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# Designing policy mixes for the sustainable management of water resources

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## ABSTRACT

Today's complex policy problems are strongly characterized by interdependencies across sectors. Such interdependencies hamper the sustainable management of natural resources such as water. The protection of water resources exhibits manifold interlinkages, often with energy and food policy. Interdependent policy problems entail trade-offs across policy sectors and therefore present decision-makers with a major challenge. In order to address this, the design of sustainable policy mixes should produce synergetic effects that contribute to both the protection of water resources and achieving the objectives of other interlinked policy sectors. However, it remains unclear why some policy mixes show significant flaws that prevent the achievement of sustainable outcomes. The contributions of this special issue step into this research gap and aim to explain variation in policy mixes and their contribution to sustainability.

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## Introduction

Global transformations, such as climate change, population growth, intensified agriculture and economic development, are putting water resources under increasing pressure (Flammini et al., 2014; Kosow et al., 2022; Richards & Padfield, 2016). Protecting these resources has been difficult due to manifold interlinkages with other essential resources, including energy and food. In fact, these interlinkages pose complex cross-sectoral policy problems, often entailing trade-offs. This makes it challenging for decision-makers to achieve water resource sustainability (Edelenbos et al., 2015; Kirschke et al., 2017; Tosun & Lang, 2017; Veraart et al., 2010; Weber et al., 2011), which means preserving water resources and their services in a way that meets the needs of humans and environmental ecosystems at present and in the future (Mays, 2007, p. 4). Water resource sustainability crucially depends on other policy sectors, either for the use (e.g., agriculture, industry) or the protection of the resource (e.g., forests, land use, soils). Policy solutions to achieve water resource sustainability need to span across policy sectors in a coherent manner in order to avoid conflicts between sectors and make use of synergies. Hence, these policy solutions necessitate the integration of water with other policy sectors, in particular livestock farming, crops and energy production (Hering & Ingold, 2012; Lane-Miller et al., 2013; Visseren-Hamakers, 2015), and require the elaboration and adoption of appropriate *policy mixes* (Bryan & Kandulu, 2011; Howlett et al., 2017; Howlett & Rayner, 2007; Kern et al., 2019; Milhorange et al., 2020; Rogge & Reichardt, 2016).

We argue for a broader conceptualization of policy mixes that goes beyond packages of policy instruments (Howlett & del Rio, 2015; Kern et al., 2019; Rogge & Reichardt, 2016). This broader conceptualization incorporates three levels of policymaking – policy goals, policy instruments and the design features or calibrations

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of instruments – and their interlinkages (Hall, 1993; Howlett & Rayner, 2007; Rogge & Reichardt, 2016). Policy goals refer to the ends and general aims formulated by decision-makers within a policy subsystem that a policy is to achieve. Governments employ policy instruments or policy tools to attain policy goals (Howlett, 2005; Howlett et al., 2017). Policy instruments can be defined as the means (e.g., environmental taxes, emission standards) governments apply to make public policies effective (Howlett & Rayner, 2007). The calibration or design features of instruments can involve several aspects that influence the impact of the policy mix, such as instruments' stringency, predictability, flexibility or durability (Jordan & Moore, 2022; Rogge & Reichardt, 2016). In order to achieve sustainable outcomes, the elements of policy mixes should be calibrated in a way that produces supplementary or synergetic effects which contribute to both the protection of water resources and achieving the objectives of other interlinked policy sectors.

In reality, policy mixes evolve incrementally over a long time period and often do not follow a unifying overall goal (Howlett & Rayner, 2007). In this case, policy mixes can be conflicting and produce counterproductive effects, leading to unsustainable outcomes (Capano & Howlett, 2020; Howlett & Cuenca, 2017; Rayner et al., 2017). Hence, we ask the following research questions, which guide the papers in this special issue: *What characterizes sustainable policy mixes that achieve water resource sustainability? What policy mixes have been adopted to integrate water protection policies with other policy sectors? What factors contribute to attaining sustainable policy mixes and what barriers exist?*

Sustainable management of water resources is challenged by numerous cross-sectoral policy problems (Ingold et al., 2016; Koebele, 2019; Metz & Leifeld, 2018; Möck et al., 2022; Schaub, 2019; Tosun et al., 2020; Tosun & Leopold, 2019; World Economic Forum, 2011) and, therefore, represents an insightful laboratory for exploring the emergence, design and change of policy mixes. The papers in this special issue provide rich empirical insights into policy mixes covering different cross-sectoral problems in various countries (e.g., Costa Rica, Denmark, and Germany) and under different institutional and socio-economic conditions.

