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

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

**Keywords:** estuaries; governance; sustainability; governance models

## 1. Introduction

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

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

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

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

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

## 2. A Literature Review on Estuary Governance

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

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

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

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

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

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

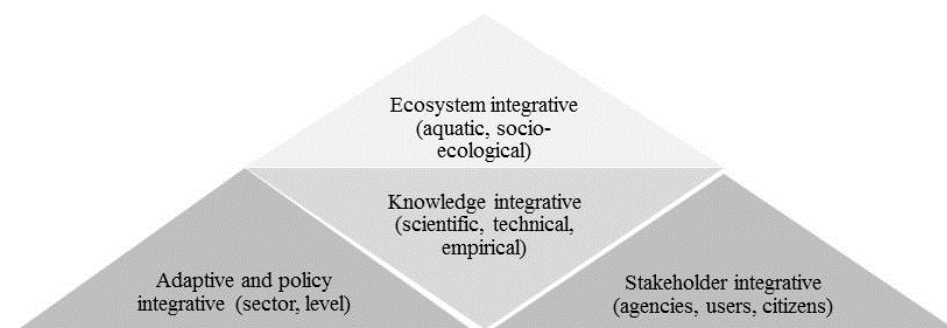
the protection of health benefits and ecosystem services supplied by aquatic ecosystems against the threats caused by frequent freshwater abstraction for human activities in estuaries. Despite the debate, it is usually concluded that “governance through bottom-up collaborative processes” is among the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

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

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

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

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



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

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

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

### 3. Theoretical Assumptions of Governance Models

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

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

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



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

#### 4. Methods and Information

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

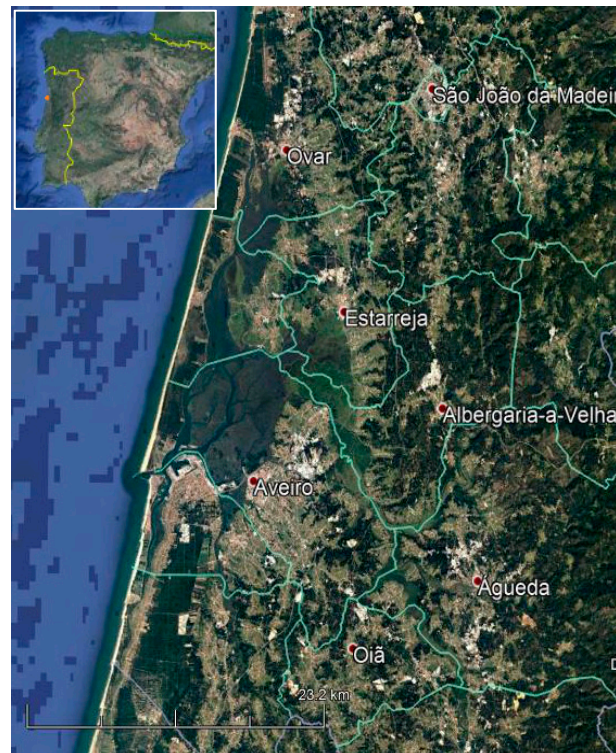
- a. Introduction to the main setting features of the case study area based on published literature and legislation on water resources governance in place;
- b. Identification of the main weaknesses of the current governance approach based on the legislation and focus group context;
- c. Identification and broad description of the alternative governance models based on the literature mentioned in Section 3 and on the analysis of the Portuguese legislation; and
- d. Assessment of the models, first, by identifying their major pros and cons, and second, by classifying them according to a set of governance factors obtained from the literature review [62], namely:
  - i. if they require major institutional reforms, i.e., new rearrangements or tiers of government, competences, and scope of responsibilities;
  - ii. if they require new practices, i.e., learning new skills and improving the pursuance of current responsibilities and related processes;
  - iii. if they are easily understandable by communities and likely to reinforce trust relationships;
  - iv. if they are adaptable and open to uncertainty, risk, and new decision-making processes;
  - v. if they are focused on the estuary as a spatial unit; and
  - vi. if they are capable of ensuring collaborative practices with all stakeholders.

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

#### 5. Assessing Alternative Governance Models for Ria de Aveiro

##### 5.1. Background Features

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



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

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

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

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

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

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

### 5.2. Current Major Governance Problems

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

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

- i. It is materialized in a complex, and often poorly articulated, network of policy objectives, plans, standards, and actions, dispersed by multiple entities with different affinities and closeness to the Ria de Aveiro.
- ii. The responsibilities for the management of the water and wetland area, one of the most important management components in the Ria de Aveiro, are currently assigned to the Portuguese Agency of Environment, IP, based in Lisbon, putting into question the principle of subsidiarity. The implementation of tasks through decentralized services is carried out with insufficient human, technical, and financial resources. In addition, successive institutional metamorphoses of public agencies responsible for water resources management, in particular at the regional level, have contributed to degrading trust levels between public administration and water resources users.



