

Chapter 2

Comparing Policy Designs in Water Protection: Micropollutants Policies in the Rhine River Riparian States

2.1 Policy Design

Recurring debates in policy analysis revolve around the question, ‘Which political solutions exist to solve a societal issue?’ There still exist situations in which policy makers understand what options exist for reducing an environmental problem, but refrain from adopting any of these options. Here, policy analysts go one step further by asking: ‘Why is little done politically to solve a specific societal problem when appropriate solutions exist and are known?’ In order to find answers to these crucial questions, policy analysis unravels the mechanisms behind policymaking with the ultimate aim of contributing to better policies. According to the classical definition by Thomas Dye, ‘*[p]olicy analysis is what governments do, why they do it, and what difference it makes*’ (Dye 1976). This definition demonstrates that policy analysis deals with three core topics:

1. Description and analysis of policy content and variation: Here, scholars analyze what kinds of policy instruments, programs, or goals exist to solve a societal problem and look at policy variations across sectors and countries (Eliadis et al. 2005; Salamon 2002; Hood 1986).
2. Finding explanations for the choice of policy content: In this field of research, analysts are interested in uncovering the reasons behind one solution being selected and adopted to solve a problem over another, or why no solution is adopted at all (Knill and Tosun 2012, p. 2; Ingold 2008; Howlett 1991; Bressers and O’Toole 1998; Varone 1998). Related to the question of policy selection is the question of policy change, where scholars aim to reveal the conditions under which long periods of stability (during which policies do not change) are interrupted by short phases of change (Sabatier 2007; Baumgartner and Jones 1991; Kingdon and Thurber 2011).
3. Description and analysis of policy effects: A central aim of policy analysis is to understand the effects of policy action, also called policy outcomes (Bressers 2004; Pressman and Wildavsky 1984; Knill 2006; Pollitt et al. 2006). Largely

routed in implementation research, the following questions are addressed: Does the adopted policy actually reduce the problem in the intended way? Which factors contribute to the deviation from (or consistency with) the intended outcome?

Scholars of policy analysis have largely focused on public policies, i.e., actions that address societal problems and structural aspects of the public sphere. The present chapter focuses on public policies in the field of water protection by including the description and analysis of policy content. It seeks to evaluate whether policy content is well-designed in the sense that it has the potential to achieve a defined policy goal and alleviate an underlying water protection problem. This chapter also looks at policy variation across countries by comparing water protection policies of Switzerland, Germany, France, and the Netherlands. The effects of an adopted policy in the form of pollution reduction, on the contrary, are not within the realm of this study.

2.1.1 What Is Policy Design?

Many studies in policy analysis aim at explaining why certain policy content was chosen over another. To discern this content dimension of policy, it is helpful to understand the common distinction between policy, polity, and politics (Sciarini et al. 2004; Knill and Tosun 2012). The term *polity* refers to *rules, which define political structures* and characterize a political system. *Politics* points to the *procedural elements of policymaking*, i.e., power and conflict configurations. *Policy* concerns the solutions to societal problems and refers to the content dimension. Evidently, in policy analysis, the analytical focus is on the study of the policy content aspect. Nevertheless, the polity and politics dimensions are central explanatory factors for policy scholars. For example, if analysts aim at explaining a specific policy output such as the adoption of tax cuts, they might ask why those tax cuts were enforceable in one political system, but not in another (studying the influence of polity on policy). Scholars might also want to understand why those actors favoring tax cuts were able to impose their policy preferences in the policymaking process (studying the influence of politics on policies). Some academics put forward that policy analysis includes the study of polity and politics and is therefore broader than solely analyzing political structures, political parties, or interest groups (Knill and Tosun 2012, p.1).

The literature defines a *public policy as a collective course of action (or non-action) enacted by a set of actors, typically a government, a legislature, or an equivalent authority, to address a particular societal issue* (Howlett et al. 2009a, p. 4 ff.; Knill and Tosun 2012, p. 4). Implied in the definition is that public policies represent some sort of solution for a societal issue with the aim of improving and structuring life in a society. From this perspective, the goal of public policies is problem solving.

Many definitions place an emphasis on state actors, since they have the legal authority to adopt public policies (e.g., Knill and Tosun 2012, p. 4). Some researchers, especially in the governance literature, have questioned the predominance of the state (Howlett et al. 2009b; Hysing 2009; Arellano-Gault and Vera-Cortés 2005; Doern and Wilks 1998; Edelenbos et al. 2010; Esmark 2009; Foster and Plowden 1996). In fact, it is widely acknowledged in the policy literature that a broad range of actor types—governmental as well as non-governmental—are involved in policymaking in Western democracies and have an impact on how societal concerns are solved through public policies (Fischer 2012; Christopoulos and Ingold 2015; Ingold 2007; Weible 2007; Howlett and Ramesh 2003). Nevertheless, these studies also demonstrate that state actors are still highly influential today due to their legal authority and veto powers in decision-making.

Some authors distinguish between a broad and a narrow definition of policy. The broad definition includes the policymaking process (the process of finding solutions) and its result in the form of policy content (the solution itself). A narrow definition solely refers to policy content (Varone 1998) and suggests that a policy is the result of a policymaking process, but not the process itself (Jann and Wegrich 2014; Howlett and Ramesh 2003; Howlett and Giest 2012). To account for this consecutiveness, the word *policy output* is often used in the literature.

Moreover, the term *policy* is used to describe different levels of generalization of a course of action. On a very general level, the word *policy* refers to all those measures taken in a certain *policy field* (also termed *domain* or *sector*), such as economic policy, social policy, or environmental policy (Knill and Tosun 2012). A little less general, the term *policy* denotes public activities in *policy subfields*. In environmental protection policy, for example, subfields include water policy, air policy, or landscape policy. On a third level of generalization, the word *policy* stands for measures taken to address even more specific *policy issues* within the just-described policy subfields. In water policy, for instance, groundwater issues can be differentiated from floods or surface water quality issues. The least general use of the term *policy* refers to *single instruments*, also called *policy tools*. *Public policy instruments are single means through which collective courses of actions (behaviors or procedures) are structured to address a societal issue and achieve defined policy goals* (Salamon 2002; Lasswell 1958). Examples of such instruments in water protection policy include pollution charges or a bans, which restrict pollution to waters by placing a price on it or prohibiting it. Such policy instruments represent a way of impacting behavior in order to improve water quality. In the empirical reality, several policy instruments are usually bundled into policy programs (Howlett 2005). Therefore, scholars use the term *instrument mix*, which denotes a bundle of several policy instruments.

With regard to the distinction between *output*, *outcome*, and *impact*, the present study concentrates on policy *outputs*, termed *policy design*, and seeks to estimate policy outputs' prospective ability to produce the intended *outcome* and *impact*. Moreover, the present work adopts a narrow definition of policy, solely referring to

policy content, which is considered an output of the policymaking process.¹ When referring to policy content, the word *policy design* is employed throughout the work. This term is similar but more specific than the word *policy instrument (mix)*. Like instrument mix, the term *policy design* also takes into consideration that policies are designed as a bundle of interrelated instruments. Additionally, the term emphasizes the specific provisions about where, how long, and to whom policies apply (Linder and Peters 1984; Schneider and Ingram 1988; Howlett 2009, 2014). As defined above, the essence of public policies is to find solutions for societal issues. Policy instruments are crucial elements of those solutions as they are the tools, which enable the pursuit of politically defined goals. However, policy instruments are integrated into wider policy programs, which define a number of conditions, and therefore, it is not enough to list or name single instrument categories from which the policy is composed (Bressers and Huitema 2000; Pape 2009, p. 2). To fully understand a policy's prospective ability to solve a societal problem, it is necessary to highlight the precise conditions under which an instrument or instrument mixes apply. For example, the word *policy instrument mix* could point to the combination of a subsidy and a best environmental practice. However, this information is not enough to capture its ability to solve the underlying issue because success depends on the precise design of the policy instrument mix. The term *policy design*, on the contrary, would further specify if the policy targets those groups causing the problem, if a positive behavior is incentivized, if negative behavior is constrained or even sanctioned, who is responsible for implementation, and alike. This way, the word *policy design* accounts for the fact that the very same instrument may have drastically different implications for problem-solving, depending on the conditions under which it applies. A regulatory instrument like a ban, for example, can have minor implications for problem-solving if it applies only to a minority of the groups causing a problem or if the enforcement authority lacks capacities. Only if we understand all the provisions of a specific policy design, can we then evaluate its prospective ability to perform best under a given situation in order to reach its defined goal.

Moreover, this study employs the term *policy design* by adopting a specific view on policy content: First, policy instruments have often been defined along their degree of state intervention. Here, on the contrary, policy design refers to intervention with regard to a specific issue. Hence, policies are understood in this study as a force for reducing a societal problem rather than a force by the state on a target group. From this perspective, the essence of public policies consists of alleviating

¹Despite its focus on the policy content dimension, the present work also considers both the polity and the politics dimensions to explain policy variations across four countries: The polity dimension is crucial as the four countries under study display different political systems, which provide for different formal rules about decision-making processes and power relations, and thereby structure policy networks. Policymaking processes, i.e., the politics or procedural dimension of policy, are incorporated into the present work through the study of policy network structures, which reflect the aggregated result of multi-actor interactions in the policymaking process over time.

public issues, e.g., improving air or water quality, enabling gender equality on the job market, promoting economic growth, and alike. This definition may be a reduction of a more complex reality where problem-solving represents just one property of public policies among many others (e.g., re-election calculus, compromise-seeking). Nevertheless, problem solving represents an important part of public policy and offers one possible research perspective among many other valid viewpoints. Second, policy design is defined here as an impact on behavior and not as a constraint, because policies are designed not only such that they constrain undesired behavior, but also so that they promote desired behavior. Third, policies may be targeted at behavior, but they may also alter structures or a sequence of steps in order to create positive conditions for reducing a policy problem. Taking these three specificities into account, a *public policy design is defined here as a policy instrument (mix) and its specific conditions of application through which behaviors (or procedures) are impacted to address a societal issue.*

With its focus on policy design, this study does not seek to explain policy stability and change. Policy change and policy design are two related, but different concepts. While *change* refers to the alteration of policy between two points in time, *design* concerns the content of policy. This work evaluates policy designs with regard to their prospective ability to comprehensively solve a policy problem. While some policies are designed to comprehensively reduce a societal issue, others address a problem without being able to reduce or solve it. The concept of change, on the contrary, does not necessarily imply that a societal issue has been alleviated. Change simply concerns policy alteration between two points in time, which is not in all cases identical to problem solving. Some changes, however, may lead to problem solving, which therefore can be considered one type of policy change.