## Policy mixes for water resource sustainability

What distinguishes policy mixes that achieve water resource sustainability from those leading to unsustainable outcomes? When studying policy mixes and especially to what degree they are designed to deliver sustainable outcomes, it is crucial to evaluate how goals, instruments and their calibrations interact with each other. First, it is important that related *policy goals* are *coherent*, meaning that they align with each other and can be achieved without significant contradictions (Howlett & Rayner, 2007; Rogge & Reichardt, 2016). In terms of water management, the protection of water resources needs to be harmonized with other goals, such as food or energy security. In fact, deficient integration with other policy sectors represents a main obstacle for the protection of water resources. One of the primary issues with implementing the EU Water Framework Directive to protect water resources in Europe is its lacking alignment with the agricultural sector, especially with the EU Common Agricultural Policy's policy goal of intensified agricultural production (Möck et al., 2022; Zingraff-Hamed et al., 2020). Not only enacted policy mixes but also the policy positions of political parties suffer from a lack of sectoral integration. In Germany, for example, most political parties fail to address water protection and agriculture in an integrated way in their manifestos, potentially contributing to the persistence of incoherent policy mixes (Schaub, 2019). Another example concerns water quantity, as the current EU policy mix addressing drought and water scarcity in Europe has been found to be inefficient because it lacks integration with many affected sectors (Stein et al., 2016). Second, a policy mix's *instruments and calibrations* should be *consistent* in that they function together to attain their policy goals without any significant counterproductive effects. Ideally, the instruments of a policy mix reinforce each other and have a synergetic effect toward achieving their ends (Howlett & Rayner, 2007; Kern & Howlett, 2009). Pakizer et al. (2020) investigate policy mixes related to the establishment of more resilient and resource-efficient water management systems. The authors conclude that informational instruments were key to linking substantive and procedural instruments, which proved to be crucial for successful policy reforms. Kosow et al. (2022) study water management in Lima, Peru, and find that the existing policy mix is inconsistent due to detrimental (side-)effects of its policy instruments. Third, the *overall policy mix* needs to be *congruent* in that the instruments and their

calibrations contribute to achieving the policy goals in a mutually supportive way, without creating contradicting effects or prioritizing some goals over others (Kern & Howlett, 2009; Rogge & Reichardt, 2016). One empirical example for an incongruent policy mix in the area of water management is provided by Howlett and Rayner (2004). In the case of aquaculture in Canada, the authors show how traditional regulatory policy instruments were coupled with economic instruments to form an instrument mix that turned out to be inconsistent. In addition, the policy objectives of environmental protection and protection of habitat for wild fisheries were in conflict with those of industrial aquaculture development. As a result, ambitions to address the issue effectively and attain the different policy goals failed (Howlett & Rayner, 2004). Finally, a *policy mix* should be *comprehensive* in that it does not neglect any crucial market, system or institutional failures responsible for the persistence of a policy problem (Rogge & Reichardt, 2016).

Empirically, most policy mixes have not been designed in a single point in time but have evolved incrementally over a long time period without following a unifying overall approach or aim (Howlett & Rayner, 2007). As a result, these policy mixes tend to be characterized either by ‘drifting’, where policy goals are coherent but the instruments inconsistent, ‘conversion’ where the instrument mix is consistent but the goals are incoherent, or ‘layering’ where both the goals are incoherent and the instruments inconsistent. These are likely to lead to unsustainable outcomes because of conflicts in goals or mutually interfering policy instruments (Howlett & Rayner, 2007). In fact, decision-makers are mostly confronted with the need to harmonize elements of policy mixes in the face of new policies being adopted over time and growing policy portfolios (Bolognesi et al., 2021; Metz & Glaus, 2019).

