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Evidence integration for coherent nexus policy design: a Mediterranean perspective on managing water-energy interactions

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ABSTRACT

Nexus governance increasingly relies on using data to design policy measures. At the intersection of different policy fields, such as energy and water, data is seen to shed light on complex challenges and have the ability to measure both problems and solutions systematically. In order to analyze the challenges linked to data use in the context of nexus governance, we use a policy design lens and more specifically the perspective of organizational policy instruments to look at the Mediterranean region. We focus on how the design of organizational tools enables or impedes policy coherence and thereby the efficacy of data use. Addressing this question, we find that current efforts in the region largely satisfy one condition of coherence, which is coordination of different stakeholders, but lacks effective integration as the second component of achieving coherence. This implies that the organizational instruments outlined in the current context of the Mediterranean efforts are only a starting point for developments over time that require holistic thinking, strengthening coherence long-term as well as developing capabilities around nexus governance. Given these findings, we identify future research questions around the role of organizational policy instruments in contributing to the coordination of data-driven nexus policy mixes.

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1. Introduction

There is widespread use of quantification in contemporary governance processes. The popularity of using data to support, implement and assess the formulation of policy measures has also entered the realm of nexus governance. Nexus governance is described as governance that addresses complex linkages between multiple resources such as water, energy, and food. This concept is a response to widely implemented, sector-specific governance of natural resources and draws attention to the interdependencies between two or more sectors (Biggs et al., 2015; Hagemann & Kirschke, 2017). At this intersection of different policy fields, data is seen to shed light not only on defining complex problems, but also to more systematically measure the interactions of problems and solutions. However, recent studies show that this 'data optimism' is misplaced in that supporting evidence lacks generalizable and reliable indicators and is often incomplete or incoherent (Magagna et al., 2019; Voelker et al., 2019). Additionally, nexus governance research lacks a deeper analysis of the governance structures that enable cross-sector policy analysis and implementation (Hagemann & Kirschke, 2017; Leidel et al., 2012).

In order to make use of data from different sources in the public sector, inherent and deliberate coordination and integration efforts are required. In the policy sciences, these efforts are discussed through the

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literature surrounding modern policy design and its emphasis on policy coherence between the different elements of policy responses (Peters, 2021). This coherence is essential for the effective management of policy areas such as nexus contexts, which are interrelated in nature and require planning across countries, sectors and governance levels (Benson & Lorenzoni, 2017). The definition of policy coherence, however, remains contested due to multiple interpretations and measurements in the literature (Benson & Lorenzoni, 2017; Thomas, 2012). A widely cited definition that also applies to the vertical and horizontal context of this paper is the one by Velaquez Gomar et al. (2014), stating that coherence is a 'complementary action (mutual reinforcement), evident across the policy cycle, in terms of process, outputs and outcomes, at international and national scales'. This reinforces the notion that coherence contains vertical and horizontal policy interaction between multiple institutional levels (Nilsson et al., 2012; Benson & Lorenzoni, 2017). For this paper, these interactions are looked at through the lens of organizational policy instruments – and especially those instruments that are internal to government processes and that structure government's own administration. We pay attention to coordination and integration activities, as these tools are considered to be main factors for upholding policy coherence (Howlett & Rayner, 2007; Rayner & Howlett, 2009; Rogge & Reichardt, 2016). Such organizational tools can take the form of multi-ministerial committees on transboundary pollution, and other actions that affect the government's internal organization and contexts of policymaking (Howlett, 2019; Howlett & Mukherjee, 2020; Lægreid, 2018). A similar distinction exists in the policy coherence literature where the substantive approach is about changing policy content and the procedural about altering the policy process only (Tosun & Leiniger, 2017). And while procedurally oriented organizational policy tools have often been alluded to as the 'forgotten fundamental' of government's policymaking and administration activities (Salamon, 2002, Howlett, 2019), their presence is often taken for granted and without pointed analysis on how they enable coherence within complex sectors such as those embodied by the water-energy nexus.

To address this pertinent gap, this article offers a timely focus on this specific class of policy tools and their interactions as nexus-oriented policy design challenges necessitate major administrative changes for coherently combining intentional, planned policy instrument formulation with the management of rapid or unplanned developments in policy sectors such as water and energy. The design of such tools exemplifies a strong emphasis on matters related to government's managerial and analytical resources, as the sector and task differences of nexus situations can overwhelm attempts at coordination if they rely solely on applying standardized tools such as agencification (Christensen & Laegreid, 2013; Cettner et al., 2014).

Building on these fundamental considerations of instrument design, we target our discussion specifically on how the formulation of relevant organizational tools affect the responses that governments devise to data-related challenges of the water-energy nexus. We focus our observations on how these tools uphold coherence through the necessary integration of policy components and coordination between relevant policy stakeholders, in governing the combining of evidence. We pay particular attention to issues related to building data infrastructure and multi-level/multi-stakeholder structures of collaboration, which either enable or impede nexus data collection efforts. Thus, the main research question is: In policy mixes or 'toolkits' that govern the water-energy nexus, *how does the design of organizational tools enable policy coherence and thereby the efficacy of data use and analytics*?

