch described the two sides as "not talking on the same level" (S 3). Flemish interviewees, in turn, frequently criticized the slow Dutch decision-making process, illustrated by the depoldering of the Hertogin Hedwigepolder, which led one participant to comment that "Flanders had to wait a very long time for the Netherlands" (S 5). But, from the Dutch perspective, the Belgians make decisions with a shorter time horizon and insufficient consideration of long-term financial consequences, such as ongoing maintenance costs for joint measures, as expressed in statements like: "the financial consequences of that and in the long term—they're not thinking about that" (S 3). Here, I identify a clear perception of governance fragmentation. This is characterized by divergent structures, institutions, authorities, and frameworks, as well as by an overall misalignment and deficiency of cross-border coordination between governance levels.

Risk perception and the experience of "living with water risks" (S 5) converged in each country's collective memory of extreme events. Stakeholders primarily focused on their own vulnerability, accompanied by a lingering fear that the other side may underestimate

or forget these dangers (S 1/S 3). This convergence in both countries underscores the deeply rooted and culturally mediated nature of vulnerability assessments in estuarine regions, as well as the resulting need for continuous efforts to protect themselves from the natural hazards inherent to these environments.

Overall, the data gathered reveal a sense of enmity, described by one interviewee as "a certain rivalry, and that is a good thing" (S 6), between the two countries. There is a type of gamesmanship between the two sides: both are willing to act for the estuary only when the other side reciprocates and are reluctant to deal with the burden on their own. Nevertheless, most stakeholders expressed such competition in a respectful manner, often referring to these tensions as starting points for negotiation. Collaboration serves as a "mediating space" (S 6), contributing to a "mutual understanding" (S 5) within cross-border Scheldt cooperation.

### *5.2. Forum Tideelbe: A Trilateral Relationship of Dependency, Benefit, and a Missing Overarching Strategy*

While the relationship across national borders in the Schelderaad appears to be more or less one of equality, the interaction between the federal states in Forum Tideelbe is characterized by a dependency-benefit dynamic. Strong identification with the individual federal states is not apparent in the interviews, rather most of the statements pointed to Hamburg's persistently dominant role in Forum deliberations. Hamburg is framed as intentionally exerting disproportionate influence, which has caused considerable resentment among stakeholders from Schleswig-Holstein and Lower Saxony. One interviewee referred to "the arrogance of Hamburg's politics" (FT 9), describing it as: "Many residents from Schleswig-Holstein and Lower Saxony work in the port industry, so just go along with it! We give the orders and you must follow. This attitude certainly set a tone that made things difficult" (FT 9).

Tensions over sediment management in the river even led representatives of Lower Saxony to abstain from attending the final event. This reflects another dynamic: a multifaceted dependency–competition over a shared, cooperatively managed estuarine space. In practical terms, the situation assembles one dominant player (Hamburg) and two less powerful partners (Schleswig-Holstein and Lower Saxony). This trilateral relationship is shaped to a considerable extent by Hamburg's significant and self-interest-driven influence.

With regard to governance structures and processes, almost all interviewees pointed to the absence of a coherent strategy and to insufficient interstate cooperation, which lead to management fragmentation. As one interviewee remarked, "A lot is sorted into categories like 'this is our responsibility' or 'this is not our responsibility.' And then, I think, it sometimes becomes difficult to make decisions or think in a holistic way." Others described how overarching structures and inadequate coordination between the states led to deadlocked situations, particularly regarding port and river policy (FT 9). Decision-making overall was hindered by "the cowardice of politicians, both at the state and federal levels, which is extreme when it comes to such important decisions" (FT 2). Multiple interviews, furthermore, confirmed that this dynamic obstructed joint progress and repeatedly manifested itself throughout the collaboration process. The resulting deliberative frustration is evident, for example, in the following comment: "Despite the fact that the Forum Tideelbe was theoretically well designed, it may have been doomed from the start by the prevailing political framework" (FT 9).

Even though interviewees explicitly acknowledged these structural limitations, they also highlighted the Forum's potential to provide a valuable platform for inter-state cooperation. As one participant observed: "Overall, it was the case that representatives from all three states were present, which made it possible to ensure cross-state collaboration. And that was very valuable indeed" (FT 7). Thus, while the Forum faced historically entrenched

horizontal and vertical governance structures and hindrances, it nevertheless served as a starting point for developing a culture of mutual exchange and negotiation.

### *5.3. Bridging Asymmetries in a Shared Governance Space*

In both cases, estuarine collaboration is characterized by the central economic role of "a port that is located a specific distance from the sea within the estuary" (S 7) within a shared natural environment, where geographic configurations and institutional arrangements produce structural imbalances. These conditions develop into a spatial decoupling of port-related impacts from ecological responsibility. As one participant from the Forum put it: "We always manage to get the Elbe deepening through, but actually carrying out a real cost-benefit analysis, what does the deepening cost us, and what do we actually gain? I would find that very helpful. And there has never been the same intensity of effort to secure land or implement renaturation measures" (FT 15). This aspect is similarly reflected in the Schelderaad, where a participant noted that Antwerp and Belgium benefit most from Scheldt shipping from an economic perspective, whereas the Dutch regions, which provide access but gain less economic return, tend to emphasize ecological interests (S 9). Ultimately, this dynamic results in asymmetrical distributions of benefits and costs within the shared estuarine governance space.

Land-use conflicts persist in both cases as a constant theme for all interviewees, who described the situation as "always a conflict between space, people, industrial developments, and nature" (S 8). Interviewees also pointed out that the status quo, with its prioritization of ports and entrenched path dependencies, still prevails today. As one participant in the Forum put it, "Even today, economic interests are simply given much more weight than ecological ones" (FT 15). A closely related aspect concerns upstream–downstream dynamics, which emerge as a source of conflict because upstream regions are often reluctant to implement management measures, whether ecological, technical, or infrastructural, whose primary benefits are felt downstream (S 5/FT 3). Nevertheless, all stakeholder groups, from NGOs to port authorities, emphasized the perceived urgent need to "give the river more space" (S 3/FT 1) for nature and sustainable development. Their motivations varied, ranging from easing the burden of sediment management to striving for more widespread ecological restoration. Still, even with these persistent asymmetries and entrenched conflicts, a shared understanding of the problem exists regarding both the direction and urgency of future developments.

### *5.4. Forms of Knowledge Integration*

#### 5.4.1. Schelderaad: Anchoring Knowledge Integration in Governance Structures

As the Schelderaad operates within the institutional framework of the VNSC, it draws on the Commission's standing pool of manpower, expertise, and data infrastructure. This knowledge base, comprising scientific personnel from both countries as well as financial and technical resources, is explicitly intended to be incorporated in collaborative processes. The VNSC, based on three overarching pillars (safety, accessibility, and nature), sets research programs, priorities, funding agendas, and informs stakeholders accordingly.