### Theoretical approaches to explaining differences in policy mixes

While public policy scholars have made significant progress in conceptualizing and describing elements and interactions within policy mixes and their relation to sustainability transitions, there is still a lack of theoretical approaches that explain variation in policy mixes and, in particular, why some policy mixes show significant flaws that prevent the achievement of sustainable outcomes. The Institutional Resources Regime (IRR) theorizes about the sustainable use of natural resources, and water in particular, arguing that a precondition of sustainability is both a sufficient amount of regulation (extent) and policy mixes that are coherent within and across policy sectors (coherence) (Gerber et al., 2009). Thereby, the IRR offers a compelling explanation as to why policy mixes often remain in a weakly or non-sustainable state: because more policies are being added over time but remain poorly integrated. Based on the IRR, Bolognesi et al. (2021) analyze long-term dynamics of policy (dis)integration. They argue that policy mixes run into an Institutional Complexity Trap (ICT), where various interdependent issues are already regulated and adding new policy instruments creates inevitable incoherencies with the pre-existing policy mix. Empirically, the authors show that even if coherence cycles exist, where policies are abolished or adapted to become more coherent, these cannot overturn the long-term, structural process of an ICT. Such insights highlight that policy mixes are the result of policy processes, but further theorizing about the politics of integration is necessary, such as on the power balance between societal and political actors, institutions or structures in public administration (Rogge & Reichardt, 2016).

With regard to policy issues that are strongly characterized by cross-sectoral overlaps, such as the protection of water resources, *interests and power structures* are expected to have a decisive impact on the design of policy mixes, particularly on the coherence of policy goals (Abazaj et al., 2016; Daugbjerg, 2019; Daugbjerg & Swinbank, 2016). On this, we can draw from literature on policy integration (see, e.g., Nilsson & Persson, 2003; Tosun & Lang, 2017; Trein et al., 2021). Earlier findings suggest that an unequal representation of interests is a barrier to the integration of policy goals. With regard to environmental pollution, polluters with economic interests often have better access to policymaking processes than do entities with environmental interests, which contributes to environmental goals being less pronounced and less integrated with other goals such as agricultural productivity (Hertin & Berkhout, 2001; Nilsson & Persson, 2003).

This perspective further emphasizes that stakeholder participation per se does not necessarily lead to sustainability or to solving wicked environmental problems, as Kirschke and Kosow (2022) argue in this special

issue. Rather, it depends on how participatory processes are structured and whether they overcome existing power imbalances that have contributed to unsustainable outcomes in the past. Vito et al. (2020) provide an empirical example by comparing how England and Scotland involved stakeholders in the process of formulating policy mixes intended to reduce diffuse pollution from agriculture. By showing how Scotland, in contrast to England, was more successful in integrating the objectives of different stakeholder groups, the authors point to the impact of different governance arrangements when looking at interests and power structures.

In fact, studying variance within governance arrangements and corporatism (i.e., whether states or other units of analysis differ in established structures of influence through industry associations or NGOs) should further help to develop a theoretical link between interests and power structures and the level of coherence and congruence of policy mixes (Finnegan et al., 2021). There is reason to assume that countries with pre-existing, strong ties to industry associations are less likely to develop coherent and congruent policy mixes, leading to less sustainable water resource management. The network approach might be useful when analyzing the link between interests and policy mix characteristics. For instance, Nielsen and Pedersen (2022) argue in this special issue that it is important to look at the characteristics of networks that involve government agencies and interest groups. Existing strong sectoral networks are expected to dominate policymaking and make significant changes to the established approach, such as integrating policy goals, less likely (Daugbjerg, 2018). Especially if affected policy sectors are all characterized by strong sectoral networks, it should be less likely that these work toward an integration of policy goals and instruments and instead contribute to the sustained incoherence of a policy mix. On the other hand, the establishment of new, cross-sectoral networks should improve the chances of developing congruent policy mixes (Jordan, 1990; Nielsen & Pedersen, 2021). Finally, political parties as the central actors in policymaking can be expected to play a decisive role in the development of policy mixes and to what degree these integrate environmental goals with other policy goals. Especially the presence of green parties in parliament and government should contribute to more coherent policy mixes and the sustainable management of water resources (Schaub, 2019). The relevance of green parties in parliament is also highlighted in this special issue by Vogeler et al. (2022), who study their impact on antimicrobial resistance policies in several European countries.