2.1.2 Lessons from Previous Research and Moving Toward a New Approach

The early, path-breaking work on policy design dates back to the 1950s (Lasswell 1956, 1958). Since then, a large body of literature developed that highlights different aspects of policy design.

An early generation of policy scholars studied entire public policy fields until Theodore Lowi claimed that public policy analysis should focus on the study of single policy techniques (Lowi 1964, 1972). Since then, a broad literature emerged, which terms these techniques *policy instruments*. Three broad goals of policy instrument studies can be distinguished (Linder and Peters 1989):

- (a) Categorizing instrument types and characterizing policy instruments: The authors' common aim is to establish distinct *categories* of policies. While some scholars categorize single instruments (Vedung 1998), others focus on entire policy programs, i.e., a mix of instruments (Lowi 1972), and still others on national policy styles (Howlett 1991). Another group of researchers

characterized policy instruments by a set of *attributes*, rather than by listing distinct categories of instruments (Linder and Peters 1989).

- (b) Assessing complementarities and conflicts within bundles of policy instruments: In this stream of literature, scholars pay attention to the mix of different policy instruments and their fruitful, as well as unsuccessful, combinations (Howlett and Rayner 2007; Gunningham and Sinclair 1991).
- (c) Characterizing the instruments' impact: A third body of literature focused on the *impact* of policy instruments. Some scientists studied the goals that policy instruments pursue, such as monitoring behavioral change or altering the behavior of target groups (Hood 1986), while others characterized efficiency or effectiveness of policy outcomes (Salamon 2002). The latter adopts an ex-ante approach, with policy instruments being evaluated with regard to their prospective ability to solve a policy problem. A different stream of literature, i.e., implementation and evaluation research, focuses on ex-post evaluation of policy instruments to discern whether a specific policy achieves the intended effects (Pressman and Wildavsky 1984; Hupe 2011; Falkner et al. 2005; Hill and Hupe 2009).

The following paragraphs provide a brief overview of the work of policy scholars on all three of the aforementioned aims (excluding ex-post evaluation research). The literature review is subdivided into first-, second- and third-generation policy design scholars. While first-generation literature started with categorizing and characterizing policy instrument types (see point a), second-generation scholars went on to assess policy instrument mixes and their cohesive or conflictual combinations (point b). Research on policy instruments' impact (point c) was initiated by the first-generation policy scholars and further expanded by the third generation.²

2.1.2.1 First-Generation Policy Design Scholars

The first generation of public policy scholars mainly addressed two basic questions: What kind of policy instruments do decision-makers have at their disposal for addressing public problems and for pursuing political goals? And into which basic categories can these instruments be grouped? In order to answer these questions, a large body of literature on policy instrument was developed that originated from the USA, Europe, and Canada.

²The differentiation between first-, second-, and third-generation policy scholars is ideal-typical since all three streams of literature built on each other, and therefore, second-generation scholars also do research about what I labeled first-generation topics; third-generation literature includes what I labeled first- and second-generation topics. Even though these literatures overlap, their distinction is nevertheless helpful here to illustrate how the research discipline evolved over time in a simplified way.

US American Schools

Theodore Lowi’s seminal work argues that four broad types of policies can be identified, namely distributive, redistributive, regulatory, and constituent policies that produce particular patterns of political conflict (Lowi 1964, 1972). *Distributive policies* stand for all policies, which distribute resources from the government to a relatively wide group of beneficiaries. *Redistributive policies*, in contrast, reassign resources from one group or social class to another. *Regulatory policies* constrain behavior in order to protect specific groups of people (such as consumers) from other groups or sectors. Finally, constituent policies create or modify the state’s institutions (Knill and Tosun 2012, p. 16). According to Lowi, redistributive and regulatory policies produce winners and losers, and therefore lend a higher potential to conflict than do distributive and constituent policies. Hence, Lowi deduced his famous statement that ‘policies determine politics.’ Critics of Lowi’s typology argue that it is ‘difficult to assign policies to just one category’ (Birkland 2010). Most significantly, however, Lowi was the first to draw attention to the coerciveness of policy intervention, and more specifically to two dimensions, he termed *likelihood of coercion* and *applicability of coercion* (Lowi 1964, 1972). *Coercion (or likelihood of coercion)* describes the degree to which an instrument constrains individual or group behavior (Salamon 2002). *Applicability of coercion* refers to whether the policy identifies specific target groups or whether it applies to society in general. Ever since the genesis of Lowi’s term, coercion has been considered ‘the most common basis for classifying instruments in the literature’ (Salamon 2000).

As a response, Wilson (1974, 1986) established a typology based the degree to which *costs and benefits* are distributed or concentrated across targets (see Table 2.1). Extending Lowi’s idea of the impact of policies on politics, Wilson characterized the policymaking process (politics) rather than policy content (policies). Hence, Wilson distinguished four types of politics, i.e., majoritarian, entrepreneurial, interest group, and clientelistic (Wilson 1986, 1974; Schneider and Ingram 1993; Knill and Tosun 2012).

Another innovation to policy design literature came with Robert Alan Dahl and Charles Edward Lindblom’s approach, which places policy instruments on a *continuum* rather than into discrete categories (Dahl and Lindblom 1953). Dahl and Lindblom characterized policies on five continua, emphasizing different aspects of governments’ capacity to exert coercion. Among others, they point to the *nature of government influence*, which can range from persuasion (low coercive capacity) on one side of the continuum to compulsion (high coercive capacity) on the other extreme of the continuum. The fine-grained analysis of different aspects of coercion

Table 2.1 Wilson’s cost-benefit typology

		Costs	
		Concentrated	Distributed
Benefits	Concentrated	Interest group politics	Clientelistic politics
	Distributed	Entrepreneurial politics	Majoritarian politics

represents a key contribution from their work. The authors look into *instrument ownership*, which denotes whether private enterprises or public agencies are responsible for the implementation of adopted policies. They draw attention to indirect versus direct government control and to voluntary versus compulsory *instrument membership* as well as to *instrument autonomy*, which ranges from autonomous agencies to bureaucratic ones.

Stephen Linder and Guy Peters synthesized the different aims of previous researchers (Howlett 1991). They identified seven general categories of policy instruments (direct provision, subsidy, tax, contract, authority, regulation, exhortation) and identified *four general instrument attributes* (Linder and Peters 1989): (1) *resource-intensiveness*, which measures the degree to which a policy instrument involves administrative costs and is simple (or complex) to operate; (2) *targeting*, which takes into account the precision of a policy instrument and its selectivity toward target populations; (3) *political risk*, which refers to the chances of failure of a policy, and also to an instrument's visibility to the public; and 4) *constraint*, meaning an instrument's coerciveness.

Linder and Peters' attempt to synthesize comes at the expense of analytical clarity: Some of the aforementioned dimensions are attributes of policy instruments (coerciveness, targeting), while others deliver explanations for instrument choices (political risk, resource-intensiveness).

Salamon (2002) offers another approach to characterizing policy instruments, by focusing on *four attributes*. First, Salamon's conception of *coerciveness* captures the degree to which an instrument restricts behavior. At the higher end of the coercion scale are instruments that limit or prohibit undesired activities; at the lower end are instruments that rely on voluntary cooperation of target groups. Second, Salamon emphasizes the *directness* of a policy instrument, which measures the extent to which the entity deciding upon the course of collective action is also involved in carrying it out (Salamon 2002). For instance, a direct instrument is one where the decision upon a course of action, funding, and implementation is all carried out by the same entity. On the contrary, a policy instrument is considered indirect when it is publicly financed but privately delivered—or financed nationally, but operated on the local or regional level. *Automaticity* represents the third-key dimension that Salamon uses to characterize policy instruments. Automaticity 'measures the extent to which a tool utilizes an existing administrative structure for its operation rather than creating its own special administrative apparatus' (Salamon 2000). The fourth dimension Salamon identifies is the *visibility* of a policy instrument. He writes '[i]nvisible tools are [...] the easiest to pass.' This reasoning suggests that *visibility* is not an instrument characteristic, but rather an explanation for why policy makers choose certain instruments over others.

Crawford and Ostrom (1995) took another approach to the question of policy design by establishing a *syntax of a grammar of institutions*. The idea here is to identify the main components that characterize a policy by answering five basic questions: Who is allowed/obliged/forbidden to do what, under which condition, in order to fulfill which aim, and what sanctions are involved? The authors make the

analogy to grammar, where each sentence always contains certain components, which deliver information about the subject, the object, the verb, and alike.

European Schools

The British scholar *Christopher Hood* is the author of a classic piece of instrument categorization (Hood 1986). Hood argues that governments have four resources at their disposal—*nodality/information, treasure/money, authority, and organization/delivering services*—and can use them to fulfill two purposes: either monitoring (detectors) or altering the behavior (effectors) of target populations (see Table 2.2).

The typology has often been criticized for not being mutually exclusive. Hybrid policy designs are difficult to disentangle in order to fit into the typology (Hood 2007).

Despite these critiques, Vedung (1998) established a similar policy typology, which developed into the best-known and perhaps most influential one in the field (Hood 2007). Vedung identifies three classes of policy instruments—*carrots, sticks, and sermons*—based on the extent of coercion, defined as the degree of state intervention, that each instrument involves. With *carrots*, Vedung refers to a family of incentive-based financial policy instruments, such as charges or trading schemes. The term *sticks* is an analogy for regulative, also called command-and-control instruments, which rely on the use of authority by the state, such as prohibitions or authorization restrictions. *Sermons* refer to persuasive, information-based instruments, such as public campaigns or best environmental practices.

Many European scholars, notably Mayntz and Scharpf (1995), Varone (1998), and Ingold (2008), have thought about policy instruments and instrument selection. Among the European stream of policy research, the approach of two Dutch scholars, Bressers and O’Toole (1998, 2005), is particularly relevant to this book’s research goal. Their work conceptualizes policy instruments as a set of rules, which specifies relations in a social setting. Bressers and O’Toole put forward six instrument attributes, which capture the degree to which the behavior of certain target groups is limited or expanded in relation to other societal groups. The first instrument attribute that the authors propose is *normative appeal*, which seizes the ideological constraints of a policy instrument toward targets. The more an instrument condemns a defined behavior as ‘good’ or ‘bad’, the more it is considered normative. A second attribute concerns *providing or withdrawing resources* to or from the target groups and establishes a resource-related (financial, personnel, authority, etc.) relationship between different policy addressees. A third characteristic involves the target group’s *freedom to opt for or against the application of policy measures*. Some policy instruments leave target actors the choice of whether or not the instrument applies to them. In the case of subsidies for organic

Table 2.2 Hood’s eight basic types of government tools (Hood 1986)

	Nodality	Treasures	Authority	Organization
Effectors	Advice	Grants, loans	Laws	Service delivery
Detectors	Surveys	Consultants	Registration	Statistics

agriculture, for example, farmers benefit from subsidies when they adopt organic farming practices, but farmers are also free to choose not to change their practices and to abstain from the subsidy (Bressers and O'Toole 1998: 224). A fourth dimension refers to the *proportionality* between a target group's behavior and the policy response. A fifth attribute is labeled the *role of decision-makers in implementation*. Policy designs often name the organization responsible for implementation. Bressers and O'Toole distinguish situations in which decision-makers assign themselves or closely affiliated organizations the task of implementation from situations in which lower levels of government, private agencies, or government corporations carry out implementation. A sixth instrument feature is called *bilateral or multilateral arrangements* and captures the degree to which policies create a direct (or indirect) relationship between the government and the target group.