To facilitate more in-depth discussion on specific topics, scientific staff from the VNSC are frequently invited to Schelderaad meetings as observers, where they present and explain key issues, answer questions, and provide clarification. Within this framework, the role of the Schelderaad is described as "a consultative function in the development of VNSC policy" (S 6), with final decisions to be made at the national level. It serves as a participatory platform that informs members and facilitates low-level harmonization of stakeholder interests, while the stakeholder process itself is described as an open and

constructive exchange: "It is a good cooperation. We have an open discussion, and there is this respect for the position of different parties" (S 8).

Moreover, the Schelderaad provides the VNSC with perspectives and feedback to inform decision-making, and ideally issues recommendations. Although in practice, the diversity of interests and frequent lack of consensus make the formation of unified recommendations rather challenging. Based on participant observation, it became apparent to some extent that, in order to promote their own agendas, stakeholders often seek to advance smaller, less controversial issues in an incremental manner. One stakeholder described this behavior in an interview as the "salami tactic" (S 3).

Overall, participants in the Schelderaad generally assessed the process of knowledge integration positively, as reflected in statements such as, "So there is a common knowledge and we work on that, which is good." (S 4). The interview material also reveals that an extensive body of data on the Scheldt is available. This is evaluated very positively by participants, as reflected in a remark about their equal footing in this respect, with "a lot of knowledge from the Dutch and the Belgian side." (S 3). However, they stressed that certain topics, such as the future of the estuary, should receive increased attention and investigation. Interviewees also emphasized that achieving a shared terminology and systemic understanding are important outcomes of the collaboration, although this is a demanding and ongoing process requiring continuous effort to ensure that all participants stay up to date with the current scientific discourse. As one participant put it, "And that is then very protracted. It takes a lot of time, these processes" (S 5).

The way knowledge is integrated in the Schelderaad constitutes an ongoing, multi-level, cross-border science–policy interface in which knowledge is not only generated in response to political needs, but is also continuously maintained as a shared resource for governance. This process enables joint problem framing, adaptive learning, and evidence-based decision-making, but also poses significant challenges. While it facilitates the development of a shared knowledge base and improves stakeholder involvement, the multi-level structure and diversity of interests can slow progress and make consensus difficult to achieve. This may result in selective integration of evidence, contested decision outcomes, and potentially limit policy innovation, leading to incremental rather than systemic change.

#### 5.4.2. Forum Tideelbe: From External Knowledge to Shared System Understanding

Unlike the Scheldt case, the Forum Tideelbe operated without a dedicated, institutionalized knowledge infrastructure or its own financial resources to commission new scientific work. Instead, it relied on consultancy and technical advice from federal agencies such as the Federal Waterways Engineering and Research Institute (BAW), drawing on their existing knowledge base, including studies and datasets from federal authorities (e.g., Waterways and Shipping Administration (WSV), the Hamburg Port Authority (HPA), and the state environmental agencies). In contrast to the VNSC, the scope of the BAW is not limited to the Elbe estuary, but covers all federal waterways.

For the selected feasibility studies on the final three priority measures, the BAW and external engineering companies conducted modeling, hydraulic, and technical analyses (FT 7). As a result, knowledge integration within the Forum Tideelbe was not systematically institutionalized. Instead, it was reactive, externally driven, project-specific, and strongly shaped by the availability, framing, and interpretation of results provided by BAW.

Despite these limitations, the Forum contributed to building a shared system understanding of the Elbe estuary, functioning as a form of boundary arena in which different stakeholder perspectives and partial bodies of knowledge were brought together. This was positively evaluated by participants, as one interviewee stated: "I find this helpful, because everyone has some partial knowledge of the Elbe" (FT 9). Through the Forum's

work, participants were able to develop common understandings on the estuary's physical and ecological characteristics. As the same interviewee noted, this meant "having a better understanding of the Tideelbe, which means being able to put things into context more effectively and also understanding better what concerns people have" (FT 9). This joint learning process accentuates that the partial knowledge held by individual stakeholders was indispensable for constructing a more comprehensive, collective understanding. This understanding became the foundation for negotiating concrete measures and "as a basis on which to. . .make joint decisions" (FT 7).

However, the Forum's approach to knowledge integration remained largely dependent on pre-existing datasets provided by governmental authorities. Some participants criticized the absence of dedicated empirical studies, especially when such data would have been essential to address unresolved technical questions. As one interviewee emphasized, "not all questions could be answered because the studies were based on available datasets. For some issues, new data collection would have been necessary" (FT 7). This reliance on existing data limited the Forum's capacity to address contested technical issues and, ultimately, restricted its potential as a platform for comprehensive and adaptive knowledge integration.

Overall, participants evaluated the process of knowledge integration as predominantly positive. The development of scientific consensus and joint documents, as well as the transparent communication of differing perspectives and positions, were repeatedly mentioned as strengths. This was also the case when certain stakeholder groups could not support all the final measures. Their dissenting views were clearly considered and transparently represented in the final report: "even the positions that could not agree with the measures were made transparent in the outcome report" (FT 7).

### *5.5. Knowledge Integration: Forms and Impacts*

The two cases reveal marked contrasts in the practice of knowledge integration, in the perception of knowledge processes, and in the way knowledge gains acceptance and legitimacy among stakeholders. In the Schelderaad, knowledge integration played a central role: explicitly anchored in the institutional framework of the VNSC and reinforced by iterative exchanges on knowledge processes between the VNSC and Schelderaad. Stakeholders consistently assess this process as positive, highlighting the availability of extensive datasets, substantial expertise, and the provision of human resources. The continuity and recognition of the need for a "continuous effort" (S 2) in producing knowledge about the Scheldt estuary were especially valued, with the established and practiced joint fact-finding approach commonly described as "the main added value" (S X).

This shared factual basis regarding the physical and biological state of the Scheldt was the foundation for all subsequent discussions within the Schelderaad. Stakeholders assessed this consensus as a major achievement and as an essential prerequisite for meaningful knowledge exchange and dialog in the Schelderaad: "we agree on all the facts of the Scheldt; that is very important for the Schelderaad" (S 9). Nevertheless, members also emphasized that some topics require further investigation, and while there was agreement on the facts, discussions about the positions of individual interest groups were ongoing.