*Institutions* play a decisive role in the policy process and may help to explain differences in policy mixes (see, e.g., Domorenok et al., 2021; Trein et al., 2021). One relevant aspect are the existing rules of policymaking. Nilsson and Persson (2003) suggest that a decision style characterized by collaborative problem-solving rules, as opposed to rules dominated by a bargaining mode, should contribute to more coherent policy mixes. An analysis of institutions should further investigate the link between policy mixes and governments and government agencies. For instance, the timing of involvement in policymaking might have an impact on the integration of environmental goals. Often, environmental ministries are involved in policy formulation at a later stage than others, resulting in environmental goals suffering from a structural disadvantage (Hertin & Berkhout, 2001; Nilsson & Persson, 2003). Regarding the rules of decision-making, there is evidence that conflicts between ministries tend to be resolved in a bargaining mode that promotes inefficient outcomes, for instance, the ‘parallel implementation of contradictory policies or costly end-of-pipe solutions’ (Nilsson & Persson, 2003, p. 343).

Differences in the characteristics of public administration, such as centralized control of funding, degrees of autonomy and discretion, levels of administrative cohesiveness or institutional path dependencies, can also be linked to variation in policy mixes (Kirsop-Taylor et al., 2022). Vogeler et al. (2022) argue in this special issue that higher degrees of executive capacity and interministerial coordination should be conducive to developing coherent policy mixes (see also Domorenok et al., 2021; Schmidt, 2020). Finally, the degree of politicization in public administration may have an impact on the design of policy mixes. In fact, highly politicized administrations can be a barrier to policy reform (e.g., toward stronger integration of policy sectors), especially if the majority of political interests within the administration is not in line with the government that initiates the policy change (Trein et al., 2021).

## Overview of the contributions

With the aim of enhancing our understanding of the design, barriers to and drivers of sustainable policy mixes, the contributions of this special issue focus on cross-sectoral policy problems in the area of water management.