To explore this question, the Mediterranean region is a fitting illustrative case, because it is one of the main climate change hotspots in the world, which is also undergoing intensive demographic, social, cultural, economic changes. Additionally, there are several stakeholders that have undertaken deliberate efforts towards evidence-based policymaking to address nexus challenges and collecting and analyzing data. In essence, national data is standardized, compared, and linked to a larger dataset with the goal of giving each government additional input on how to design policies going forward as well as streamlining coordination and data collection efforts across various countries and policy areas. Further, countries in the region are connected through effects of climate change on sea level rise or availability of fish for example, and this requires data meta-analyses that span individual countries in the Mediterranean. These analyses however encounter issues which are typical for data challenges across different policy sectors.

The analysis is based on a content analysis of technical and policy reports by the various stakeholders active in the Mediterranean Region, such as the European Environmental Agency, the European Commission, or the Union for the Mediterranean. Documents were chosen based on their focus on the data or evidence and organizational dimension of the research. The EU efforts for streamlining data collection in the Mediterranean Region in combination with organizational changes serves as an exploratory case for identifying challenges in quantifying nexus policy efforts from a policy design perspective. The Mediterranean Region case gives insights into how the multi-level, multi-stakeholder structures only 'patch' (Howlett et al., 2017) gaps for more complete and structured data collection efforts. The case also highlights a complex set-up in which any data collection efforts on nexus challenges need to navigate a plethora of stakeholders from the local level up to European stakeholders. This creates different abilities to engage and trust depending on who is involved in initiatives as well as the short- or long-term goals linked to it.

The following theoretical section, section 2, highlights the current debate on organizational policy instruments within the policy design literature in junction with the idea of policy coherence as well as outlines the mechanisms to facilitate coherence in a nexus setting. Section 3 describes the details of the Mediterranean Region by looking at the data collection and standardization efforts through common databases in combination with former and current organizational bodies aiming to streamline policy efforts around the water-energy nexus in this region. These aspects are picked up again in the analysis, section 4, where these elements are categorized as types of procedural organizational instruments, which points towards the fact that current efforts largely satisfy one condition of coherence, which is coordination of different stakeholders across the region, but lack effective integration as the second component of achieving coherence. The final and concluding section, section 5, develops future research questions based on these findings, pointing towards the design of procedural instruments as a prerequisite for having an impact on which nexus policy combinations receive support and whether there is merit to exploring the organizational structure of procedural policy means as explanatory factors of the content of resulting substantive policy.

2. Policy coherence in nexus governance: the critical role of organizational instruments

Coherence has often been depicted as a desirable, process-oriented characteristic of effective policy mixes and especially so in contemporary energy policy scenarios (Howlett & Rayner, 2007; Peters et al., 2018; Rayner & Howlett, 2009). For example, Rogge and Reichardt (2016), in their exposition of the term in relation to sustainable energy transitions, directly link coherence to the procedural elements of policy mix design. The authors define coherence as the 'synergetic and systematic policy processes [that] can be achieved through a number of structural and procedural mechanisms, such as strategic planning, coordinating structures and communication networks' (Rogge & Reichardt, 2016, p. 1626). Perceived as this effort to streamline diverse policy objectives towards a common goal, coherence, in this sense, addresses the deliberate effort by policymakers to create synergies across the governance of different policy domains and implicates the design and restructuring of relevant policy structures. The broader literature informing policy design further indicates that most of the tools for upholding coherence in policy mixes tend to be organizational (Bouckaert et al., 2003), with their main functions oriented towards supporting policy integration and coordination (Howlett & Rayner, 2007 Magro et al., 2014; Quitzow, 2015). Herein, 'the former can improve policy coherence by enabling a more holistic thinking across different policy sectors. In contrast, the latter can strengthen coherence by aligning the tasks and efforts of public sector organizations' (Rogge & Reichardt, 2016, p. 1627).

Beyond this definition, there have been various attempts over the years to define and develop the policy coherence concept (for an overview, see, e.g. Cejudo & Michel, 2017; Benson & Lorenzoni, 2017). Especially important for the multi-level context of the Mediterranean Region is the idea of vertical and horizontal policy coherence. Vertical policy coherence is referred to as the 'mandates, roles and interactions within the responsibility of one sectoral ministerial authority or within one policy domain' (Di Gregorio et al., 2017; Lafferty & Hovden, 2003). Complementary, 'horizontal policy integration refers to the institutional interactions across distinct sectors, or the 'extent to which a central authority has developed a comprehensive cross-sectoral strategy (Lafferty & Hovden, 2003, p. 14). Additionally, in this paper, we focus particularly on the coherence among

policy instruments, because the interaction of multiple policies or tools within the same 'toolkit' has been established as being fundamental to overcoming the limitations of environmental policy, as this line of enquiry directly answers the call to create greater complementarity and synergies between new and existing policy responses (Gunningham et al., 1998). Organizational instruments in particular, have been fundamentally linked to upholding coherence, especially in policy mixes linked with sustainability policy domains (Mukherjee, 2021).