Canadian Schools

There is a rich body of literature on policy instruments from Canadian scholars (Doern and Phidd 1983). Howlett (2000) has added a new element to the instrument typology schools. He argues that the literature has so far concentrated on *substantive* instruments and neglected *procedural* ones (Howlett 2000). Substantive instruments can be understood as those techniques that aim at reducing a policy problem. Instruments, which alleviate pollution, for instance, can be considered substantive. Procedural instruments, on the contrary, are not intended to reduce a policy problem directly, but they create structures or procedures that establish positive conditions for reducing a policy problem. Examples of procedural policy instruments include reporting or monitoring by following a defined timetable over a period of several years, as well as the formation or reform of administrative structures in order to act more efficiently in addressing a policy problem.

Summary of First-Generation Policy Design Scholars

A large number of scholars, more than could be presented here, have expressed valuable ideas concerning types of policy instruments or instrument characteristics. The literature overview brings to light that most policy analysts developed *typologies* of policy instruments. Those typologies allow for a classification of virtually unlimited policy tools into a limited number of general categories using a common language (Howlett 2005; Lowi 1972). Generic classification schemes help with identifying long-term patterns of public policymaking through comparisons across time, country, or policy field. Categorization also promotes lesson-drawing from past experiences with the performance of specific instruments under given circumstances (Linder and Peters 1984; Howlett 2005; Salamon 2002; Hood 2007). Howlett (2005) argues that policy instrument classifications do not only aim at better descriptions but also aim at providing better prescriptions or recommendations to decision-makers on how to best address a policy problem.

Most of the aforementioned prominent literature on policy instruments has its origins in the 1980s and 1990s (Howlett 2011b). After the early 1990s, scholars moved away from a single instrument focus of earlier works and drew attention to instrument mixes (Howlett 2005).

2.1.2.2 Second-Generation Policy Design Scholars

The first-generation policy scholars already criticized a pure focus on single instrument types and moved on to assess characteristics of policy instruments [see, e.g., Bressers and O'Toole (1998) and Salamon (2002) as exposed above]. Hence, a second generation of policy design scholars emerged, who assessed in more detail policy instrument mixes, their complementarities, and conflicts. Salamon (2002), for example, convincingly demonstrates that there is a growing number of instruments at the disposal of governments, which come bundled in programs and only very rarely appear in a pure form (Salamon 2002, p. 21). Most of today's policies are composed simultaneously of regulatory, incentive, and information elements. Hence, Vedung's (1998) distinction of sticks, carrots, and sermons should not be regarded as a policy typology with mutually exclusive categories. For example, pollution reduction policies are typically composed of the following: (a) emission limits setting a defined pollution cap (sticks); (b) financial incentives for polluters to invest in technologies or practices that will allow them to reduce their emissions and thus comply with the emission limit (carrots); (c) information about how to operate green technologies or practices (sermons); and finally, d) new governmental agencies being created in order to control, fund, or support citizens or businesses in their efforts to reduce pollution (organization). Hence, research has evolved to ask the question: Which mix of instruments (rather than which instruments) do we have at our disposal to solve societal problems?

One new insight this literature gained compared to the first-generation research is that policy instruments can undermine each other's effects. Instrument mixes fail to deliver desired policy goals when, for example, new instruments are simply added to existing ones (called *layering* in the literature) or when new policy goals are formulated without abandoning previously adopted policy instruments (called *drift*) (Howlett and Rayner 2007). As a result, policy goals and means, i.e., the policy instruments by means of which policy goals are to be achieved, do not match. To avoid such incoherence, a literature on *integrated strategies* emerged (Howlett and Rayner 2007; Gunningham and Sinclair 1991; Gunningham and Young 1997; Gunningham et al. 1998; Grabosky 1995). Scholars in this discipline analyze complementarities and conflicts within bundles of instruments. More concretely, they study how policy instruments can be combined such that they support one another in the pursuit of a common goal. Underlying research questions include the following: a) Which policy instruments can be mixed? and b) Which factors allow us to evaluate whether a policy mix is coherent? Scholars refer to carefully arranged instrument mixes as *New Governance Arrangements* (NGAs) (Howlett and Rayner 2006). NGAs are ideal types of policy designs which combine policy instruments into a cohesive and holistic strategy to optimally reach a defined policy goal (Howlett and Rayner 2007). Hence, NGAs are conceptual reference points of policy design rather than empirically observable policies. Some authors, such as Michael Howlett in his book titled 'Designing Public Policies' (2011a), base their definition of policy design on ideal-typical arrangements. From that perspective, policy designs are concepts emerging from an intellectual exercise;

they are underlying but not representing real-world policies. Accordingly, the study of policy designs is viewed as antecedent to the study of policy content and policymaking. The present work, on the contrary, conceives of policy design as a real-world, empirically observable arrangement of policy instruments.

2.1.2.3 Third-Generation Policy Scholars

There is a broad consensus among first- and second-generation policy scholars that the level of coercion or state intervention used to alter, limit, or create behavior or processes is a chief criterion for categorizing policy instruments (Linder and Peters 1989; Salamon 2002; Vedung 1998; Howlett and Ramesh 1995). Implicit to this definition of coercion, as with the degree of state intervention, is the perspective that the state restricts society in a top-down fashion. In reaction, a new third generation of policy research emerged which drew attention away from the state in favor of (a) 'more global' and (b) 'more local' policies (Howlett 2011a). The former stream of research highlights the effects of globalization in undermining state capacities. The latter stream of research 'decentered' policy studies away from analyzing policies based on central state authority toward studying policies that emerge locally, or from a bottom-up approach. A large body of literature developed that studied local governance, decentralization, and collaborative governance (Arellano-Gault and Vera-Cortés 2005; Doern and Wilks 1998; Edelenbos et al. 2010; Esmark 2009; Foster and Plowden 1996; Gibbs et al. 2002; Ingold 2014; Lemos and Agrawal 2006). This research demonstrates that various actors are involved in policy decisions today (Ingold 2008, 2011) and that contemporary governments are unable to move unilaterally without incorporating other social forces (Bressers and O'Toole 1998; Sabatier and Jenkins-Smith 1993). Hence, the view of a managerialist state was replaced by a more deliberative model, where multiple state and non-state actors participate in policymaking. Some scholars interpreted the involvement of non-state actors, along with deregulation and privatization trends, as a further sign for reduced government capacity to govern, aside from globalization (Howlett et al. 2009b; Hysing 2009; Provan and Kenis 2008; Eliadis et al. 2005; Jordan et al. 2005). Most famously, the move away from *government to governance* was proclaimed. This statement went along with a new perspective on policy instruments, which are no longer viewed as instruments of governments alone. Policymaking is rather conceived of as a participative process out of which policies *emerge bottom-up* rather than being designed top-down (Howlett 2011a). Consequently, parts of the literature employ the terms *formal rules* or *institutions*, rather than the expression *policy design* (Ostrom 1990, 2009). Since policies are considered emerging bottom-up, the question of which instruments do governments have at their disposal was replaced by the question of which instruments do *we* have at *our* disposal to best solve societal issues (Metz and Ingold 2014). Researchers then examined if the government-to-governance statement goes along with a turn from command-and-control instruments to more participative policy designs. In this regard, empirical studies demonstrate that in many

countries and in multiple realms, this shift did not occur (see, e.g., Sager 2009; Jordan et al. 2003, 2013). The domestic arena is still important for policy design, along with (and not despite of) trends of globalizing and localizing policymaking (Howlett 2011a). Governance research demonstrated that policymaking is more complex today and involves multiple actors and levels of governance, i.e., from global to local. In light of such complexities, it remains relevant today to increase and deepen our understanding of policy design.

2.1.2.4 Lessons from Previous Research and Moving Toward a New Approach

Howlett and Rayner had already postulated in 2007 that a new generation of policy design theory was necessary, which conciliated the thinking of first- and second-generation policy scholars with insights from the third generation (Howlett and Rayner 2007). In order to reconcile those literatures, the governance perspective must incorporate the insight that governance does not replace government, but rather governments are ‘part of’ governance. This inclusive view on governance does not imply that policy research should recenter on solely studying state authorities, but rather that research should reconsider state actors as one of many actors shaping policy designs.

Conciliating a governance perspective with a focus on policy design is possible, for example, when conceiving of policy design as a result of network interactions, where state and non-state actors interact. The present work considers both and disentangles their relationship by conceiving of complex decision-making processes as policy networks (independent variable) out of which policy designs emerge (dependent variable).

Moreover, current research has to move beyond the search for instrument categories. Understanding which types of policy instruments exist evidently remains relevant today. However, past research already provides a solid base of knowledge concerning instrument categories, characteristics, mixes, and more complex processes of deregulation, privatization, and new governance modes. Instead of continuing to distinguish different categories of policy instruments, research could evaluate the expected impact of policy designs on reducing societal issues. If we define policies in terms of comprehensive problem solving (and not coercion), then it is a valid research aim to be able to say *how much* or *how little*—in other words *how comprehensively*—a policy design contributes to addressing a collective problem (as opposed to measuring the degree of state intervention). In order to understand a policy’s prospective ability to comprehensively solve a societal problem, it is crucial, but not enough, to list or name single instrument categories out of which the policy is composed. Necessary is also to highlight the precise conditions under which instrument mixes apply.

The present work aims to contribute to the advancement of policy design research in two ways: First, instead of sorting policy instruments into boxes, this research aims at examining the ability of policy designs to comprehensively address

societal issues. This research goal involves a change in perspective on policy designs, which are not viewed as channels of governmental coercion, but as means to solve societal issues. Underlying this research is a definition of policy design, which differs from the conventional coercion approach, with its problem-solving perspective rather than having a state-power perspective.