Nielsen and Pedersen (2021) shed light on social networks in the context of biogas policy in Denmark. They show how the cross-sectoral character of biogas promotion – and the diverging challenges it poses for the policy subsystems involved, especially water, agriculture and energy – contributes to the disintegration of sectoral social networks. This opportunity of a reconfiguration of actors within the network, they argue, can be an important prerequisite of the design of coherent and consistent policy mixes. Their findings are relevant beyond the specific case study, as they show how emerging policy networks composed of actors from different subsystem networks may offset the risk of sectoral and unsustainable policymaking in the case of cross-cutting issues. Kirschke and Kosow (2022) link literature on wicked problems and policy mixes in an innovative way by developing criteria for assessing the usefulness of policy mixes for addressing wicked problems, which are typically characterized by goal conflicts, complexity and uncertainty. Empirically, the authors evaluate two policy mixes proposed to address water pollution by pharmaceutical residues in Germany and show that both policy mixes are coherent in their goals and consistent in their instruments. They further investigate whether stakeholder participation facilitates the development of policy mixes better suited to addressing wicked problems and conclude that the participation of powerful stakeholders seems to have prevented the designing of a more sustainable policy mix. Kirsop-Taylor et al. (2022) shed light on how different governance configurations influence the design of policy instrument mixes for implementing nature-based solutions (NBS). Through a systematic literature review, the authors analyze in particular whether current NBS-policy studies in European contexts exhibit influences of public administrative dynamics or institutional logics of operation on policy instrument mixes for implementing integrated urban water management. In fact, one of the key contributions of this article is to link the study of policy mixes with public administration theory, paving the way for further promising research. Tosun and Koch (2022) propose diffusion theory as an analytical lens for investigating the dissemination of policy mixes. As an empirical example, they analyze the diffusion of policy mixes proposed by citizens' initiatives (CIs) across German states. They conclude that policy mixes diffused across states, but with some variation, which, they argue, is the result of a careful calibration of policy instruments to achieve consistent instrument mixes. Wiedemann and Ingold (2022) argue that cross-sectoral dimensions of policy mixes are key when evaluating policy performance and emphasize the importance of target group integration and administrative coordination. To showcase their argument, the authors analyze the performance of pesticide risk reduction policy mixes in Costa Rica, with a focus on the interdependencies across the sectors for drinking water, aquatic ecosystems and occupational health. The authors conclude that, for the case of Costa Rica, coordinating policies across sectors is not only a challenge for policy formulation, but persists throughout the policy implementation phase. Leong et al. (2022) contend that new kinds of regional structures are necessary for the effective governance of complex problems on multiple levels and across sectors. In their contribution, the authors address the water-forestry-energy-climate (WFEC) nexus. They highlight the often decentralized, fragmented and incoherent nature of the policy mix in each sector of the nexus and show that numerous partially overlapping and non-hierarchical institutions govern each one. The authors conclude that in such non-regime or weak regime complexes, international coordination through regional agreements is critical for policy success in coordinating policy mixes in the WFEC nexus. Giest and Mukherjee (2022) argue that developing policy strategies for nexus challenges is critically dependent on consolidating knowledge and data across sectors. In particular, they underline the importance of administrative coordination and internal government processes to organizing data-sharing across sectors. Empirically, the authors focus on the energy-water nexus in the Mediterranean region. Their results reveal that energy-water cooperation remains low and challenged by limited capacity and trust in the region. Competences for water and energy lie within separate, specialized ministries that use independent sources of data and analysis. The authors conclude that knowledge generation is not sufficiently coordinated among administrations at different levels and across stakeholders. Consequently, data are not being properly integrated,

especially when issues span multiple sectors. Vogeler et al. (2022) study the conditions that might lead to integrated policymaking in the case of Antimicrobial Resistance (AMR) Policies in different European countries. Even though AMR represents one of the major future challenges for human and animal health as well as water resources, the cross-sectoral character of this policy problem is hardly reflected in actual policies. Studying 22 European countries by means of a Qualitative Comparative Analysis, they show how institutional as well as socio-economic and political conditions affect the likeliness of integrated policymaking. Their results highlight the role of green political parties and consensus-oriented decision-making processes in the development of sustainable solutions to cross-sectoral policy issues.

## Conclusion

Sustainable management of water resources is challenged by numerous cross-sectoral policy problems, often entailing trade-offs, which make it difficult for decision-makers to find sustainable policy solutions. These necessitate an integration of water with other policy sectors and require the elaboration and adoption of sustainable policy mixes which both ensure the protection of water resources and achieve the objectives of inter-linked policy sectors. In reality, policy mixes develop mostly incrementally over a long time without following a unifying overall goal. This leads to policy mixes often remaining poorly integrated and in a non-sustainable state.

This special issue set out to assess the sustainability of policy mixes for water resource protection and enhance our understanding of barriers to and drivers of sustainable policy mixes. Until today, there has been a lack of theoretical approaches that explain variation in policy mixes and, in particular, why some policy mixes are designed in a non-sustainable way. In this introduction to the special issue, we have pointed toward some promising theoretical approaches on the impact of different aspects of the policy process on characteristics of policy mixes; for example, the power balance between societal and political actors, institutions or structures in public administration. We encourage future research to build on these ideas and contribute to a better understanding of how we can develop sustainable solutions to emerging cross-sectoral policy problems.

## Disclosure statement

The authors declare no competing interests.

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