2.1. Coherence among policy instruments

The emphasis on the choice of organizational policy tools in policy design studies resides fundamentally in understanding the government's activity of forming policy goals and matching these with the means or instruments to achieve them. Over the last decade, the literature on policy design within the broader studies of the policy process has articulated several key research emphases to directly understand the constraints of policy formulation such as finding the 'best fit' organizational structure in complex scenarios, which can effectively enable and deploy the most suitable policy tools (Peters et al., 2011). In the context of the water-energy nexus, these constraints have to do with the government's own organizational and administrative choices aimed deliberately at institution building. Relevant sectoral experiences note that, 'institutional inertia in both energy and water sectors can effectively lock out competing and more efficient options' (Unruh, 2000, p. 820) for managing the energy intensity of water use and vice-versa while tackling the challenges of evidence gathering, analysis and dissemination.

In exploring the design of water-energy nexus policy and its reliance on integrating data and evidence from two sectors that have traditionally functioned independently, organizational policy instruments within government become prominent, as the embodiment of the institutional developments that are needed for upholding coherence within emerging policy mixes. The link between governments' own organizational policy instruments and coherence in terms of policy design for nexus policy domains, as well as the terms themselves in the context of energy and water policy, warrant further elaboration. In short, 'coherence among *instruments* means that two policies can potentially contribute, by the way they are designed, to solve the same public problem with different tools' (Cejudo & Michel, 2017, p. 755).

Findings from existing water-for-energy or energy-for-water analyses have pointedly stated that the remaining knowledge and information gaps result from inadequate streamlining, reporting and analysis of data that simultaneously look at both directions of the nexus (WFE and EFW) or explore the implications of the nexus at multiple spatial scales of comparison (provincial, national and regional) (Chu et al., 2017). Some studies also call for a systematic nexus-oriented management system for regulating water and energy use at various jurisdictional levels for integrated management that 'encourage cross-sectoral collaboration, comprehensive feasibility analysis, and data-sharing' (Chu et al., 2019, p. 500).

Additionally, dedicated organizations for the effective synchronization of energy-water nexus management priorities at regional, national, and sub-national scales can be rare, and reflect a need for more decentralized and diversified means of governing the interconnectedness between these sectors, even though energy and water separately have tended to be governed as centralized systems (Villamayor-Tomas et al., 2015). The governance of water-energy interactions can entail a diversity of organizational choices that, for example, include merging data analysis and management operations of energy and water activities, or enhancing integrative training and skills-building at local levels, or imparting authority and autonomy to a new regulatory organization meant to specifically oversee nexus interactions. The choice between these organizational tools in response to the water-energy nexus can all implicate and depend on the government's endowment of various procedural resources for regulatory cooperation, participation of multiple stakeholders and monitoring the tradeoffs and impacts of alternative energy-water interaction scenarios (Scott et al., 2011; Villamayor-Tomas et al., 2015). The interaction of such instruments within policy mixes is a rapidly emerging body of research, and especially so in the area of energy transitions and sustainability policy (see for instance Del Río González, 2007; Philibert, 2011; Mukherjee, 2021; Rogge et al., 2017).

Bringing these elements together, Table 1 provides illustrative examples of procedural organizational tools in terms of how their main functions address policy integration and coordination.

Table 1. Main categories of procedural organizational policy instruments (Source: Based on Howlett (2019)).

	Upholding coherence in policy mixes	
Instrument type	*Supporting policy integration*	*Supporting actor coordination*
Network Management Tools	*Instruments for managing and structuring the participation and interactions of policy actors within a policy subsystem various policy actors surrounding a particular policy domain.*	
e.g. Tribunals, quasi-judicial bodies	X	X
New agencies or reorganization	*Allocation of organizational resources for institution building, change and management.*	
e.g, Institutional reform	X	X
Government Review	*Formal mandated reviews of legislation or government activity by congressional or parliamentary committees, supporting review of matters related to judicial or administrative conduct.*	
e.g. Ad hoc taskforces and commissions		X
Legislative and executive oversight agencies	*Independently functioning, specialized agencies. These units can be attached to legislatures.*	
e.g. arm's-length auditor-general	X	

Note: Additional examples from Howlett and Rayner (2007), Mukherjee and Giest (2020).