Secondly, to evaluate policy designs' comprehensiveness, the present work argues that typologies are not suitable and a different analytical tool is needed. Although typologies have commonly been used in political science, past research has made apparent that inherent limitations exist concerning typologies (Smith 2002). By definition, a typology separates a given set of dimensions and considers all possible combinations of dimensions through cross-tabulation. The resulting categories are ideal-typical, and therefore, they cannot necessarily be found in the empirical reality. Policy instruments do not neatly fit into conventional boxes, which can be seen in cases where command-and-control instruments are adopted by a government lacking the necessary enforcement capacities (Bressers and O'Toole 2005, p. 142). Here, command-and-control instruments may be much less compulsive than the label indicates (Bressers and O'Toole 2005: 142–143). Voluntary instruments or incentives, on the other hand, can be very compulsive when there is a high pressure to conform to a certain norm. With high societal or cultural pressure to adopt an environmentally friendly behavior, for example, one might feel more compelled to adapt the own conduct than by regulatory instruments. Another such example is subsidies, which are conventionally classified as economic instruments. Subsidies do not only involve resource exchanges, but also involve the provision of information on how to change behavior in order to be eligible to the subsidy. Thus, a subsidy does provide target actors not only with financial resources, but also with information. As such, a subsidy could also be classified as a persuasive instrument. These examples illustrate that existing instrument typologies have not proven adequate in portraying the complexity of policy content. Real-world policies are multi-dimensional and therefore do not neatly fit into typologies. To cope with this restriction, scholars produced more fine-grained typologies (see, e.g., Linder and Peters 1989; Bressers and O'Toole 1998). Nevertheless, many categories impair conceptual clarity and analytical parsimony, and complicate the task of classifying instruments into categories. Reducing the number of dimensions to broad categories leads to typologies that show as much variation within cases than between them (Linder and Peters 1989). When categories are not mutually exclusive, scholars can classify the same instrument in different ways (Smith 2002). Hence, simpler typologies might provide misleading information and obstruct comparison across countries or time (Linder and Peters 1989, p. 43). Additionally, these reduced categories bear the risk of not being exhaustive enough. A carrot–sticks–sermon typology does not even consider services provided by the state, such as wastewater treatment, street lighting, or education (Hood 2007). Their purely descriptive nature, along with their lack of predictive or explanatory power, represents another difficulty scholars encountered with typologies. Scientists have expressed difficulties to infer hypotheses from instrument typologies. Finally, most policy typologies insufficiently take into account instrument mixes since they rely on individual

instruments as the unit of analysis, rather than on packages of instruments (exceptions include, e.g., Bressers and O'Toole 1998; Salamon 2002).

In summary, identifying categories of instruments by means of a typology is not a straightforward endeavor (Linder and Peters 1989). If policy instruments cannot be clearly classified using one common language, any typology loses its claim in supporting the search for a general understanding of policy instruments (Smith 2002).

Some alternatives to the typology approach have been proposed. Smith (2002), for instance, argues that taxonomies are preferable to typologies. Taxonomies classify items on the basis of empirically observable and measurable characteristics, similar to a cluster analysis. Since empirically derived categories are less ideal-typical, it could be more straightforward to classify instruments, thereby placing taxonomies at an advantage to typologies. A shortcoming of taxonomies, however, is that they are case- and context-specific. Hence, taxonomies do not necessarily lead to the establishment of a common language, which allows for comparisons across countries and time. Moreover, categorizing instruments into single categories never provides satisfactorily answers, not even by means of taxonomies, because policy instruments are inherently multi-dimensional.

We have seen so far, that, on the one hand, all the previously exposed schools of thought bring us closer to obtaining a detailed picture of policy design. On the other hand, the reliance on typologies is a great source of criticism within the existing literature. Those criticisms have shown that any new attempt to characterize policy design has to combine the following features:

1. In order to recognize the multi-dimensionality of policy designs, a new approach should not rely on ideal-typical categories.
2. A new approach should be exhaustive and, simultaneously, provide conceptual clarity.
3. It should overcome pure description. Rather than categorizing instrument types, a new approach should be able to evaluate a policy design's prospective ability to solve an underlying societal issue.
4. The new attempt should not purely focus on single policy instruments as the unit of analysis, but should also be applicable to an instrument mix. Additionally, it should consider all the arrangements specifying how long, to whom, and on which level the policy applies.
5. Policy typologies have been criticized for not allowing causal analysis and hypotheses testing. One obstacle in this regard is the fact that typologies are multi-dimensional, which makes relating several independent variables to one dependent variable difficult, as is the case with hypothesis testing. To fill this void, capturing multi-dimensionality in the form of categorical or continuous variables, rather than as mutually exclusive categories (such as typologies), would prove useful. Moreover, a new attempt to conceptualize policy designs should rely on numerical values and not distinct categories to allow for statistical analyses. Such a new approach should give clear guidance on how to objectively quantify policy.

2.1.3 *A New Approach to Policy Design: The Policy Comprehensiveness Index*

Building on the lessons of previous research, this book explores a new approach to policy design, which incorporates insights on policy instruments from primarily *first-* and *second-generation* scholars. Along with these discernments, the new approach examines the ability of policy designs to comprehensively address public problems.

Evaluating the performance of an instrument design for solving an underlying issue requires a new analytical tool. Such a tool should overcome shortcomings of typologies and comply with the five premises formulated previously in Sect. 2.1.2.4. The following items seek to highlight explanations for why an index approach is a powerful tool for arriving at each of the five premises:

1. An index approach does not predefine ideal-typical mutually exclusive categories, but rather highlights different facets of a policy in a composite way. Because indices summarize a multitude of indicators (Hajkowicz 2006), there is no artificial reduction into one single category, as is the case with typologies.
2. Indices capture complexity by looking at multiple dimensions all the while producing one synthetic, representative result. In this way, policies may parallel on another along some facets and differ from each other along others, in multiple combinations, and without creating a new category for each combination.
3. An index also complies with the present study's aim to moving beyond instrument categorization and toward a measure of performance. By means of indices, a policy design's performance can be evaluated such that it becomes apparent how much or how little a policy design contributes to addressing a public policy problem. Likewise, policy designs may be ranked with regard to their prospective ability to solve an underlying issue.³
4. Moreover, an index can be applied to a single policy instrument, as well as to policy mixes. Through its multiple composite indicators, an index can take into account the specific provisions that come along with policy instrument mixes.
5. Finally, an index may assign qualitative values (low–medium–high) or numerical ones (e.g., 0–0.5–1, or from 0 to 10). Creating one numerical index value enables one to rank policies' performance, as well as to compare policy designs over time. Moreover, hypotheses are testable in quantitative ways, e.g., in statistical analyses.

In conclusion, the ultimate aim of a policy index is not only to establish an instrument typology in the form of discrete categories, but also to create a single synthetic measure of policy performance. More specifically, here-proposed index

³When two policy designs perform equally, this can be due same scores for different composite indicators. If the aim was to categorize policy design, this would clearly be a problem. But, the aim here is to evaluate performance. Two equal scores reflect that policies can be designed very differently and still address the policy problem equally well.

seeks to evaluate a policy design's prospective performance in comprehensively addressing an underlying policy issue.

As opposed to environmental performance, the index captures *policy performance*, which involves an *ex-ante* estimation about the chances of a policy design to (a) cope with an underlying problem and (b) to be implemented. Both are necessary in order to problem-solve: First, a policy design has to be well adapted to the underlying policy problem. However, even such a well-adapted policy may not contribute to problem solving if it is not implemented. Hence, to achieve problem-solving, a policy also has to be designed so that it increases its chances for implementation.

An *ex-ante* evaluation is followed here to account for the analytical difference between *policy output*, *outcome*, and *impact* (Schneider and Janning 2006, p. 15). *Policy output* refers to an adopted policy and its content as a result of a policy-making process. *Policy outcome* reflects the policy results after implementation, and *policy impact* concerns the societal or environmental changes induced by a policy. Take the example of a crossroad where accidents happen regularly, and therefore, actors wish to adopt measures to reduce accidents. The decision to install stop signs, for example, is equivalent to a *policy output*. The installation of stop signs on the crossroad corresponds to a *policy outcome*, and the reduction of accidents represents the *policy impact*. The index proposed here exclusively evaluates *policy outputs*, defined as policy designs. As such, the index seeks to estimate whether the arrangements of policy designs are able to achieve the desired *policy outcome* and *impact*. Since the index is not tailored to evaluating actual policy outcomes or impact, it is considered an *ex-ante* estimation here.

In order to address a policy problem in a *comprehensive* way, policy designs need to fulfill three criteria: First, policy designs have to be *effective*; second, *efficient*; and third, *compelling* (see Sect. 1.2 for a definition of the terms *effective* and *efficient*). *Effectiveness* suggests that, ideally, a policy addresses the entirety of the sources contributing to a problem in order to comprehensively solve an underlying policy problem. At the same time, however, more regulation does not necessarily denote *efficient* problem solving. When only a subgroup of society causes a problem, it is not efficient if a policy targets society in general. Efficient policies, on the contrary, may be less costly and also receive a higher level of acceptance. A *compelling* policy is designed such that it increases its prospective chances in being applied in order to address an issue (without simply existing on paper). Hence, *policy comprehensiveness is defined here as the degree to which a policy design addresses an underlying policy problem in an effective, efficient, and compelling way*.

Since indices represent a summary of multiple indicators, it is fundamental to include the 'right' indicators. The literature advances two main requirements for choosing indicators: (a) the avoidance of redundancy and (b) exhaustiveness (Hajkowicz 2006). Redundancy occurs when two indicators measure the same phenomenon, which leads to double counting and a biased outcome. Exhaustiveness denotes that indicators should grasp all composite aspects of the overall phenomenon that the index aims to summarize. To comply with these

requirements, index construction can be guided by either empirical data or a solid theoretical framework (Niemeijer 2002). For the present work, a theory-driven approach is adopted. The indicators that feed into the policy comprehensiveness index are derived from the rich literature on policy instrument characteristics developed by previous scholars (see Sects. 2.1.2.1 and 2.1.2.2).⁴ As such, the proposal of indicators should be considered a starting point for future research that reflects the current knowledge of policy design.

Drawing on previous research about policy design characteristics, the following indicators are proposed to approximate the comprehensiveness of policy design, i.e., policy output (not policy outcome, impact, or change):⁵

- **Pressure on target group(s):** The first indicator that feeds into the index can be found in above-described work of Linder and Peter under the term *constraint* (1989), in Dahl and Lindbom's (1953) idea about the *nature of government influence*, or in Salamon's (2002) work characterizing policies' *coerciveness*. Bressers and O'Toole (1998) formulate this aspect of policy design in a more positive way as *the freedom of target groups to opt for or against the application of policy measures*. Here, the term *pressure* is used, because policies do not only constrain undesired behavior, but also promote desired behavior. Both constraining and promoting involve a certain degree of pressure for adopting a desired behavior.