In the Forum Tideelbe, the interviews reveal a high level of conflict surrounding the past projects to deepen the Elbe, which resulted in a longstanding mistrust of the state-run research institute, BAW. This mistrust also permeated the Forum Tideelbe and persisted throughout its four years, as reflected in quotes such as: "The documents were prepared by the same institution that did the calculations for the Elbe deepening—and those turned out to be completely wrong in their predictions" (FT 9). Concerns extended not only to the perceived accuracy of scientific findings, but evolved into general skepticism, described by

another participant as "a certain mistrust that everything is really coherent in what they produced" (FT 15). This skepticism considerably limited the potential for developing a jointly accepted factual basis and trust building across stakeholder groups.

Another facilitator for knowledge integration in the Schelderaad was the continuous renewal of a long-term vision. One stakeholder described this strategic goal setting as "putting a dot on the horizon" (S 9), based on which a joint "Scheldt-Story" (S 9) was and continues to be developed. The development and maintenance of a shared knowledge base are emphasized as essential requirements for formulating both visions and subsequent concrete measures. Participants regarded the long-term vision as a highly important tool for providing a shared direction for the estuary, leading to a jointly perceived "broader perspective" (S 1) and a common sense of purpose through an agreed-upon temporality within collaboration. It appears that a long-term vision serves as a kind of social glue for cooperation, offering a shared reference point that aligns interests across institutional and national boundaries enabling consensus-building on both strategic objectives and concrete measures. However, some criticism has been raised that the long-term vision has become less directive over time, as one interviewee explained: "it worked out well sometimes, but nowadays I think it's too less directive" (S 4).

While the Schelderaad could successfully link scientific evidence with governance goals and local perspectives through its long-term strategy, such an approach was lacking in the Forum Tideelbe. As a consequence, several participants expressed concern about the future of the Elbe and emphasize the need for a comprehensive "long-term strategy" (S 4). They argued that the approach seen in the Forum should not be as narrowly focused on the selection of river engineering measures to identify and prioritize interventions that promote the sustainable development of the Tidal Elbe. Rather, it should be broader in scope. Participants identified the idea of a strategy as an essential task for the involved federal states and the federal government: "The three states and the federal government need to face this. In my opinion, it is absolutely necessary. Otherwise, one day the Elbe may no longer exist" (FT X). Another interviewee insisted that the federal government must be fully involved because it is responsible for the federal waterway and for implementing EU requirements: "It is imperative that the federal government sits at the table" (FT 8). Thus, it appears in the Forum Tideelbe that the call is not only for a long-term perspective, but also for a stronger top-down management involving the federal government.

#### 5.5.1. Knowledge Asymmetries

In both cases, the estuarine system creates a highly technical knowledge environment. Participation was marked by pronounced knowledge asymmetries, making it difficult for some actors to fully grasp the scientific and technical aspects of the discussions. Scientific input, largely shaped by disciplines such as hydrology, engineering, and environmental sciences, was often perceived as overly technical and its content inaccessible, particularly for local participants or those without a natural science background. As one stakeholder put it: "I don't have much, uh, knowledge about [morphology and hydrodynamics]" (S 7), while another indicated that "most of them just didn't have the necessary expertise" (FT X).

This led to a knowledge gap between stakeholders, one which not only stems from differences in disciplinary background and sectoral expertise, but also from unequal institutional support and varying familiarity with highly specialized scientific content. As one interviewee outlined: "These organizations do not have the capacity to understand the complexity of the topics. They have too few staff, maybe not the right training. But it is just too complex, what is being discussed and decided upon for many parties in the Schelderaad" (S 5). As a result, some participants were less able to engage substantively with technical discussions, which reduced their capacity to shape debates and reinforced a dependency

on expert interpretation. Here, interviewees emphasized the need for non-experts to be able to trust in expert assessments, noting for example, "[the stakeholder] has to be able to rely on the fact that there is an assessment he can trust" (FT X). Overall, the interview data underline that enabling all stakeholders to contribute meaningfully in technically complex governance processes is an enduring challenge for equitable and effective participation.

#### 5.5.2. Stakeholder Fatigue with Limitations of Science

Beyond the limits of individual expertise, several interviewees also pointed to the intrinsic limitations of scientific knowledge in the face of the estuarine system's complexity. This realization often led to disappointment and frustration, as participants observed that even advanced modeling and expert assessment had reached their epistemic boundaries. As one interviewee put it: "Science had reached the end of its possibilities" (FT X), adding, "If the result is that science can't be more precise, or we don't know any more, then at some point participants become exhausted and mentally drained." This sense of exhaustion sometimes undermined motivation to continue the process, revealing a certain stakeholder fatigue: "Then there's no point in continuing the conversation if you [the experts] can't give us any clearer answers" (FT 6). Overall, this also mirrors the historically established path dependency of science-policy interdependence, with a persistent emphasis on "focusing on technical solutions" (S 7) and a tendency to rely on and defer to expert knowledge, although scientific predictability is increasingly perceived as limited.

### *5.6. Unfolding the Dynamics of Collaboration*

A comparison of the two cases reveals substantive differences in terms of knowledge integration. There was a positive perception of agreement on facts in the Schelderaad, whereas the overall knowledge process was perceived negatively in the Forum Tideelbe. Despite this, the fundamental challenge is similar in both contexts: numerous and often conflicting interests converge in the respective collaborative governance setting.

When interpreting these findings, it becomes apparent that the Schelderaad has developed and actively embodies a pragmatic cooperation mindset, whereas this did not happen in the Forum Tideelbe. The Benelux setting, furthermore, displays a high level of institutional reflexivity and professionalism, accepting differences and constructively addressing them. One participant indicated that they perceived interests as divergent but emphasized that mutual understanding and ongoing negotiation were key to maintaining collaboration (S 5). Another participant described the guiding principle as "using the waterway like friends" (S 9). This statement underlines that, despite individual interests, actors never lose sight of the shared estuary as a common good and point of reference. In practice, this pragmatic mindset produces ongoing cooperation. Although substantive differences persist, they are considered normal and manageable. Underpinned by the bilateral treaty on common policy and management of the Scheldt estuary, the underlying concept of a partnership remains stable and functional, fostering constructive exchange and keeping negotiation capacity intact.

In the Forum Tideelbe, these positive effects do not seem to have been achieved. The differences among participants appear to be too great, as evident in statements such as: "Reaching decisions is difficult when so many different interest groups with very different decision-making and dialogue cultures come together" (FT 7). Furthermore, despite the development of a general systems understanding, knowledge integration remained fragmented and dominated by individual interests. According to one participant, discussions rarely produced a sense of overall understanding but rather appeared to be driven by stakeholder-specific agendas, with collaboration never truly emerging (FT 15). Participants also thought that the goals and the format of the Forum never quite fit, as

the "setting [of] the Forum could never live up to its expectations" (FT 2). The process consumed a great deal of time and resources, yet the output was perceived as modest. One participant's verdict summarizes the process succinctly: "They started as tigers and ended as house cats" (FT 15). However, even if the schisms between the actors could not be overcome and the output was rated as unsatisfactory, information-sharing, individual and joint learning, and overall exchanges among stakeholders within the Forum Tideelbe were portrayed by participants in a positive light.