2.2. Evidence integration in water-energy mixes: data challenges

The inter-dependence of energy and water is a growing topic of concern as the demand for both resources are expected to increase in step with global population and economic development. That water and electricity use information and data are fundamentally linked, however, has become a policy realization only over the last few decades (Hamiche et al., 2016). Until the turn of the millennium, water and energy systems were traditionally analyzed independently of each other. As Siddiqi and Anadon (2011) review 'historically the per capita water resources in many countries were abundant and the economic sensitivities to variations in natural systems were low (or at least not well understood)' (Siddiqi & Anadon, 2011, p. 4529) making their inclusion in the modeling of sustainable energy use a rare and often absent phenomenon. Even within initial conceptualizations of the water, food, energy and climate nexus, such as those by the World Economic Forum (Waughray, 2011) water-food-trade was considered to be a 'sub-nexus' that is distinct from that on energy-climate. Furthermore, the integration of these into a 'grand nexus' concept took place without 'an accessible framework that identified the important key assumptions … or incentives that would bring together the two very powerful operational supply chains responsible for the way society was using its natural resources of water and energy' (Allan et al., 2015, p. 303).

Organizationally, the design of policy instrument mixes and programs dedicated to address energy security and water security have also tended to be separate. And this separation has perpetuated largely independent sources of data, analytical methodologies at disjointed spatial scales of enquiry. For example,

> most energy data of high temporal resolution [e.g. daily, or weekly scales] omit water use linkages entirely, whereas those that include information on water uses tend to be aggregated at annual scales and therefore do not capture spatio-temporal details e.g. seasonal variations, which are important for managing most water systems. (Larsen et al., 2019, p. 11)

While research on these challenges underscoring the information and data needs for sustainable water-energy nexus policy design are emergent, it warrants an equal emphasis on the necessary organizational choices that can enable this activity. While the acceptance of the 'nexus' conceptually has gained momentum in policy deliberations, from the perspective of policy design this area still lacks a direct attempt to formulate dedicated policy goals and policy instruments. The governance of the links that understandably occur across two sectors, are usually assigned to the one receiving the resources or service (ie. water or electricity) and tend to remain poorly coordinated (Rodriguez et al., 2018). As such, this exacerbates the challenges emerging from the nexus, especially in regions of the world where both energy security and water security form the backbone of national development plans that rely critically on, for example consolidating knowledge and data about, hydropower infrastructure or increased electricity trade. This is the case in parts of the Mediterranean whereby 'the appetite for regional dialogue is increasing. Nonetheless the capacity of regional institutions

mandated to tackle water and energy cooperation remains low and is undermined by limited trust between stakeholders' signaling the critical need for strengthening institutions that foster clearer coordination and cooperation (Rodriguez et al., 2018). A closer look at the case of nexus policy design unfolding in the Mediterranean region brings a clear empirical perspective on these various challenges.

3. Data efforts in the Mediterranean region

3.1. Mediterranean context

The Mediterranean Region is a unique case to explore the complex interactions of climate, environment, and human activity. 'Because of the latitude range it covers, the Mediterranean Region is a transition area under the influence of both the temperate mid-latitude climate and the hotter-drier North-African climate' (Ducrocq, 2016, p. 73). The region further has several mountainous areas while being split into two major basins (Western and Eastern) and major rivers that are strongly influenced by weather and climate conditions (Lacroix, 2016; Sicre et al., 2016). Studies show that the Region has tended to be warmer and drier during the last half-century. This trend will likely continue, resulting in increasing temperatures and decreasing rainfall, heat waves as well as longer, more intense, and earlier drought periods (Mouillot et al., 2016). At the same time, the population of southern Mediterranean Countries will almost double by 2050, 'thereby threatening the fragile balance between water availability and human demand, and, more specifically food security' (Jarlan et al., 2016, p. 304). Finally, researchers warn that looking ahead, there will an increased pressure on water, soil, plant, and animal resources, as climate change results in internal migration – especially on the Southern and Eastern shores of the Mediterranean where social inequality is high and poverty in rural areas is widespread (Charef & Dorai, 2016).

Regarding the intersection of water and energy in particular, the Mediterranean region is particularly vulnerable to 'over-allocation of natural resources, particularly water, which is already scarce to meet all sector demands' (Karabulut et al., 2019, p. 232). Issues revolve around 'water pollution and natural resource degradation to water scarcity, large amounts of food loss and waste and increasing demand for energy and food' (Markantonis et al., 2019, p. 1). There are further discrepancies between Mediterranean countries, which are exacerbated by rapid population growth in North Africa and the Middle East (MedECC, 2019). For water, summer rainfall is at risk of being reduced by 10–30 percent in some regions, and thereby worsening existing water shortages – ultimately causing loss in agricultural productivity. In junction with this, irrigation would have to be increased by 4–22 percent while competing with demands for drinking water production (Cramer et al., 2018). This has to do with a precipitation decrease, temperature increase and population growth (MedECC, 2019). In fact, freshwater availability is predicted to decrease by 2–15 percent for every 2-degree warming. This is one of the largest decreases in the world (MedECC, 2019). There is also evidence that points towards the fact that there is a 'wide range of illicit but tolerated groundwater exploitation practices in many Mediterranean countries, which are sometimes even encouraged by national authorities (Leduc et al., 2016, p. 330).