Target groups are the addressees of policies and as such are supposed to adapt their behavior or procedures accordingly. Depending on the exact design of a policy, there can be more or less pressure on target groups to adapt their behavior (or procedures). In other words, individuals or groups may be granted more or less freedom for choosing whether or not to take action (Bressers and O'Toole 1998). Persuasive instruments, such as information campaigns or subsidies, typically do not force the target group to adopt a particular behavior. Likewise, product charges leave some degree of choice between continuing to use the product (and pay the charge) and ceasing to use it.

⁴An alternative approach would be to look into the indicators proposed by other policy indices. To my best present knowledge, there is currently no other index measuring the general ability of policy designs to comprehensively address a societal issue. Existing indices are specifically designed for measuring defined problems such as corruption (Corruption Perceptions Index), economic uncertainty (Economic Uncertainty Index), migrant integration (Migrant Integration Policy Index), or environmental sustainability (Environmental Sustainability Index, State of the Nation's Ecosystems, Ecological Indicators for the Nation, Environmental Policy Stringency, Index of Environmental Regulations, Climate Laws, Institutions and Measures Index, Environmental Regulatory Regime Index). In absence of an exemplary index, the theory-guided approach to select indicators, chosen here, seems to be the most appropriate one to establish a first index proposal.

⁵As mentioned above, *comprehensive* emphasizes that a policy design has to be effective, efficient, and compelling. These criteria apply to the overall index, but not each indicator. The indicators composing the index can fulfill one or two out of the three criteria, because through the addition of the composite indicators the final index fulfills all three criteria.

Based on the assumption that policies aim at alleviating policy problems, the more a target group has the choice about whether or not to respond to the policy, the less pressure there is to comprehensively reduce a societal problem. And vice versa, the more a policy design places pressure on target groups to adopt desired or quit undesired behavior, the more likely the underlying problem is to be alleviated. The amount of existing pressure is a first indicator that a policy design has the potential to comprehensively address a societal issue by compelling the target group to change behavior or processes.

- **Sanctions** are a decisive element of policy designs and can be found, for example, in the work of Crawford and Ostrom (1995). In theory, target groups could deliberately choose not to comply with a policy. To prevent such situations, sanctions impose a financial or social cost on defection. Consequently, *sanctions* limit the freedom to choose non-compliance. The higher the costs of violating a policy compared to the gains of non-compliance, the more likely a policy is to not only exist on paper, but also be applied in reality. Policy designs that include sanctions are able to compel target groups to take a desired course of action, and this, in turn, can promote comprehensive problem solving. The threat of sanctions alone does not yet guarantee policy implementation. Enforcement requires the existence of an agency responsible for the control of compliance, as well as the imposition and pursuit of sanctions. Hence, when a policy provides for an enforcement agency, its ability to comprehensively reduce a societal issue is considered larger than without such provisions.
- **Inclusiveness:** Lowi (1964, 1972), Linder and Peters (1989, pp. 43, 46), as well as Bressers and O'Toole (1998) theorized about how precisely policy designs target the root causes of a problem (see also Metz and Ingold 2014). Policy problems can be caused by the behavior of (or processes practiced by) a few individuals, a specific or several target groups, or society in general (Linder and Peters 1989; Schneider and Ingram 1993; Howlett and Ramesh 2003; Lowi 1964). Precise policies target those units, which cause the underlying policy problem, while imprecise policies apply to other units (more or less units) than just the ones causing the problem. Ideally, policies are effective in that they address the entirety of target groups contributing to a problem. In reality, distortions might occur if an instrument addresses symptoms rather than causes of a problem, or if directly addressing the root cause is politically unfeasible. Hence, some policies are more adept than others at including liable target groups. The idea here is that the broader the target group relative to those units contributing to a problem, the more comprehensive the policy design; the more partial the target groups, the less comprehensive the policy. Thus, establishing policy *inclusiveness* denotes achieving a point of maximum policy efficiency. More concretely, policy inclusiveness concerns *horizontal* policy efficiency as it refers to addressing different societal groups or sectors (such as agriculture and industry) that cause a policy problem.
- **Proportionality:** While inclusiveness takes a horizontal perspective, proportionality takes a vertical one. This indicator is derived from Bressers and

O'Toole's (1998) work who refer to the correspondence between the scope of a policy issue and the scope of the regulative answer to it. The underlying approach takes up this idea of proportionality between problem and solution and adds the aspect of governance level. Accordingly, proportional policies apply to the same jurisdictional level (local, regional, national, international) as the elements contributing to the regulated aspect of the problem. Precisely, proportionality deals with the level on which the policy has to be implemented, and not the level upon which the policy is decided. For instance, a law adopted by a national parliament pertaining to the promotion of economic growth in exclusively one region in the country would be considered a regional-level policy for this indicator.

A further difference between inclusiveness and proportionality should be pointed out: Inclusiveness examines all potential causes of a policy problem and evaluates the ratio of liable target groups considered in a policy design. The indicator *proportionality*, on the contrary, restricts its perspective to the selected target groups of a policy and disregards all elements not targeted by the policy, even if they contribute to a policy problem. For example, if a defined climate change policy targets the transportation sector and disregards the industrial or energy sector, only the transportation sector is taken into consideration in order to evaluate the proportionality between the scope of the transportation policy and the scope of the transportation problem.

There are two possible disproportionalities between the policy level and the problem scale. First, the policy deals only partly with the problem when the policy applies to a smaller scale compared to the extent of the problem (see also Metz and Ingold 2014). In that case, a policy design is not effective enough. Second, disproportionalities exist when a policy applies to a larger scale than the extent of the problem. In such a case, a policy design is too extensive and, therefore, not efficient. This phenomenon may occur when a national-level policy deals with a geographically concentrated problem.

In short, the indicator proportionality is the difference between the extent of the problem and the jurisdictional level of its solution. The smaller the difference, the higher the score for proportionality. Take the example of a municipality that adopts measures to solve its own local issue. Despite the fact that the policy applies only locally, the policy would still receive a high score for proportionality because problem scale and solution level are identical. An example of disproportionality would be an environmental quality norm that applies and has to be monitored in an entire country, whereas the emitters of that pollution are regionally concentrated in one jurisdiction.⁶ In that case, a regional

⁶Note that the problem scale of the pollution considered in the policy design is contrasted to its solution level. What is not considered here are the types of pollution that may occur, but that are not taken into consideration in the policy design.

environmental quality norm would be more proportional. Hence, establishing proportionality means working toward a point of maximum vertical policy efficiency. The more proportional a policy design, the more comprehensively (meaning efficiently) it addresses a policy problem. Likewise the less proportional, the less likely a comprehensive policy design is to transpire.

- **Directness:** This indicator is derived from Dahl and Lindblom's (1953), Salamon's (2002), and also Bressers and O'Toole's (1998) work, who themselves build on Pressman and Wildavsky's research (1984). Thanks to the latter, it is well known that a huge number of organizations participate in implementation and adjust, alter, or even obstruct policy design. Implementing a policy in the intended way depends largely on the design of the implementation duties. A policy design characterized by resource shortages for implementation (financial, time, personnel, intellectual) or competing loyalties can impair interactions among implementers and hence can lead to gaps in the implementation process. Pressman and Wildavsky conceived of implementation as a problem stemming from too many *clearance points*, defined as the number of individual decision points that must be agreed to before any policy decision can be translated into action (Peters 2013, p. 139). When numerous actors participate in the implementation process, there are many clearance points and opportunities for altering policy design.

Building on this line of thought, Bressers and O'Toole (1998) wrote about the *degree of state involvement in implementation*. Similarly, Salamon popularized the term *directness*, which 'measures the extent to which the entity authorizing, financing, or inaugurating a collective activity is involved in carrying it out' (Salamon 2000, p. 1654). When a policy is designed such that the same institution is involved in all the three tasks (i.e., deciding, financing, and implementing), there are fewer opportunities for clearance points. A policy is classified here as *direct* when the same authority *carries out* all the three tasks, or when the authority that adopted the policy *supervises* implementation, while other levels of government or private actors actually implement and finance the policy. Generally, a policy design is considered indirect when the decision-making entity plays no or little role in supervising implementation, whereas other levels of government or private actors are assigned key responsibilities in controlling or carrying out implementation. Insights from implementation studies and principal-agent theories demonstrate that indirect policy designs bare the risk that goals of those deciding (principals) and those implementing (agents) diverge. With principal-agent difficulties, the number of clearance points increase, as well as the risk of goal displacement; goal achievement, on the contrary, becomes more difficult to achieve. Hence, an indirect instrument design is considered less compelling because the diffusion of tasks increases the chances of principal-agent difficulties. With dispersed implementation duties, there is some leverage to adapt, change, or soften policy

design so that its impact on behavior or processes differs from its intended outcome. On the contrary, when a policy is designed such that the same authority is involved in all three tasks (deciding, funding, and implementing), exceptions, adaptations, or dilution of it in the implementation process are less likely. Thus, the more direct a policy is designed, the higher the chances of comprehensive problem solving.⁷

- **Bindingness:** Western democracies generally assign a hierarchy to their norms (Shelton 2006; Rüthers et al. 2011). The constitution is placed on the highest rung followed by laws, and finally ordinances or decrees. Oral agreements are unwritten laws and ranked below written ones. Either of these types of legal acts or informal arrangements may deal with policy problems.

Policymaking processes are distinct among the different types of legal acts. In general, policymaking processes that adopt or amend a law are much more formal; i.e., they follow a more precise constitutionally given procedure involving the legislature, than the adoption of decrees, for example. Therefore, decrees (and even more so unwritten law) can be changed more easily and in a shorter timeframe than laws or constitutions. Constitutions and laws, on the other hand, are generally characterized by more stability. Because of their higher rank and structure, constitutions and legal acts enjoy higher authority and can be more compelling. When a policy problem is dealt with on the level of a legal act (rather than in a decree or an action plan), it signals policy commitment on a longer-term horizon. The hierarchy of norms can be considered an indicator of how compelling a policy is. The indicator builds on the relationship that the higher the level of bindingness, the more comprehensively a policy problem is addressed.

In total, six indicators can be deduced from existing policy design theories to establish an index of policy comprehensiveness.⁸ From here on, this index will be referred to as *policy comprehensiveness index*, which is a tool for evaluating and comparing policy designs' prospective ability to comprehensively address an underlying issue. The index serves to evaluate policy outputs, which passed the

⁷Some streams of literature highlight self-regulation (Howlett 2004, p. 6) or adjustment flexibility, defined as the possibility to adapt regulations to local circumstances or new developments (Knill and Lenschow 2003, p. 8). Note that these concepts do not necessarily contradict a direct policy design. For example, a community that self-regulates its matters may adopt *direct*—as defined here—policy designs when it decides, finances, and self-implements its own policies.