### *5.7. The Knowledge-Compromise Paradox*

While stakeholders may share increased knowledge and understanding of the system, this does not necessarily lead to a greater willingness to make concessions or to adjust entrenched positions. Thus, there is a knowledge-compromise paradox in both of the analyzed cases. It became apparent that knowledge integration reaches its limits when interests are so divergent that they ultimately block collaborative governance processes. As one interviewee noted, "If one group yells too much, everything gets blocked" (S 8).

Although conceptual approaches and practical instruments like long-term visions and joint fact-finding were assessed positively, individual stakeholder interests continued to dominate collaborative dynamics: "Interests are more important than long-term vision. . . and the fact-finding is important, but it is subordinate, in the end, to interests" (S 7). NIMBY-type reactions arise across all stakeholder groups, especially when measures must be implemented and financed in specific locations. For example: "Based on the abstract basis, the [Haseldorfer Marsch] measure was accepted. But when it comes to implementation, it's a whole different story" (FT 1); "Locally, people just said, yes, maybe that makes sense, but I still don't want it" (S 5). This dynamic is empirically significant because it marks the moment when issues such as national identity, perceived responsibility, structural dependency, and power asymmetries intersect. Namely, it occurs when the debate moves from abstract agreement to concrete action and the allocation of financial burdens, often resulting in "very emotional discussions" (S 9).

Science appears to reach its limits, particularly when local populations and political interests diverge. In this context, science can do little: "Because people do not agree, politics do not agree. And science is not used to this" (S 1). Thus, in both cases, political actors were ultimately expected to take responsibility and act: "And that is it. It's up to politics to solve it" (S 6). However, courageous political decisions seem to be lacking: "There is no solution because nobody wants to take the first step on difficult measures" (S 7). Another interviewee observed, "No one wants to take responsibility. That is also typically German. . . Many more people must be willing to actively assume responsibility for decisions, including accepting accountability for possible mistakes" (FT 15). Institutional transformation is, thus, needed to move away from a culture of error avoidance and towards greater accountability and acceptance of risk, which requires willingness to take responsibility even if mistakes occur. Ultimately, these findings suggest that jointly produced knowledge may stimulate learning and exchange but is not a substitute for genuine political or social compromise.

## 6. Discussion

In the previous sections, I presented the findings on knowledge integration in the Schelderaad and Forum Tideelbe case studies. My theoretical approach combined frameworks of collaborative (estuary) governance and insights from empirical studies. Methodologically, I adopted an international comparative governance approach and applied data triangulation, systematically analyzing official documents, newspaper articles, and semi-structured interviews. Zooming in on the aspect of knowledge integration within collaboration, this design produced detailed insights into how knowledge is shaped by

contexts, structurally embedded, exchanged, integrated, and utilized. It revealed that knowledge integration can be interpreted as a socially embedded capital of shared understanding among stakeholders. Taken together, this theory-informed and empirically grounded approach not only underscores case-specific differences and similarities, but also offers valuable insights for broader environmental governance research, where incomplete knowledge, socio-ecological conflicts, diverse stakeholder interests, and fragmented governance structures remain pressing challenges.

Conceptually, the study applied a novel three-phase conceptual lens that systematically distinguishes between the pre-collaborative, collaborative, and post-collaborative phases of knowledge integration. To answer the guiding research questions on how knowledge integration functions within collaborative estuary governance and what these cases reveal about how contextual conditions and institutional structures shape, embed, and are reshaped by such integration, the following discussion is structured along these three phases.

**Phase 1: Pre-Collaboration**

In phase one, the cases clearly demonstrate that pre-collaborative factors fundamentally structure both the incentives for and the boundaries of knowledge integration. The analysis shows that estuary governance is persistently shaped by incomplete knowledge of the system under uncertainty and a fragmented governance system characterized by entrenched and sometimes long-existent stakeholder conflicts and continued adherence to the status quo of port interests. These preconditions set the stage for the social arena of knowledge integration, defining both the requirements for its functioning and limitations.

In the case of the Schelderaad, strong patterns of national affiliation, finger-pointing at others, and blame-shifting permeate collaborative interactions pre-shaped by a history of cross-border governance. Nevertheless, stakeholders share a common understanding of the necessity for collaboration and the ongoing development of a joint knowledge base. In contrast, the Forum Tideelbe is characterized by highly fragmented trilateral governance, the absence of an overarching strategy, and the dominant role of Hamburg as a port. These factors structurally create a dependency-benefit-competition dynamic that steered knowledge integration in a specific direction from the very beginning and undermined trust among actors. The findings from both cases resonate with the conceptual lens developed here and are consistent with previous research demonstrating that contextual factors, including environmental, systemic, and conflict dimensions, play a central role in shaping both the structural and social processes in collaboration and knowledge integration [19,31–34].

Path dependencies and the deep entrenchment of technocratic and scientific routines became evident in both cases. This was due to the shaping and utilization of knowledge within policy-science interfaces that are dominated by technical solutions that offer a supposedly efficient decision-making process. Efforts to change these patterns through dynamic collaborative arenas have largely proven to be unsuccessful because rigid governance structures rather tend to reproduce themselves within collaborative processes. These results echo findings in the broader literature on collaboration and knowledge integration, which emphasize that by prioritizing technical knowledge, public managers often miss the potential of other types of knowledge and the opportunity to act as catalysts for knowledge co-production in participatory settings [26,34,35,46]. This suggests that a persistent prioritization of technical and scientific expertise prevents any pluralistic reinterpretation and negotiation of knowledge as well as the development of a shared knowledge base; contextual factors continue to exert an overwhelming influence on prioritizing certain types of knowledge over others.

**Phase 2: During Collaboration**

The second phase examined the actual lived and experienced reality of knowledge integration within the respective collaborative processes. The two cases exhibit contrasting integration modes: in the Schelderaad, knowledge integration is prospective, institutionalized, and continuous while it tends to be reactive, externally driven, and project-specific in the Forum Tideelbe.

In the Schelderaad, practices such as institutionalized joint fact-finding, the ongoing development and revision of a shared long-term vision, and the systematic involvement of scientific staff in deliberations have facilitated processes that are widely perceived as transparent and constructive. Embeddedness within the VNSC provides a robust and valued institutional anchoring, supporting a stable science-policy interface where knowledge is framed as a collective resource, despite existing differences in political culture and national identity. These organizational procedures and structures have enabled the establishment of a shared factual basis and mutual understanding, serving as foundational pillars for trust, professional and social collaboration, and a broadly accepted and respected knowledge infrastructure.