From a nexus perspective, there are trade-offs among the different dimensions – especially for policies around water and energy provision, which are highly regulated and known to have positive and negative externalities. One aspect of the link between water and energy is that of water cooling for a thermoelectric generation. Electricity-related water withdrawal in combination with water stress is observed in vulnerable basins, of which a majority lies in the Mediterranean region (Behrens et al., 2017). On the EU side, Behrens et al. (2017) find that 'basins in the Mediterranean show greater vulnerabilities, predominantly in Greece and Italy, despite decommissioning of generation in several of these basins' (Behrens et al., 2017, p. 3). Additional studies anticipate a decrease in rainfall, ranging between −4 and −27 percent for the countries of Southern Europe and the Mediterranean Region during the twenty-first Century (EIB, 2008).

In this context, a key barrier to the implementation of the WEF nexus that has been identified is the 'absence of precise and uniform data for the whole Mediterranean region' (Markantonis et al., 2019, p. 6). Measures are needed to model climate change developments both across the Region as well as for specific

urban and rural environments. For this, Mediterranean countries rely mostly on (European) public organizations for modeling regional climate models, or on collaborations with climate services. Currently however there is an 'inadequacy of data recorded by conventional networks' (Briche et al., 2016, p. 446) and comprehensive and relevant data sets, methods and objectives are still missing (Lacroix, 2016).

As highlighted in earlier sections, the institutional setting plays a role in managing policy instruments. 'Appropriate structures and procedures need to be instituted at and between different levels of government so that information can be exchanged, and action coordinated' (Kassim & Le Gales, 2010, p. 15). For data collection efforts this is increasingly relevant because this requires wide-ranging coordination across governance levels and national institutions. Below the organizational setting is laid out, followed by the data-focused efforts in the Mediterranean Region with the goal of combining efforts.

3.2. Organizational setting

There are long-standing efforts to protect the ecosystem in the Mediterranean region. Over 40 years ago, this started with the Mediterranean Action Plan (MAP), followed with the Barcelona Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean and its Protocols, as well as the Barcelona Process (EuroMediterranean Partnership (EUROMED)). In 2008, these efforts were re-launched with the Union for the Mediterranean (UfM) (EEA, 2014). The UfM can be described as an intergovernmental Euro-Mediterranean organization which brings together all countries of the European Union and 15 countries of the Southern and Eastern Mediterranean. This includes governments, local authorities, international and regional organizations, international financial institutions and donors, universities and think tanks as well as civil society groups and the private sector. Together with the 27 EU member states, the Union consists of 15 Southern Mediterranean countries: Albania, Algeria, Bosnia and Herzegovina, Egypt, Israel, Jordan, Lebanon, Mauritania, Monaco, Montenegro, Morocco, Palestine, Syria (suspended), Tunisia and Turkey. Libya is an observer. The main goal is to provide a forum to enhance regional cooperation and dialogue, as well as the implementation of concrete projects and initiatives with tangible impact on the citizens of its Member States. UfM further strives to bring together the latest scientific studies and data available at the regional level to develop common responses to core issues in the Mediterranean (UfM, 2019). To promote data collection and knowledge creation, UfM supported the launch of several research networks, among them the PRIMA, BlueMed and the International Center for Advanced Mediterranean Agronomic Studies (CIHEAM) or the Food and Agriculture Organization of the United Nations (FAO) (UfM, 2019). Another initiative by UfM in collaboration with Plan Bleu that is specifically aimed at compiling relevant information for the region are the efforts by MedECC (Mediterranean Experts in Climate and Environmental Change), who aim to 'synthesize existing scientific knowledge across disciplines' and 'provide a better understanding of the combined risks' (MedECC, 2019, p. 4).

There is also PANORAMED, which is a governance platform that supports the process of strengthening and developing multilateral cooperation frameworks in the Mediterranean region for joint responses to common challenges and opportunities – this applies to horizontal links among countries for joint actions as well as vertical coordination between transnational strategies and frameworks. One of the main objectives is to enhance institutional capacity of public authorities and stakeholders to implement macro-regional strategies and sea-basin strategies, as well as other territorial strategies (Panoramed, 2020). A goal that is mentioned throughout the recent report by Panoramed (2020) is that of data sharing and harmonization. The report further recognizes 'that providing standardized and open data information exchange is currently inefficient within the Mediterranean countries' (Panoramed, 2020, p. 20).

There are additional initiatives from other backgrounds that have been created in the Region, such as the Center for Mediterranean Integration (CMI), Global water Partnership-Mediterranean (GWP-Med) or the Association of Agriculture Research Institutions in the Near East and North Africa (AARINENA). On top of dedicated organizations and centers, there are several cooperative initiatives, such as the UNEP Mediterranean Action Plan (UNEP-MAP), the Protocol on Integrated Coastal Zone Management (ICZM Protocol) or the Regional Activity Centre of the Priority Actions Programme (PAP/RAC).