Also note that directness is not in opposition to privatization. A policy design can be *direct*—as defined here—even if a private actor is entrusted with the implementation of a public policy, under the condition that correct implementation is supervised by the entity that adopted the policy.

⁸Some policy design features put forward by previous scholars, such as visibility or political risk (Linder and Peters 1989; Salamon 2002), have deliberately not been included in the index. Rather than providing information about the comprehensiveness of a policy design, these factors help to explain why one instrument is chosen over another.

policymaking process and have been adopted, but not yet implemented. As such, the quality of the policy design is evaluated rather than the quality of its implementation. However, the policy comprehensiveness index is not tailored to evaluate policy outcomes, policy impact, or policy change.

The indicators capture the degree to which policy designs address underlying policy problems in an effective, efficient, and compelling way. The first two indicators, i.e., *pressure on target groups* and *sanctions*, measure the degree to which policy designs compel target groups to respond to a policy as intended. The indicator *directness* points to the degree to which policy designs are compelling for implementers. *Bindingness* highlights the degree to which policy designs compel the state to enforce its own laws to addresses an underlying policy problem. The indicators *inclusiveness* and *proportionality* both capture whether a policy is designed to address the underlying problem in an effective and efficient way. Effectiveness and efficiency are necessary for highlighting the fact that comprehensive policy design establishes congruence between the scope of the problem and its solution. The difference between the two indicators is that *inclusiveness* concerns achieving a point of maximum horizontal policy effectiveness and efficiency; proportionality, on the other hand, deals with achieving a point of maximum vertical policy effectiveness and efficiency. Taken together, the composite indicators result in an index that matches the definition of comprehensiveness according to whether a policy design should address an underlying policy problem in an effective, efficient, and compelling way.

In summary, the index proposes six indicators evaluating a policy design's prospective performance in comprehensively addressing a societal problem. Accordingly, comprehensive problem solving depends on the degree of pressure on target groups, and on deterrence from non-compliance through sanctions enforced by agencies staffed with enough resources to control compliance and impose sanctions. Additionally, comprehensive problem solving is evaluated by looking at a policy design's inclusiveness and proportionality with regard to addressing the entirety of sectors and levels (not more and not less) contributing to the policy problem. Another indicator for a policy design's prospective performance is its directness, i.e., the degree to which the authority deciding is also involved in supervising implementation. The indicator *bindingness* captures the degree to which a legally binding formal law addresses a policy problem or an informal policy document.

2.2 Policy Comprehensiveness Index: Data, Method, Operationalization

The previous paragraph introduced the indicators that feed into the policy comprehensiveness index. Subsequently, methodological questions of index construction are addressed.

2.2.1 Data Collection

The assessment of policy designs according to the policy comprehensiveness index relies on qualitative data gathered through content analysis of policy documents and through interviews conducted by the author. More concretely, information about the policies that each country adopted (or is in the process of adopting) toward micropollutants was gathered. To ensure that the gathered, qualitative data is comparable across cases, the exact same information about different aspects of micropollutants policies across the four countries was collected. To establish a uniform and in-depth qualitative and descriptive analysis of a policy design, it is proposed here to establish a *policy design profile*. It then serves as underlying ‘raw data’ for the policy comprehensiveness index. A policy design profile lists the most important aspects of a policy design, including the instrument types or instrument mix adopted (e.g., ban, trading scheme, and norms) and other specifications about target groups, sanctions, competent enforcement agency, and alike. The literature presented under Sects. 2.1.2.1 and 2.1.2.2 drew attention to the important characteristics of policy designs. Accordingly, profiling may start with naming single instrument types out of which the policy design is composed (Q 1, Table 2.3). There is sufficient theoretical knowledge available to gather information on the latter by using a universal or common language. For example, one could distinguish regulative, economic, persuasive, and organizational instruments like in Hood’s (1986) or Vedung’s typology (1998) (see Sect. 2.1.2.1 for alternatives). Moreover, the questions asked by Crawford and Ostrom (1995) offer sufficient guidance on the aspects that need to be understood regarding policy design, aside from naming policy instrument types: If or what sanctions are involved (Q 2, Table 2.3)? Who enforces sanctions in cases of infringement (Q 3, Table 2.3)? Who is the target group (Q 4, Table 2.3)? What are the criteria defining target groups and do they enable exceptions (Q 5, Table 2.3)? To profile a policy design, it is additionally useful to answer the following questions: Which jurisdictional level is responsible for implementation (Q 6, Table 2.3)? Who adopted the underlying policy (termed decision-making entity in Q 7, Table 2.3)? Who bears the costs of the policy (Q 8, Table 2.3)? Which entity implements or controls implementation (Q 9, Table 2.3)? What is the type of policy document cementing a policy design (Q 10, Table 2.3)?

For the policy design profile, two further questions are deduced from the literature on characteristics of policy problems, as they enable one to compare the cause of the problem with the adopted policy solution (Metz and Ingold 2014; Peters and Hoornbeek 2005): Which are the sectors or target groups contributing to the occurrence of the underlying policy problem (Q 11, Table 2.3)? On which scale (local, regional, national, international) does the policy problem occur (Q 12, Table 2.3)? In total, analysts must answer twelve questions for each policy design under investigation, in order to establish uniform profiles and to acquire sufficient information for ranking policy designs according to the policy comprehensiveness index.

To gather information about policy designs and answer question 1 through 10 of Table 2.3, an in-depth content analysis of policy documents was conducted. Policy documents studied here include laws, ordinances or policy plans, legal drafts

Table 2.3 Policy design profile

Profiling a policy design
Q1: Policy instrument(s)
Q2: Sanctions for non-compliance
Q3: Competent enforcement agency
Q4: Target group(s)
Q5: Criteria defining target groups/exceptions
Q6: Competent jurisdictional level for implementation
Q7: Decision-making entity
Q8: Distribution of costs
Q9: Competent agency for implementation/supervision of implementation
Q10: Type (and name) of policy document
Q11: Target groups/sectors contributing to the underlying policy problem
Q12: Problem scale
<i>Q</i> Question

reflecting all stages of the process, meeting protocols of parliamentary committees or working groups, letters such as invitations to public hearings or exchanges between the legislature and the executive, and reports, i.e., evaluation or implementation reports written by the bureaucracy or external advisors. Access to these kinds of policy documents was offered by the Web sites of the environmental ministries in the four countries and the European Commission, databases provided by parliamentary or the executive services, and also Google searches. In cases where a database was not public, access through e-mails, phone calls, or personal meetings was requested and usually enabled by the respective organization.

While policy documents were used to characterize policy designs in terms of instruments, sanctions, target groups, and implementation duties, (Q1–Q10 of the policy design profile, Table 2.3), other sources of information are necessary to describe the environmental problem itself (Q11–Q12, Table 2.3). To characterize micropollutants as a policy problem, and to identify emitters and the scale of the problem for waters, scientific sources of information, such as scientific articles, were consulted (Hollender et al. 2008; Schwarzenbach et al. 2006; Cunningham et al. 2010; Touraud et al. 2011; Sacher et al. 2008; Bach and Frede 2012; Müller 2011; Altmann et al. 2012; Reungoat et al. 2011; Clarke and Smith 2011; Valiente Moro et al. 2012; Sedlak et al. 2000; Rowney et al. 2009; Johnson et al. 2008; Bercu et al. 2008; Richardson and Ternes 2011; Kortenkamp et al. 2007; Mostafa and Helling 2002; McGonigle et al. 2012). Additional sources of information include analytical policy reports (ICPR 2003, 2010a, b, c, d, e, f, 2011a, b, 2012a, b, c; WHO 2008, 2012; BAFU 2012; Abegglen and Siegrist 2012; Götz et al. 2010b; EEA 2011; IAWR 2007), or results of statistical offices (Annual reports of the International Rhine Monitoring Station in Weil am Rhein 2010).

In a second step, the information from content analysis was validated and complemented with detailed insights from a total of 41 semi-structured in-person interviews with high-ranking state officials (see Annex 1 for a full list of interviews).

2.2.2 Index Construction and Operationalization of Indicators

Indices are useful tools for summarizing multiple indicators by isolating key aspects from an otherwise overwhelming set of information (Niemeijer 2002). The literature describes index construction as a series of five steps (Keeney and Raiffa 1993; Hajkowicz 2006; Von Neumann and Morgenstern 1944):

1. The analyst must identify relevant indicators and obtain data for each indicator.
2. Data units (e.g., money, time, distance) have to be transformed into a uniform unit.
3. The relative importance of each indicator can be weighted.
4. The analyst must determine whether an additive, multiplicative, or hybrid utility function is appropriate for the aggregation of the underlying indicators.
5. A sensitivity analysis should be conducted.

Each of those five steps is subsequently explained in more detail and applied to construct the policy comprehensiveness index.

2.2.2.1 Identification of Relevant Indicators

The identification of relevant indicators can be guided either by empirical data or by a solid theoretical framework (Niemeijer 2002). In both cases, indicators should exhaustively grasp all composite aspects of the overall phenomenon that the index aims to summarize, without being redundant (Hajkowicz 2006). For the present study, indicators were deduced from theory. The theory-driven approach was chosen because existing literature on policy designs (see Sect. 2.2.1) provides reliable information about the relevant indicators necessary to construct an exhaustive index (Niemeijer 2002). Section 2.1.3 explained in detail how relevant indicators were deduced from theory in order to establish the policy comprehensiveness index. In total, six indicators were identified:

1. pressure on target group,
2. sanctions,
3. inclusiveness,
4. proportionality,
5. directness, and
6. bindingness.⁹

The next paragraphs explain the operationalization of each of the six components in more detail.

⁹Since the present study relies on only four cases, it was not possible to test for correlation between indicators (Hajkowicz 2006). Researchers working with the index should test for redundancy and feel free to drop certain indicators.

2.2.2.2 Transformation into Uniform Units

The second step in index construction consists of transforming diverse data units into a uniform unit. Since composite indicators of indices usually rely on different units (e.g., hours, miles, hectares, and liters), a transformation function is necessary, which places the scores of each policy scenario at some point on a scale between zero (lowest utility) and one (highest utility) (Hajkowicz 2006). The simplest transformation technique is a linear one, which adjusts lowest and highest indicator values on a linear scale. An alternative to the linear scale is the logarithmic one, which takes into consideration diminishing marginal utility. A linear transformation function $v_i(x_i)$, where composite indicators of the index are denoted by i and indicator raw scores by x_i , can be written as follows (Hajkowicz 2006):

$$v_i(x_i) = \frac{x_i - \min x_i}{\max x_i - \min x_i}$$

where $\min x_i$ and $\max x_i$ denote minimum and maximum indicator scores across all observed scenarios.