By contrast, knowledge integration in the Forum Tideelbe remained fragmented, with knowledge perceived less as a shared infrastructure and more as an instrument for strategic negotiation and maneuvering. The Forum's pronounced reliance on federal agencies such as the BAW reinforced pre-existing mistrust of external expertise, particularly directed toward government-affiliated scientific advice. Although the Forum did foster some cross-boundary dialog and contributed to a more comprehensive understanding of the estuarine system, persistent deficits in confidence in scientific authorities impeded the development of a robust and broadly accepted knowledge base as an amalgamating foundation for collective action.

The dynamics observed in the two cases reinforce the conceptual proposition [20,28,29] that knowledge integration is far more than a technical or scientific endeavor. It represents, at its core, a social process shaped by institutional support and individual capacities, including cognitive barriers, fact-evaluation practices, and the degree of mutual trust. These factors influence not only the quality, structure, and perceived legitimacy of the knowledge integration process, but, more importantly, shape stakeholders' willingness to engage. They can foster a pragmatic mindset oriented toward constructive commitment or, conversely, generate a perception and feeling of collaborative processes as being ineffective and too time-consuming.

Future research could, based on the insights provided here, investigate whether, in other socio-environmental systems, efforts to reduce uncertainty through the accumulation of knowledge may in fact result in information overload, thereby generating increased social uncertainty among stakeholders. Further studies might also explore how questions of knowledge validity interact with social acceptance, for instance whether higher validity can foster broader legitimacy or whether entrenched conflicts prevent any convergence toward a commonly accepted understanding of what constitutes valid knowledge.

**Phase 3: Post-Collaboration**

In phase three, it became clear that effective knowledge integration within collaborative processes serves as an enabler for shared understanding and legitimacy. This was observable in the Schelderaad not only when consensus was reached on the physical and ecological state of the estuary, but also through the rise of an institutionally anchored commitment to maintaining and further developing a shared body of knowledge over time. An inadequate process can worsen collaborative capacity, intensify mistrust, and entrench deadlock in the present, and it can also have a negative impact on future processes, as seen in the Forum Tideelbe.

The findings from the Schelderaad demonstrate that the existence of long-term strategies genuinely creates space for anticipatory knowledge practices and the possibility for actions, such as foresight, continuous monitoring, reshaping existing scenarios, or fine-tuning them to new conditions. This illustrates that the spatial dimension ("where?"), the temporal horizon ("when?" and "for how long?"), and social direction ("for whom and how") are all crucial for maintaining orientation and agency, both for the environmental system and, perhaps even more importantly, for the social co-ownership and collective action towards governance tasks. Without such a future-oriented perspective, knowledge integration often remains fragmented, reactive, and focused on the short term, thereby hampering targeted governance and resulting in coping strategies, as observed in the Forum Tideelbe. Both cases further exhibit that, even when stakeholders reach consensus on system understanding, this does not automatically lead to a willingness to compromise. Individual interests frequently continue to dominate collaborative processes, a phenomenon clearly reflected in recurring NIMBY effects and emotional debates during discussions about the implementation of concrete measures in specific places.

It is clear that even the most effective knowledge 'flow' can eventually reach its 'gate', since scientific or pluralistic consensus alone appears to have only limited impact on actual decision-making. Ultimately, only bold political decisions can spark real progress, implementation of measures and other actions– especially in light of continuing incomplete system knowledge. Knowledge integration can lead to both outputs within the system context (long-term visions) and soft outcomes (mutual understanding, social learning). Yet, its potential for change depends on whether knowledge is perceived as legitimate, linked to decision-making authorities, and made an integral part of the decision process.

## 7. Conclusions

To conclude, this comparative analysis illustrates that the conceptual lens of collaborative governance provides a useful framework to disentangle how knowledge integration hinges on the nuanced interplay of context, process, and stakeholders. While both the Schelderaad and the Forum Tideelbe operate within fragmented cross-border governance landscapes marked by persistent uncertainty and entrenched interests, their experiences reveal sharply contrasting pathways of knowledge integration. The Schelderaad's institutionally anchored processes, joint fact-finding, and long-term visioning fostered a broadly respected foundation of shared understanding and mutual trust, highlighting the critical importance of continuity, strategic foresight, organizational reflexivity, and accountability. Knowledge was treated as a common resource, systematically developed and maintained as part of a continuous cross-border learning and negotiation process. In contrast, fragmented approaches and reliance on existing knowledge, framed as a precondition, led to the Forum Tideelbe's failure to cultivate either trust or a systematically institutionalized and cooperatively developed evidence base. Rather than fostering collaborative dynamics, knowledge became a source of debate, mutual accusation, and even conflict.

These findings reinforce the fact that knowledge integration is not a purely technical and scientific endeavor, but rather a genuine social process. Through estuarine collaborative processes, knowledge production boundaries are actively opened, enabling the incorporation of non-technical and non-scientific knowledge types such as local knowledge thereby creating a dynamic stakeholder arena. This shift from technocratic to social–participatory knowledge integration could enable governance processes to move beyond previously rigid, path-dependent, and natural science-dominated epistemologies, helping to expand knowledge integration from expertise-driven confines toward broader, more dialogic, approaches. However, in practice, this potential is rarely realized. Instead, power asymmetries persist. Even where system understanding improves, willingness to compromise and to resolve

problems for substantive action ultimately is reliant on enduring political commitment and bold decision-making.

Through the application of the novel three-phase conceptual lens, I have demonstrated that knowledge integration in collaborative governance processes can only realize its transformative potential when preconditions, social dynamics, and decision-making structures are considered together and actively shaped. In this way, my empirical-theoretical comparison offers a meaningful contribution to environmental governance research by highlighting the importance of context sensitivity, institutional anchoring, and above all, the understanding of knowledge integration as a fundamentally social process.

Overall, knowledge integration emerges as a necessary, but never sufficient, process and condition for more effective estuary governance: its full potential is only realized when contextual conditions, institutional anchors, and social dynamics are mutually reinforcing. Such an integrative momentum could reconfigure both the goals and boundaries of knowledge integration in estuary governance, advancing it from technically focused models toward a more social and pluralistic procedure with the potential to lead to a more full-fledged understanding of estuarine realities. By opening estuary governance to social realities, local attachments, and collective identities to shape deliberation and negotiation, decision-making could become more aware of concerns of those actually involved. It may be that turning factual uncertainty into greater social certainty about necessary actions depends on evolving commitments within boundary-spanning institutions, long-term relationships, stable institutional foundations, and a dedicated core group that cultivates a sense of collective ownership of the estuary. Still, while governance processes may move closer to accommodating pluralistic interests, they do not resolve the persistent challenges of incomplete system knowledge and uncertainties in decision-making with which they might have to deal forever.