In this multi-level and multi-stakeholder setting, the level of engagement and trust in and among stakeholders varies significantly, which can impact data sharing practices. The individual nexus dimensions, such as water, food or energy are assigned to individual ministries, which hampers both communication within countries as well as with European level institutions – this also applies to gathering and combining data (Markantonis et al., 2019). 'At national level data necessary for the regional indicators are stored in several databases which sit in different ministries or institutes' (EEA, 2014, p. 22). In addition, data is retained at different administrative levels and within different institutions that might also limit access to datasets (EEA, 2017). Each country as well as governmental agency further pursues their own strategic goals, which might hamper data sharing practices. For example, concerns around a gap between the stakes perceived by local actors and the stakes scientists perceive as being linked to climate change led to non-participation of countries in climate adaptation studies (Eakin et al., 2007; Faysse et al., 2014). Actors also work in different time horizons for data analysis and strategy formulation. While an economic perspective puts emphasis on short-term developments, climate change simulations generally cover a period over 50–100 years. To summarize, when they are short-term needs, it is a challenge for local actors to discuss long-term plans. 'For these reasons, climate change and even climate variability may not be a key issue for actors involved in the economy and governance of local territories' (Faysse et al., 2014, p. S58).

3.3. Organization of data collection efforts

Given these differences, the following sections zoom in on data collection efforts from the perspective of coherence.

With the goal of 'informed decision-making' (EEA, 2017, p. 9), a collaboration of EU and United Nations stakeholders set up data procedures and databases. To monitor progress and make impact assessments, data is streamlined and combined from different countries located in the Mediterranean Region as well as from different policy sectors. Whereas the 'country contributions have proved to be an efficient capacity building approach and a useful tool to assess main environmental drivers and pressures at national level' (EEA, 2017, p. 5), production of reliable data and regular monitoring has been a challenge. 'For most of the countries there is a lack of access to data and information which is a constraint when producing indicators' (EEA, 2017, p. 9).

Several databases have been created with the goal of combining data. The main process is described as providing members of the Union for the Mediterranean (UfM), an intergovernmental Euro-Mediterranean organization, with web-based tools and applications for uploading data into existing databases, such as 'Reportnet'. This system has been operational since 2002 and contains tools to assist countries in reporting data and information as well as keep track of reporting obligations (EC, 2018; EEA, 2017). Some of the key aspects include the Central Data Repository, which provides a web interface to support the reporting institution in uploading files as well as offering quality control feedback. The Content Registry provides access to information that go beyond the individual country that is reporting. It has a registry of metadata and provides information on this. Finally, the Data Dictionary, as the name suggests, stores technical specifications of data requested in the obligatory reports.

This process applies to data sharing that is obligatory. Countries have numerous reporting obligations that involve a variety of international, national, and regional institutions. Since this data is already uploaded and streamlined at the European level, a Mediterranean Data Repository (MDR) was set-up in that environment. This is a way to create a virtual storage space for data specifically pertaining to this region. 'The Mediterranean Data Repository is like a bookshelf, with data on the environment as submitted to international clients, e.g. to the Barcelona Convention' (EIONET, 2020). More importantly, the database standardizes data and makes reported information searchable for both individual countries as well as European decision-makers. In addition, there is the Shared Environmental Information System (SEIS) and the Mediterranean Information System on Environment and Development (SIMEDD) through EEA that have the goal of setting up a uniform database for water related initiatives (Markantonis et al., 2019).

This procedure of countries uploading information in specific formats while also having access to a large database and receiving quality checks and guidance on data collection however comes with challenges. From the European side, the EEA points towards issues where 'the adoption and use of international standards for the production of statistics still requires additional capacity building efforts and coordination among national institutions to ensure an effective improvement in the data production' (EEA, 2017, p. 9). To support coordination efforts, Reportnet and the sub-group of the MDR have the goal of building a national network for reporting which is done by identifying and nominating responsible persons in each country for providing data. The nomination of so-called 'data reporters' has the effect that a position within each country is created that is responsible for data sharing, it creates coherence in how data is reported and a key contact for any questions on the European side (EEA, 2017). As Voelker et al. (2019) point out these are crucial pre-conditions to quantify issues that policy wants to address. Technical and administrative infrastructures need to be in place that allow for data collection and processing, including the development of methods and the training of a skilled workforce. At the same time, such procedures become a 'sticky' guideline as to how data collection and reporting is taking place and become consequential in how countries and regions think about their metrics and modes of governance (Rottenburg et al., 2015; Voelker et al., 2019).