For the present study, the underlying raw data is qualitative, and hence, the ‘units’ are not conventional ones, such as hours, euros, kilograms, or kilometers. In order to maintain assigned scores to indicators, it is particularly important to clearly define what the qualitative ‘units’ and what the highest or lowest level of performance corresponds to for each indicator of the policy comprehensiveness index. The next step explains (a) which piece of information from the policy design profile (see Sect. 2.2.1) feeds into building each indicator (see Tables 2.16, 2.18, 2.20, 2.22, 2.24, 2.26) and (b) how to assign scores to each of the six indicators.

Tables 2.17, 2.19, 2.21, 2.23, 2.25, and 2.27 highlight, for each indicator, the corresponding qualitative type of ‘unit.’ Moreover, these tables portray how the qualitative units are transformed into quantitative, measureable units by translating minimum and maximum performance levels into a linear scale between 0 and 1, where no performance corresponds to a score of 0 and complete performance corresponds to a score of 1: low to 0.25, medium to 0.5, and high to 0.75.¹⁰

Pressure on Target Groups

The first indicator of the policy comprehensiveness index consists of evaluating the degree to which a policy places pressure on target groups to abandon undesired behavior or to adopt desired behavior. In order to carry out such an evaluation, it is helpful to resort to information from the policy design profile concerning single *policy instruments (and instrument mixes)* contained in policy designs (Table 2.4).

The present work broadly distinguishes between command-and-control, economic, and persuasive instruments (Vedung 1998). The degree of pressure on target

¹⁰The performance levels of all six indicators are already scaled between 0 and 1. Therefore, it was not necessary to transform units by means of the transformation function.

Table 2.4 Information from the policy design profile for the indicator ‘pressure on target group(s)’

Indicator of the policy comprehensiveness index	Information from the policy design profile
Pressure on target groups	Q1: Policy instrument(s)

Table 2.5 Pressure on target group(s): units, levels of performance, and scores

Indicator (qualitative ‘unit’)	Pressure on target groups (likelihood that target groups take action)
No performance (score 0)	No policy instruments adopted
Low performance (score 0.25)	Policy instrument mix relying on persuasion at most [<i>sermons</i> according to Vedung (1998), or <i>nodality/information</i> according to Hood’s (1986) instrument typology]
Medium performance (score 0.5)	Policy instrument mix relying on economic incentives at most [<i>carrots</i> according to Vedung (1998), or <i>treasure</i> according to Hood (1986)]
High performance (score 0.75)	Policy instrument mix combining economic incentives with some sort of control/state authority
Complete performance (score 1)	Policy instrument mix mostly relying on state authority [<i>sticks</i> according to Vedung (1998), or <i>authority</i> according to Hood (1986)]

groups is considered gradually decreasing from the first to the last instrument category. In water protection policy, command-and-control instruments include, for example, substance bans, authorization restrictions for marketing substances, environmental quality norms, emission limits, mandatory best environmental techniques, or other forms of compulsory technical standards (see Metz and Ingold 2014 for an encompassing overview). Examples of economic instruments in water protection include product or substances charges, subsidies for behavioral changes, or improved wastewater treatment and effluent charges. Persuasive instruments may include voluntary best environmental practices, information campaigns or consulting, research, or suggestions for the correct disposal of waste or private–public partnerships.

The next question is then how to translate the degree of pressure that a policy design puts on target groups into quantifiable performance levels. Table 2.5 highlights the underlying qualitative unit of the indicator, namely the types of policy instruments that make up an instrument mix. Additionally, the table links instrument mixes to different performance levels and scores. Performance levels range from no performance (score of 0), where a policy design does not fix any policy instruments, to complete performance (score of 1), where a policy design consists of a policy instrument mix largely relying on command-and-control types of policy instruments. Instrument mixes that are composed of persuasive instruments at most, but do not contain policy instruments putting more pressure on target groups than persuasion, obtain a low performance level (score of 0.25). Instrument mixes that rely on economic incentives at most, i.e., there are no policy instruments placing a

higher level of pressure on target groups than economic incentives, attain a medium-level performance (score of 0.5). Instrument mixes composed of economic incentives paired with some sort of control attain a high performance level.

An example of a policy design that places a high degree of pressure on target groups could be an emissions trading system, which sets a politically defined cap to yearly CO₂ emissions and, as such, controls the maximal amount of emissions. Nevertheless, individual emitters can choose to continue emitting higher amounts of CO₂ by paying for emission allowances. Taking the same example of CO₂ reduction policy, a score of 1 could be attributed to a policy design, which legally capped the yearly amount of allowed CO₂ emissions for individual emitters. In that scenario, emitters would not be able to continue emitting CO₂ at discretion, but would be highly compelled to change their production processes in order to comply with the defined cap. A CO₂ policy design could attain a medium level of performance if it relied on a fuel tax to reduce emissions from transportation. Although fuel taxes set a price signal and, therefore, encourage people to switch from cars to alternative means of transportation, these incentives cannot ensure such a change in behavior.¹¹ If people choose to pay the fuel tax, CO₂ emissions do not diminish as a consequence of the introduced policy. Policy design that relies on voluntary CO₂ reduction measures, or on public campaigns, would attain a low level of performance here, since it is not unlikely that target groups choose to abstain from taking action by ignoring a public campaign or a voluntary engagement.

Sanctions

The second indicator of the policy comprehensiveness index concerns sanction. To evaluate the effectiveness of sanctions, it is necessary to know *if sanctions exist* at all and, if so, whether there is a *competent agency* with enough resources to control compliance and enforce sanctions where necessary (Table 2.6). Without sanctions and enforcement agencies, there is the danger that a policy is not implemented and exists solely on paper, which would considerably reduce the comprehensiveness of a policy in addressing a societal problem.

Sanctions include all types of measures that can deter target groups from adopting or continue adopting an undesired behavior. If we establish a continuum measuring, the stringency of sanctions, imprisonment, or severe monetary fines would lie on the high side, while appeals to moral conscience would lie on the low side of the continuum. To determine performance, the absolute stringency of sanctions is less decisive than its relative impact on target groups' behavior. For example, a policy design defining a one million dollar fine might be a very effective way to deter

¹¹Note that the assignment of policy instrument types to different performance levels is meant as a guideline for analysts. However, the overarching logic, which should finally guide analysts' decision on how to assign scores, is the *likelihood that target groups take action*. A policy instrument mix that relies on economic incentives at most could theoretically attain a complete level of performance if economic incentives were high enough to oblige target groups to take action. A hypothetical example would be if fuel taxes were constantly increased, so eventually no one would be able to use cars as a means of transportation anymore.

Table 2.6 Information from the policy design profile for the indicator ‘sanctions’

Indicator of the policy comprehensiveness index	Information from the policy design profile
Sanctions	Q 2: Sanctions for non-compliance Q 3: Competent enforcement agency

Table 2.7 Sanctions: units, levels of performance, and scores

Indicator (qualitative ‘unit’)	Sanctions (portion of deterred target groups)
No performance (score 0)	No existing sanctions
Low performance (score 0.25)	Existing sanctions deter small parts (less than half) of the target group
Medium performance (score 0.5)	Existing sanctions deter half of the target group
High performance (score 0.75)	Existing sanctions are high enough to deter important parts (more than half) of the target group
Complete performance (score 1)	Existing sanctions are high enough to deter the entire target group

individuals, small farms, and enterprises. However, companies with very large budgets may purposefully take hefty fines into account in order to continue with a politically undesired, but economically profitable behavior. To take into consideration that the impact of sanctions on target groups’ behavior is sensitive to its context of application, the ‘unit’ of the indicator is defined here as a relative value, i.e., the proportion of target groups that sanctions achieve to deter and not as an absolute value (e.g., amount of a fine, years of imprisonment). Table 2.7 provides an overview of how to translate different levels of sanctions into performance levels and scores. Accordingly, complete performance (score of 1) for the indicator exists when sanctions are high enough to deter the entire target group of the policy. Low performance, on the contrary, implies that sanctions deter only small parts of the target group (score 0.25). One can assign a medium-level performance if a policy is designed such that existing sanctions deter half of the target group (score 0.5). If sanctions deter important parts of the target group, a policy design is characterized by high performance on this indicator (score 0.75). No performance is equivalent to an absence of sanctions in the policy design (score of 0).

Inclusiveness

The third indicator of the policy comprehensiveness index is called *inclusiveness* and addresses the question of how precisely policy designs target the root causes of a problem. To gauge inclusiveness, two steps are necessary: First, analysts must identify the *sectors contributing to a policy problem*; second, they must assess the *target group(s) addressed by a policy* (see Table 2.8). Inclusiveness then builds on the idea of comparing the sectors causing a problem with the groups targeted by a policy design. A policy design is considered inclusive when it targets the entirety of groups contributing to a problem. Who the target groups of a policy really are

Table 2.8 Information from the policy design profile for the indicator ‘inclusiveness’

Indicator of the policy comprehensiveness index	Information from the policy design profile
Inclusiveness	Q 4: Target group(s) Q 5: Criteria defining target groups/exceptions Q 11: Target groups/sectors contributing to the underlying policy problem

Table 2.9 Inclusiveness: units, levels of performance, and scores

Indicator (qualitative ‘unit’)	Inclusiveness (ratio of target groups to causes)
No performance (score 0)	No defined target groups
Low performance (score 0.25)	Small parts (less than half) of the groups/individuals causing the problem are targeted by the policy
Medium performance (score 0.5)	Half of the groups/individuals causing the problem are targeted by the policy
High performance (score 0.75)	Important parts (more than half) of the groups/individuals causing the problem are targeted
Complete performance (score 1)	The entirety of groups/individuals causing the problem are targeted

highly depends on the *criteria defining target groups*, which refers to exceptions or restrictions of the applicability of the policy design. For example, a policy might apply only to particularly large operators or certain sectors, rather than to society as a whole, which would restrict the inclusiveness of a policy design in cases where the very vast majority of society contributes to causing a policy problem.

The underlying ‘unit’ of inclusiveness is defined here as the ratio of groups targeted by a policy design to the groups causing a policy problem (Table 2.9). Accordingly, a policy design attains complete performance for this indicator (score 1), when the entirety of groups causing a problem is defined as target groups by a policy design. A policy that is designed such that only small parts of the groups causing a problem are targeted attains a low performance level (score 0.25). Medium-level performance (score 0.5) indicates that half of the groups causing the problem are targeted by the policy. High performance (score 0.75) is attributed to policy designs which target important parts of the groups causing an underlying policy problem. No performance (score 0) signifies that a policy design does not define any target groups.