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## Abbreviations

The following abbreviations are used in this manuscript:

| | |
|---|---|
| MSSD | Most-Similar-Systems Design |
| MDSD | Most-Different-Systems Design |
| VNSC | Flemish-Dutch Scheldt Commission |
| NGO | Non-Governmental Organization |
| BUKEA | Ministry for Environment, Climate, Energy, and Agriculture of Hamburg |
| BAW | Federal Waterways Engineering and Research Institute |
| WSV | German Federal Waterways and Shipping Administration |
| HPA | Hamburg Port Authority |
| NIMBY | Not In My Back Yard |

## References


1. Carvalho, T.M.; Fidélis, T. The relevance of governance models for estuary management plans. *Land Use Policy* **2013**, *34*, 134–145. [CrossRef]
2. Hein, J.; Hilder, N. Estuarine territorialization and the port of Hamburg. *Marit. Stud.* **2023**, *22*, 39. [CrossRef]
3. Warner, J.F.; van Buuren, A. Reframing long-term controversies in transboundary river management. The intermediate role of puzzling and powering in tackling wicked problems. *Futures* **2016**, *76*, 18–29. [CrossRef]
4. Notteboom, T. The adaptive capacity of container ports in an era of mega vessels: The case of upstream seaports Antwerp and Hamburg. *J. Transp. Geogr.* **2016**, *54*, 295–309. [CrossRef]
5. Adams, J.B. A review of methods and frameworks used to determine the environmental water requirements of estuaries. *Hydrol. Sci. J.* **2014**, *59*, 451–465. [CrossRef]
6. Pinto, R.; Carlos Marques, J. Ecosystem services in estuarine systems: Implications for management. In *Ecosystem Services and River Basin Ecohydrology*; Springer: Dordrecht, The Netherlands, 2015; pp. 319–341. [CrossRef]
7. Sousa, L.P.; Alves, F.L. A model to integrate ecosystem services into spatial planning: Ria de Aveiro coastal lagoon study. *Ocean. Coast. Manag.* **2020**, *195*, 105280. [CrossRef]
8. Luisetti, T.; Turner, R.K.; Jickells, T.; Andrews, J.; Elliott, M.; Schaafsma, M.; Beaumont, N.; Malcolm, S.; Burdon, D.; Adams, C.; et al. Coastal Zone Ecosystem Services: From science to values and decision making; a case study. *Sci. Total Environ.* **2014**, *493*, 682–693. [CrossRef]
9. Ostrom, E. A general framework for analyzing sustainability of social-ecological systems. *Science* **2009**, *325*, 419–422. [CrossRef]
10. Strotmann, T.; Hein, S.; Fröhle, P.; Nelsen, E.; Sohrt, V. *Abschlussbericht RefTide: Das Reflexions- und Resonanzverhalten Tide-dominierter Ästuare (RefTide), Eine Analyse des Antwortverhaltens der Tideelbe auf die Gezeitenanregung, Teilprojekte: Reflexion und Resonanz, Fachlicher Schlussbericht*; Technische Universität Hamburg: Hamburg, Germany, 2022.
11. Veraart, J.A.; Klostermann, J.E.M.; van Slobbe, E.J.J.; Kabat, P. Scientific knowledge use and addressing uncertainties about climate change and ecosystem functioning in the Rhine-Meuse-Scheldt estuaries. *Environ. Sci. Policy* **2018**, *90*, 148–160. [CrossRef]
12. Hein, J.; Thomsen, J. Contested estuary ontologies: The conflict over the fairway adaptation of the Elbe River, Germany. *Environ. Plan. E Nat. Space* **2022**, *6*, 153–177. [CrossRef]
13. Wachholz, A.; Jawitz, J.W.; Büttner, O.; Jomaa, S.; Merz, R.; Yang, S.; Borchardt, D. Drivers of multi-decadal nitrate regime shifts in a large European catchment. *Environ. Res. Lett.* **2022**, *17*, 064039. [CrossRef]
14. Quiel, K.; Becker, A.; Kirchesch, V.; Schöl, A.; Fischer, H. Influence of global change on phytoplankton and nutrient cycling in the Elbe River. *Reg. Environ. Change* **2011**, *11*, 405–421. [CrossRef]
15. Schulz, G.; Sanders, T.; Voynova, Y.G.; Bange, H.W.; Dähnke, K. Seasonal variability of nitrous oxide concentrations and emissions along the Elbe estuary. *Biogeosci. Discuss.* **2023**, *20*, 3229–3247. [CrossRef]
16. Voynova, Y.G.; Brix, H.; Petersen, W.; Weigelt-Krenz, S.; Scharfe, M. Extreme flood impact on estuarine and coastal biogeochemistry: The 2013 Elbe flood. *Biogeosci. Discuss.* **2017**, *14*, 541–557. [CrossRef]
17. Dewulf, A.; Biesbroek, R. Nine lives of uncertainty in decision-making: Strategies for dealing with uncertainty in environmental governance. *Policy Soc.* **2018**, *37*, 441–458. [CrossRef]
18. Kerner, M. Effects of deepening the Elbe Estuary on sediment regime and water quality. *Estuar. Coast. Shelf Sci.* **2007**, *75*, 492–500. [CrossRef]
19. Schick, E.; Döring, M.; Knieling, J.; Ratter, B.M.W.; Pein, J.; Dähnke, K. Turning the tide in estuary governance through collaboration? A systematic review, meta-synthesis, and conceptual framework. *Ecol. Soc.* **2025**, *30*, 6. [CrossRef]
20. Emerson, K.; Nabatchi, T.; Balogh, S. An Integrative Framework for Collaborative Governance. *J. Public Adm. Res. Theory* **2012**, *22*, 1–29. [CrossRef]