Despite reporting obligations in place, countries provide information at different points in time, for example only uploading data every two to three years. Existing databases further have existing classifications that limit the ability to create (meta-) data on issues pertaining to the intersection of policy sectors. For example, the Eurostat database only has information regarding water abstraction of water employed for electricity generation-cooling. Cooling of power plants is indeed expected to account for the majority of water used by the energy sector, but this, at the same time, provides 'incomplete estimation of energy sector water abstraction, since processes such as fuel extraction and oil refining are not specifically accounted for' (Magagna et al., 2016). As a result, it is challenging to design policies based on this information given that 'incomplete information about how energy and water interact at different scales means that policies … designed to increase efficiency in one sector may be creating additional demand in the other sector' (Magagna et al., 2016).

To summarize, these efforts to set-up data infrastructures, harmonize data collection and analysis as well as sharing practices by the different stakeholders outlined above, 'the results of this research remain often not easily accessible to policymakers' (MedECC, 2019, p. 21). Oftentimes existing assessments only cover part of the region and address specific areas of concern such as droughts or ecosystems. Given the wide set of stakeholders, knowledge generation is not sufficiently coordinated at both country and regional level and data not properly integrated. 'Even the current large research effort leaves significant parts of the region without adequate information' (MedECC, 2019, p. 21). This is in contrast to existing and legally binding set of instruments, for example by the MAP-Barcelona Convention system and a variety of strategic and planning documents. What comes from many of the reports is that collaborative efforts lack coordination and integration of data and knowledge on regional challenges – especially those that go across specific research areas, such as water.

4. Discussion

The research question posed in this paper captures a key aspect of policy design studies: how do different policy tools working towards the same goal interact and influence each other? In the nexus case explored herein, the focus is on the design of governments' own organizational instruments and how they work together to maintain or enhance coherence within emerging policy mixes. The case reiterates the concerns raised in the literature on the critical role of procedural instruments in complex policy contexts, and their contributions towards building institutions through the design of organizational policy instruments. The multi-level, multi-stakeholder structures show initiatives at different government levels as well as targeting different groups of countries located in the Mediterranean Region. These efforts, or what the literature calls 'patches' (Howlett et al., 2017), create an additional layer in an already complex institutional set-up. In addition, some of them are limited to a certain timeframe to set impulses. Taken together, this creates a complex set-up in

which any data collection efforts on nexus challenges need to navigate a plethora of stakeholders from the local level up to European stakeholders. This also creates varying levels of engagement and trust depending on who is spearheading certain initiatives as well as the short- or long-term goals linked to it. Local needs might diverge from European goals, which has effects on the willingness to devote resources to collect and share data. In short, different levels of government and stakeholders follow their own timelines and goals. Data collection is influenced by this and leads to incomplete data sets as well as gaps in information on specific countries or localities. Not to mention the difficulty of distilling relevant policy information from this diverse set of information. In other words, as May et al. (2005) describe it, these efforts are often populating policy space without integration.

Upon closer inspection, the organizational structure, and the fit of the current management of both the knowledge base and the stakeholders, we find that there are ambitions in the Mediterranean Region to overcome knowledge gaps by streamlining data infrastructures and reporting procedures. This is done by setting up reporting structures and timelines as well as communicating this to relevant stakeholders in the Region. However, this active integration of data lacks parallel and effective integration of stakeholders. While there are regional and European level efforts to organize actors in different types of transnational networks, the time horizons of planning, the levels of engagement as well as abilities to contribute, differ across countries. Going back to the definition of policy coherence used here, which states coherence can be achieved through structural and procedural mechanisms (Rogge & Reichardt, 2016), the Mediterranean Region is currently more 'component-driven' (May et al., 2005). This means that the focus on data collection made only partial coordination and integration possible by creating mostly data infrastructure and attention to data collection by multi-purpose organizations, such as the Union for the Mediterranean. In other words, of the two components of policy coherence, integration and coordination, effective integration, is currently still lacking.

In essence, there is a cyclic development, where the EU is pushing these countries to provide data on a regular basis and in specific formats to provide them in return with impact assessments, innovative indicators, and meta-data on the ongoing policy initiatives. This however only works if such data is being collected and uploaded. Further, meta-analysis type of information is that 'large-scale assessments are typically not focused on certain sectorial audiences or specific decision-making venues' (Waylen & Young, 2014), which means that identifying specific nexus issues is more difficult. As highlighted, there is a distinction between compulsory and voluntary data. To tackle challenges arising at the intersection of water and energy for example, these would need to come together in order to have a more complete picture of developments in the region at large and individual countries and regions. Along similar lines, a recent report points out that 'often stakeholders do not need raw data, but meaningful indicators and knowledge which should be obtained by appropriate elaboration and interpretation of data' (Panoramed, 2017, p. 18). This indicates that to improve the nexus governance framework that covers data from different geographic areas and scientific fields, there is a need to integrate and harmonize existing information and expertise, 'as well as the enlargement of the ownership and community feeling among a variety of players and stakeholders across different regions and institutional levels' (Panoramed, 2017, p. 18). This points towards the fact that the underlying multi-level and multi-stakeholder structure is a bottleneck for providing a broader data and knowledge basis for nexus policies. This is a challenge due to a crowded stakeholder field that exists in a multi-level and trans-national setting. Table 2 summarizes this by linking current instruments in the Mediterranean Region to integration and coordination.