- iii. There are other relevant public agencies related to agriculture, fisheries, aquaculture, industry, spatial planning, navigation, or civil protection, which in the absence of an integrated reference framework to guide decision-making, lack coordination and cooperation and fail to deliver the necessary integrated governance approach.
- iv. Stakeholders' dissatisfaction with public administration has been quite evident. It also conveys a public perception that the lack of adequate management worsens the loss of value, not only environmental but also social and economic. In addition, the existing institutional mechanisms that would allow for more accountability and public participation are spread out in multiple procedures with few opportunities for a collective vision to be discussed and built in a consistent manner.

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

### 5.3. Assessment of Alternative Models

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

- i. The “centrally based compliance model” relies on the current governance framework, with the allocation of responsibilities to the various existing government agencies and associated procedures, but is enriched with an estuary plan, where goals and rules for the protection and use of the estuarine area are to be established.
- ii. The “municipal community-based compliance model” is based on the delegation of the current powers from the central government agencies to the Inter-municipal Community of Aveiro Region (CIRA). It would also be supported by a decision-making reference framework, i.e., an estuary plan (as mentioned in the previous model).
- iii. The “collaborative model” is based on a system of governance through the main users of Ria de Aveiro, equated by the creation of an association of water users. This model would require a decision framework plan built out of a collective building process.
- iv. The “multi-sector government agency model” is based on the creation of a new multilevel government agency with its own resources and autonomy, merging the different expertise and government responsibilities with particular relevance to the Ria into a single organisation. A decision-making framework plan would also be needed.

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

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

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

	<b>The Centrally-Based Compliance Model</b>	<b>The Municipal Community-Based Compliance Model</b>	<b>The Collaborative Model</b>	<b>The Multi-Sector Government Agency Model</b>
<b>Pros</b>	<ul style="list-style-type: none"> <li>- It facilitates the link to European and national water and nature conservation programs</li> <li>- It has fewer drawbacks on legal grounds, as it is the state defining the principles and rules to guide the decision-making</li> </ul>	<ul style="list-style-type: none"> <li>- It earns from the experience of inter-municipal collaboration</li> <li>- It is close to the lagoon, its problems, and challenges</li> <li>- It is close to the local users and to the regional authorities</li> </ul>	<ul style="list-style-type: none"> <li>- It responds to the conveyed willingness of users to participate in decision-making</li> <li>- It may be less sensitive to political cycles</li> <li>- It may address adaptive resource management</li> </ul>	<ul style="list-style-type: none"> <li>- It may simplify permitting procedures of uses in the estuary</li> <li>- It may join the best procedures from different agencies into the new institutional framework</li> <li>- It facilitates institutional cooperation</li> </ul>
<b>Cons</b>	<ul style="list-style-type: none"> <li>- It is unlikely to significantly change current rules in use</li> <li>- It is prone to gaps and rigidity problems which may hinder the necessary adaptive management required for strong environmental and economic dynamic contexts</li> </ul>	<ul style="list-style-type: none"> <li>- The delegation of powers from all the relevant agencies into Inter-municipal Community of Aveiro Region (CIRA) is unlikely</li> <li>- It does not assure effective institutional consultation</li> <li>- It requires a significant institutional capacity</li> <li>- It is vulnerable to political cycles</li> <li>- It requires significant supporting political</li> </ul>	<ul style="list-style-type: none"> <li>- It would not guarantee the inclusion of all relevant stakeholders</li> <li>- It would lead to a very complex collaboration process due to the wide variety of users</li> <li>- There is no experience with such collaborative practices</li> </ul>	<ul style="list-style-type: none"> <li>- It is unlikely under the political and administrative circumstances</li> <li>- It would raise legal and institutional difficulties</li> <li>- It would not guarantee, per se, the involvement of stakeholders</li> <li>- It would require high organizational resources</li> </ul>

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

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

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

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

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

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

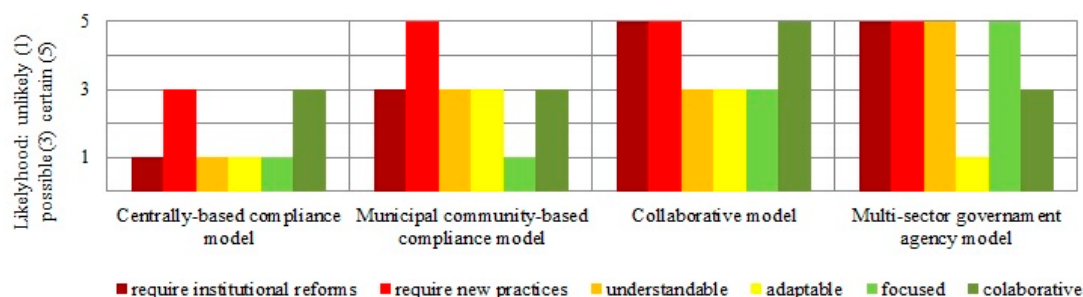


Figure 3. Comparative assessment of the alternative governance models.

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

## 6. Discussion

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

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



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

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

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

## 7. Conclusions

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

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

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