21. Cairney, P. *The Politics of Evidence-Based Policy Making*; Palgrave Pivot: London, UK, 2016.
22. Taylor, B.; de Loë, R.C. Conceptualizations of local knowledge in collaborative environmental governance. *Geoforum* **2012**, *43*, 1207–1217. [CrossRef]
23. Newig, J.; Challies, E.; Jager, N.W.; Kochskaemper, E.; Adzersen, A. The environmental performance of participatory and collaborative governance: A framework of causal mechanisms. *Policy Stud. J.* **2018**, *46*, 269–297. [CrossRef] [PubMed]
24. Bodin, Ö. Collaborative environmental governance: Achieving collective action in social-ecological systems. *Science* **2017**, *357*, eaan1114. [CrossRef]
25. Emerson, K.; Nabatchi, T. Evaluating the productivity of collaborative governance regimes: A performance matrix. *Public Perform. Manag. Rev.* **2015**, *38*, 717–747. [CrossRef]
26. Koontz, T.M.; Thomas, C.W.; Cheng, K.R. Integrating science with indigenous and experiential knowledge in collaborative governance. *Environ. Policy Gov.* **2025**, *35*, 808–821. [CrossRef]
27. Schick, E.; Döring, M.; Knieling, J.; Ratter, B.M.W.; Dähnke, K.; Pein, J. *Unpacking Stakeholder Engagement in a Multifaceted Estuarine Space: Collaborative Governance Dynamic in the Forum Tideelbe*; Working paper; University of Hamburg and HafenCity University Hamburg: Hamburg, Germany, 2025.
28. Ansell, C.; Gash, A. Collaborative governance in theory and practice. *J. Public Adm. Res. Theory* **2008**, *18*, 543–571. [CrossRef]
29. Emerson, K.; Nabatchi, T. *Collaborative Governance Regimes*; Georgetown University Press: Washington, DC, USA, 2015; 279p.
30. Fromm, N.; Veit, S. Internationaler Governance-Vergleich. In *Governance*; Springer VS: Wiesbaden, Germany, 2024; pp. 315–336.
31. Cockburn, J.; Schoon, M.; Cundill, G.; Robinson, C.; Aburto, J.A.; Alexander, S.M.; Baggio, J.A.; Barnaud, C.; Chapman, M.; Garcia Llorente, M.; et al. Understanding the context of multifaceted collaborations for social-ecological sustainability: A methodology for cross-case analysis. *Ecol. Soc.* **2020**, *25*, 7. [CrossRef]
32. Ulibarri, N.; Emerson, K.; Imperial, M.T.; Jager, N.W.; Newig, J.; Weber, E. How does collaborative governance evolve? Insights from a medium-n case comparison. *Policy Soc.* **2020**, *39*, 617–637. [CrossRef]
33. Swette, B.; Huntsinger, L.; Lambin, E. Collaboration in a polarized context: Lessons from public forest governance in the American West. *Ecol. Soc.* **2023**, *28*, 29. [CrossRef]
34. Carr Kelman, C.; Srinivasan, J.; Lorenzo Bajaj, T.; Raschke, A.; Brown-Wood, R.N.; Kellner, E.; Ahn, M.; Kariuki, R.; Simeone, M.; Schoon, M. Convergence research as transdisciplinary knowledge coproduction within cases of effective collaborative governance of social-ecological systems. *Ecol. Soc.* **2024**, *29*, 23. [CrossRef]
35. Yumagulova, L.; Vertinsky, I. Moving beyond engineering supremacy: Knowledge systems for urban resilience in Canada's Metro Vancouver region. *Environ. Sci. Policy* **2019**, *100*, 66–73. [CrossRef]
36. Finewood, M.H.; Vail, E.; Meierdiercks, K.L.; Bennett, C.; Read, L. The importance of capacity-building in watershed groups: Lessons from the Hudson River Watershed, USA. *Environ. Manag.* **2024**, *74*, 1086–1100. [CrossRef]
37. Innes, J.E.; Booher, D.E. *Planning with Complexity: An Introduction to Collaborative Rationality for Public Policy*; Routledge: London, UK, 2010.
38. McNaught, R. The application of collaborative governance in local level climate and disaster resilient development–a global review. *Environ. Sci. Policy* **2024**, *151*, 103627. [CrossRef]
39. Barrett, P.; Kurian, P.; Simmonds, N.; Cretney, R. Explaining reflexive governance through discursive institutionalism: Estuarine restoration in Aotearoa New Zealand. *J. Environ. Policy Plan.* **2021**, *23*, 332–344. [CrossRef]
40. Truchet, D.M.; Noceti, B.M.; Villagran, D.M.; Truchet, R.M. Alternative conservation paradigms and ecological knowledge of small-scale artisanal fishers in a changing marine scenario in Argentina. *Hum. Ecol.* **2022**, *50*, 209–225. [CrossRef]
41. Dawson, R.J.; Ball, T.; Werritty, J.; Werritty, A.; Hall, J.W.; Roche, N. Assessing the effectiveness of non-structural flood management measures in the Thames Estuary under conditions of socio-economic and environmental change. *Glob. Environ. Change* **2011**, *21*, 628–646. [CrossRef]
42. Gerlak, A.K.; Heikkila, T. *Learning for Environmental Governance: Insights for a More Adaptive Future*; Cambridge University Press: Cambridge, UK, 2024.
43. Gerlak, A.K.; Heikkila, T. Building a theory of learning in collaboratives: Evidence from the Everglades Restoration Program. *J. Public Adm. Res. Theory* **2011**, *21*, 619–644. [CrossRef]
44. Bonnell, J.E.; Koontz, T.M. Stumbling forward: The organizational challenges of building and sustaining collaborative watershed management. *Soc. Nat. Resour.* **2007**, *20*, 153–167. [CrossRef]
45. Lévesque, A.; Bissonnette, J.F.; Vansintjan, A.; Dupras, J. Conflicting perspectives on ecosystem conservation in a cultivated floodplain: The role of science and the challenge of pluralism in decision-making in Lac Saint-Pierre (Quebec, Canada). *Environ. Policy Gov.* **2024**, *34*, 476–489. [CrossRef]
46. Maiello, A.; Viegas, C.V.; Frey, M.; Ribeiro, J.L.D. Public managers as catalysts of knowledge co-production? Investigating knowledge dynamics in local environmental policy. *Environ. Sci. Policy* **2013**, *27*, 141–150. [CrossRef]
47. Koppenjan, J.F.M.; Klijn, E.-H. *Managing Uncertainties in Networks: A Network Approach to Problem Solving and Decision Making*; Psychology Press: East Sussex, UK, 2004.