Table 2. Organizational policy tools and coherence implications for data integration in the mediterranean water-energy nexus.

Organizational policy instrument		Implications for coherence	
Instrument type	Instrument	Integration	Coordination
Network management tool	Joint databases and reporting structure e.g. Reportnet, MDR or SIMEDD	x	
Establishment of a new unit	Establishment of the Union for the Mediterranean	x	x
	Governance platform PANORAMED		x
Ad hoc taskforce/commission	Actions Plans and Protocols, such as UNEP-MAP, ICZM or PAP/RAC		x

In Table 2, the Union for the Mediterranean stands out, because it contributes to both integration and coordination due to its linkages across a diversity of stakeholders, such as local and civil society groups, universities, and private companies, as well as the efforts around integrating data collection and knowledge creation. In other words, striving for synergetic and systematic processes that are facilitated through planning, coordination, and communication. There is further an emphasis on infrastructure development for data collection and thereby neglecting additional factors relevant for creating joint data bases, such as skill development in individual countries as well as standardized data collection. These changes do not solve the nexus challenges in the Mediterranean Region, but they overcome fragmentation of government action (Cejudo & Michel, 2017). Additionally, each of these efforts advance at a different pace. While setting up data platforms can be done more short-term, facilitating data skills at local level, and integrating data collection efforts with individual ministries is much more long-term.

Another aspect coming out of the case is that short- and long-term effects of nexus challenges are at times at odds. When they are pressing short-term needs – economic or otherwise – it is a challenge for local actors to discuss long-term plans linked to water-energy nexus calculations. This results in local actors being unwilling to invest resources into data collection. Additionally, even if there is willingness to do so, there is a lack of regional capacity and skills to take on data reporting. Capacity of regional institutes mandated to tackle water and energy remains low and is potentially further challenged by a lack of trust among responsible stakeholders (EEA, 2017). Capacity challenges also stem from the technical and administrative infrastructures in place. Water, food, or energy are the responsibility of separate ministries, hampering both communication within countries as well as with European level institutions.

5. Conclusion

To summarize, we utilize the extended exposition of coherence in policy mix design in combination with a discussion of procedural organizational policy instruments (Howlett, 2019) to highlight challenges for data use in the context of nexus governance in the Mediterranean Region. Thereby, we zoom in on the characteristics of coherence, which is depicted as the synergy and synchronicity between the processual elements in policy design (Rogge & Reichardt, 2016), and subsequently highlights how procedural policy tools are fundamental to upholding coherence in nexus policy design through deliberate efforts at policy integration and coordination of nexus policy mixes. For data-related considerations coupled with organizational questions specifically, we find that there is a need for coordination of technical capabilities as well as a long-term need for sustained political support for a systemic coordination of sectors. As such, while technical coordination needs can address time-sensitive issues or short-term priorities, in the longer-term, greater political support may be critical to sustaining sound nexus policy design. In fact, systematic capabilities are needed for the ability of policymakers and organizations to assemble related knowledge from diverse sources and to build networks and engage with multiple stakeholders (Quitzow, 2015; Rogge & Reichardt, 2016). This implies that the organizational instruments outlined in the current context of the Mediterranean efforts are only a starting point for developments over time that require holistic thinking, strengthening coherence long-term as well as developing capabilities around nexus governance.

This line of thinking provides several interesting research questions going forward for both the policy design literature that has, until now, looked very nominally at procedural policy tools (Howlett & Mukherjee, 2021), and also the literature on nexus policy that is motivated to investigate how different policy elements can be carefully combined to create necessarily new policy mixes to govern the interaction between sectors that have traditionally been managed independent of each other. In this light, can the design of prerequisite procedural instruments have an impact on which nexus policy combinations receive support? And is there merit to exploring the organizational structure of procedural policy means as explanatory factors of the content of resulting substantive policy?

Such questions examining the operationalization of organizational variables for policy design are well aligned with emerging research priorities in policy formulation studies. As has been argued recently by Egeberg and Trondal (2018) in their exposition of the organizational variables of governance, and in a subsequent

discussion of the organizational implications of policy design (van Buuren et al., 2020), this link between organizational characteristics and the delivery of policy has remained mostly descriptive in the contemporary literature on policy design. With the exception of the instrumentation stream of the policy design studies (e.g. Capano & Howlett, 2020; Hood & Margetts, 2007) and more recently within the discussion of dedicated policy mixes of energy transitions and sustainability (Kern et al., 2018).

Disclosure statement

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