48. Borowski-Maaser, I.; Graversgaard, M.; Foster, N.; Prutzer, M.; Roest, A.; Boogaard, F. WaterCoG: Evidence on how the use of tools, knowledge, and process design can improve water co-governance. *Water* **2021**, *13*, 1206. [CrossRef]
49. Zaucha, J.; Davoudi, S.; Slob, A.; Bouma, G.; van Meerkerk, I.; Oen, A.M.P.; Breedveld, G.D. State-of-the-lagoon reports as vehicles of cross-disciplinary integration. *Integr. Environ. Assess. Manag.* **2016**, *12*, 690–700. [CrossRef]
50. Buitenhuis, Y.; Dieperink, C. Governance conditions for successful ecological restoration of estuaries: Lessons from the Dutch Haringvliet case. *J. Environ. Plan. Manag.* **2019**, *62*, 1990–2009. [CrossRef]
51. Vanderlinden, J.-P.; Baztan, J.; Touili, N.; Kane, I.O.; Rulleau, B.; Simal, P.D.; Pietrantoni, L.; Prati, G.; Zagonar, F. Coastal flooding, uncertainty and climate change: Science as a solution to (mis)perceptions?—A qualitative enquiry in three coastal European settings. *J. Coast. Res.* **2017**, *77*, 127–133. [CrossRef]
52. Kuhlmann, S.; Wollmann, H.; Reiter, R. *Introduction to Comparative Public Administration: Administrative Systems and Reforms in Europe*; Edward Elgar Publishing: Cheltenham, UK, 2025.
53. Kuhlmann, S.; Seyfried, M. Comparative methods B: Comparative methods in public administration—The value of looking around. In *Handbook of Research Methods in Public Administration, Management and Policy*; Vigoda-Gadot, E., Vashdi, D.R., Eds.; Edward Elgar Publishing: Cheltenham, UK, 2020.
54. Wollmann, H. Comparative public administration. *Oxf. Res. Encycl. Politics* **2021**. [CrossRef]
55. Newig, J.; Fritsch, O. Environmental governance: Participatory, multi-level—And effective? *Environ. Policy Gov.* **2009**, *19*, 197–214. [CrossRef]
56. Lauth, H.-J.; Kneuer, M.; Pickel, G. *Handbuch Vergleichende Politikwissenschaft*; Springer: Wiesbaden, Germany, 2016.
57. Kosmützky, A. The precision and rigor of international comparative studies in higher education. In *Theory and Method in Higher Education Research*; Emerald Group Publishing Limited: Leeds, UK, 2016; Volume 2, pp. 199–221.
58. Kosmützky, A.; Nokkala, T.; Diogo, S. Between context and comparability: Exploring new solutions for a familiar methodological challenge in qualitative comparative research. *High. Educ. Q.* **2020**, *74*, 176–192. [CrossRef]
59. Dogan, M.; Pelassy, D. *How to Compare Nations: Strategies in Comparative Politics*; CQ Press: Washington, DC, USA, 1990.
60. Seawright, J.; Gerring, J. Case selection techniques in case study research: A menu of qualitative and quantitative options. *Political Res. Q.* **2008**, *61*, 294–308. [CrossRef]
61. Yin, R.K. *Case Study Research and Applications*, 6th ed.; Sage Publications Ltd: Los Angeles, CA, USA; London, UK; New Delhi, India; Singapore; Washington, DC, USA; Melbourne, Australia, 2018; 319p.
62. Schreier, M. *Sampling and Generalization*; SAGE Publications Ltd.: London, UK, 2018; pp. 84–97.
63. Krause, M. *Comparative Research: Beyond Linear-Causal Explanation*; Mattering Press: Manchester, UK, 2016.
64. Schreier, M. *Qualitative Content Analysis in Practice*; SAGE Publications Ltd.: London, UK, 2012.
65. Mayring, P. Qualitative Content Analysis: Theoretical Background and Procedures. In *Approaches to Qualitative Research in Mathematics Education. Advances in Mathematics Education*; Springer: Dordrecht, Germany, 2015; pp. 365–380.
66. Gläser, J.; Laudel, G. *Theoriegeleitete Textanalyse? Das Potential Einer Variablenorientierten Qualitativen Inhaltsanalyse*; WZB Discussion Paper: Berlin, Germany, 1999; pp. 99–401.
67. Gläser, J.; Laudel, G. *Experteninterviews und Qualitative Inhaltsanalyse: Als Instrumente Rekonstruierender Untersuchungen*; VS Verlag für Sozialwissenschaften: Wiesbaden, Germany, 2004.
68. Gläser, J.; Laudel, G. *Experteninterviews und Qualitative Inhaltsanalyse: Als Instrumente Rekonstruierender Untersuchungen*; Springer: Berlin/Heidelberg, Germany, 2009.
69. Gilissen, H.K.; Suykens, C.; Kleinhans, M.; van Rijswick, M.; van der Werf, K. Towards a rights-based approach in EU international river basin governance? Lessons from the Scheldt and Ems Basins. *Water Int.* **2019**, *44*, 701–718. [CrossRef]
70. Boyes, S.; Cutts, N.D.; Elliott, M. Legislative Drivers & Sectoral Plan Review of TIDE Estuaries. In *TIDE Project Report*; University of Hull: Hull, UK, 2013.
71. Vikolainen, V.; Bressers, H.; Lulofs, K. The role of Natura 2000 and project design in implementing flood defence projects in the Scheldt estuary. *J. Environ. Plan. Manag.* **2013**, *56*, 1359–1379. [CrossRef]
72. Janssen, S.K.H.; Ellen, G.J.; Taal, M. From Stakeholder to Shareholder. In *TIDE Project Report*; Vlaams-Nederlandse Scheldecommissie: Antwerp/Rotterdam, The Netherlands, 2015.
73. Warner, J.F. More sustainable participation? Multi-stakeholder platforms for integrated catchment management. *Int. J. Water Resour. Dev.* **2006**, *22*, 15–35. [CrossRef]
74. Vlaams-Nederlandse Scheldecommissie (VNSC). Over de VNSC. Available online: https://vnsc.eu/over-de-vnsc/ (accessed on 10 September 2025).
75. Slinger, J.H. Developing the transboundary long term vision of the Scheldt Estuary–an untold story. *Water Int.* **2023**, *48*, 1046–1067. [CrossRef]
76. Plancke, Y.; Maris, T.; Verleye, T.; Sandra, M. Scheldt estuary. In *Compendium voor Kust en Zee = Compendium for Coast and Sea 2023*; Vlaams Instituut voor de Zee (VLIZ): Oostende, Belgium, 2023; pp. 1–12. [CrossRef]

77. Vlaams-Nederlandse Scheldecommissie (VNSC). Schelderaad and Cooperation. Available online: https://vnsc.eu/over-de-vnsc/schelderaad-en-samenwerking/ (accessed on 10 September 2025).
78. van Bets, L.; Deelstra, Y.; van Lieshout, M.; Taal, M.; Enemark, J.; Geritts, L. *Improving Estuary Governance*; Wing: Wageningen, The Netherlands, 2020.
79. Forum Tideelbe. Ergebnisbericht des Forum Tideelbe: Die Zukunft der Tideelbe Gemeinsam Gestalten. Available online: https://www.forum-tideelbe.de/ergebnisse (accessed on 30 May 2025).