Let us take the example of a policy design, which aims at the reduction of gender inequalities on the job market and introduces a 50% women quota for the boards of directors of the 30 biggest stock companies. Since gender inequalities largely exist on the job market outside of the 30 biggest stock companies and outside of boards of directors, policy design would attain a low score for the level of inclusiveness.

Proportionality

The fourth indicator of the policy comprehensiveness index is labeled *proportionality*. A policy is considered proportional when it must be implemented at the same jurisdictional level (local, regional, national, international) as the elements contributing to the problem. A two-step approach is necessary for evaluating proportionality: First, one needs information on the *scale of the problem*; secondly, on the *competent jurisdictional level for implementation* (see Table 2.10). In many countries, different levels of government have constitutionally or legally given competencies, such as education, police, water, or waste management. In accordance with a country’s division of competencies, policies are implemented at a defined jurisdictional level, such as the municipal, state, federal, or European level, termed here *competent jurisdictional level for implementation* (in short, *solution level*). The proportionality of a policy design is measured as the difference between the extent of the problem and the jurisdictional level of the solution. The smaller the difference between solution level and problem scale, the higher the score for *proportionality*.

Building on this idea, the underlying ‘unit’ for the indicator proportionality is the ratio of the solution level to the problem scale Table 2.11). Accordingly, a policy design performs best (score 1) when the defined solution level corresponds exactly to the problem scale; it performs least well when the defined solution level is much larger or much smaller than the problem scale (score 0.25). A medium-level performance for that indicator exists when policies are designed such that the defined

Table 2.10 Information from the policy design profile for the indicator ‘proportionality’

Indicator of the policy comprehensiveness index	Information from the policy design profile
Proportionality	Q 6: Competent jurisdictional level for implementation Q 12: Problem scale

Table 2.11 Proportionality: units, levels of performance, and scores

Indicator (qualitative ‘unit’)	Proportionality (ratio of solution level to problem scale)
No performance (score 0)	No defined solution level
Low performance (score 0.25)	The defined solution level is much smaller/larger than the problem scale (e.g., less than half the size or more than 1.5 times the size)
Medium performance (score 0.5)	The defined solution level is somewhat smaller/larger than the problem scale (e.g., less than quarter the size or more than 1.25 times the size)
High performance (score 0.75)	The defined solution level is only slightly smaller/larger than the problem scale (e.g., less 0.125 times the size or more than 1.125 times the size)
Complete performance (score 1)	The defined solution level corresponds exactly to the problem scale

solution level is somewhat larger or smaller than the problem scale (0.5); high performance exists in cases where solution level is only slightly larger or smaller than the problem scale (0.75). No performance at all signifies that a policy design does not define any solution level at which the policy has to be implemented. To define how ‘larger’ or ‘smaller’ play out in the empirical reality is likely to be context-sensitive and needs to be assessed by future research. For now, Table 2.11 provides preliminary guidelines, which should be applied with flexibility until further research approves their validity. Take the example of a policy that aims at securing a country’s endangered rain forest from being cut or burned. If a policy design achieved securing half of a country’s total rain forest acreages, one could argue that the defined solution level is much smaller than the problem scale (i.e., half the size). However, this evaluation of proportionality might not result in equal accuracy when considering the context of the policy. If we consider securing half of the Amazonian rain forest, this acreage might be large enough to achieve a high level of performance on the indicator *proportionality*. It is not possible to define, in absolute terms, how a smaller or larger solution level in comparison with the problem scale is realized. Rather, analysts should evaluate the ratio between problem scale and solution level relative to the underlying context.

Directness

The fifth indicator of the policy comprehensiveness index is *directness*, which measures the extent to which the entity deciding upon and financing a policy design is also involved in (the supervision of) its implementation. To assess directness, the analyst requires information regarding who *authorized or decided upon a policy design*, as well as *who pays for and implements a policy or supervises correct implementation* (Table 2.12).

The decision-making entity in Western-style democracies is usually the legislature, the executive, or the bureaucracy. The supervision of implementation is usually the responsibility of state bodies, which oversee lower levels of government, or the private sector tasked with implementation. A hypothetical example of a direct policy would be municipalities levying their own fee in order to finance garbage collection carried out by municipal workers, who are directly supervised by the municipality itself. The policy design would be considered less direct if a private company carried out garbage collection without any supervision by the municipality deciding upon and financing the policy. With dispersed implementation duties, there are more clearance points that provide some leverage to adapt,

Table 2.12 Information from the policy design profile for the indicator ‘directness’

Indicator of the policy comprehensiveness index	Information from the policy design profile
Directness	Q 7: Decision-making entity Q 8: Distribution of costs Q 9: Competent agency for implementation/supervision of implementation

Table 2.13 Directness: units, levels of performance, and scores

Indicator (qualitative ‘unit’)	Directness (number of clearance points through dispersion of implementation duties)
No performance (score 0)	No defined implementation duties
Low performance (score 0.25)	Implementation and funding are passed on to private sector or to other levels of government without control by authority deciding
Medium performance (score 0.5)	Implementation is controlled by authority deciding, and implementation and funding are passed on to private sector or other levels of government
High performance (score 0.75)	Implementation is controlled and funded by authority deciding, and implementation is passed on to private sector or other levels of government
Complete performance (score 1)	Authority deciding is also funding and implementing

change, or soften the policy design. Hence, directness is quantified here via the number of clearance points accumulating through the dispersion of implementation duties (Table 2.13). Accordingly, a policy is thought to perform strongest on that indicator if it is designed such that the authority deciding is also funding and implementing a policy (score 1). A policy is thought to perform weakly on directness when implementation and funding are passed on to the private sector or to other levels of government without any control by the authority deciding (score 0.25). A policy design attains a medium-level performance when implementation is controlled by the deciding authority, but implementation and funding are passed on to the private sector or other levels of government (score 0.5). High performance indicates that implementation is controlled and funded by deciding authority, and implementation is passed on to the private sector or other levels of government (score 0.75). No performance for directness signifies that implementation duties are not clearly defined in the policy design (score 0).

Bindingness

The last indicator of the policy comprehensiveness index carries the label *bindingness*. The information contained in the policy design profile on the *type of policy document* provides important insights into the evaluation of a policy’s *bindingness* (Table 2.14).

Laws or ordinances, which have formally been adopted by the legislature, demand more commitment to a policy by the state than informal policy plans or unwritten arrangements. A policy design attains best performance scores for bindingness (score 1) when it is long-term binding through the adoption or amendment of constitutional law (Table 2.15). Low performance scores are

Table 2.14 Information from the policy design profile for the indicator ‘bindingness’

Indicator of the policy comprehensiveness index	Information from the policy design profile
Bindingness	Q 10: Type of policy document

Table 2.15 Bindingness: units, levels of performance, and scores

Indicator (qualitative ‘unit’)	Bindingness (type of policy document)
No performance (score 0)	No existing legal document
Low performance (score 0.25)	Existing document, but non-binding
Medium performance (score 0.5)	Short-term binding (e.g., ordinance and decree)
High performance (score 0.75)	Medium-term binding (e.g., law)
Complete performance (score 1)	Long-term binding (e.g., constitution)

attributed to policies anchored in a non-binding documents (score 0.25). Medium-level performance exists in cases where policies are adopted through ordinances or decrees, which can be altered more easily than laws or constitutions and, therefore, can be considered short-term binding (score 0.25). Policies ratified through laws point to bindingness on a longer time horizon and to high performance (score 0.75). No performance is equivalent to a situation in which there is no legal document codifying the design of a policy (score 0).

In summary, policy analysts may rely on information gathered through the policy design profile (Q 1–12, Table 2.3) in order to evaluate performance levels of the six indicators composing the policy comprehensiveness index. In this study, the assessment of policy designs’ performance on each of the six indicators builds on careful estimation. The scores attributed to the indicators of the policy comprehensiveness index were cross-validated and approved by a top-ranked bureaucrat in a personal interview. Future research could alternatively rely on surveys, in which policy actors themselves evaluate policy designs according to the six indicators of the policy comprehensiveness index.

2.2.2.3 Weighing Indicators

The third step in index construction consists of attributing weights to indicators if the relative importance of indicators differs. It is possible that composite indicators are not equally important predictors of what the overall index captures. In such cases, indicators can be assigned different weights. Weights strongly impact the overall index score and therefore must be well justified through empirical verification (Hajkowicz 2006). To do so, test data should be used, which is different from the final data to which the index is applied (Lockwood 2004, p. 508). Weights can be identified, for example, by asking survey respondents to weigh the importance of different indicators.

Since the policy comprehensiveness index constitutes a novel approach, and this study represents its preliminary test, a lack of evidence exists to justify the greater importance of some indicators over others. To minimize the risk of falsely overestimating the importance of certain indicators, this work refrains from making a priori assumptions about the indicators’ relative importance. Instead, equal weights are attributed to the six index components. With more data, future research could close the gap in empirical evidence and assess the relative importance of each

indicator for the overall index of policy comprehensiveness, using, for example, a factor analysis. It is also possible that ‘weighing needs to be based on the character of the policy problem to be solved’ (Knill and Lenschow 2003, p. 15).

2.2.2.4 Generating an Indexed Measure of Utility

The fourth step in index construction involves choosing an adequate utility function for the aggregation of the composite indicators. To generate a one-dimensional summary of the underlying multi-dimensional data, the analyst has the choice between an additive, multiplicative, and hybrid utility function. Where indicators interdepend on each other; i.e., a high score for one indicator depends on a high score of another, multiplicative, or hybrid utility functions can be used (Hajkowicz 2006). The consequence is that poor performance on any one indicator makes scoring high in the overall index difficult. Most commonly, an additive utility function is applied, which implies that poor performance for one indicator can be compensated by high performance for others. Von Neumann and Morgenstern’s (1944) famous utility theorem, along with their multi-attribute utility theory, constitute the theoretical underpinnings of a simple and commonly used form of an additive utility function, which is written as follows (Hajkowicz 2006):

$$u_j = \sum_{i=1}^N w_i v_i(x_i)$$

Here, u_j stands for the utility of policy scenario j . A policy scenario represents a particular set of indicator values describing the empirical reality (Hajkowicz 2006). Different composite indicators of the index are denoted by i , indicator weights by w_i , indicator raw scores by x_i , and a transformation function by $v_i(x_i)$ (explained above). Consequently, one can determine the utility u_j of a policy scenario j from indicator weights (w_i) and a transformation function $v_i(x_i)$ of indicator raw score x_i (Hajkowicz 2006, p. 124). The resulting indexed measure of utility allows for the evaluation of one policy scenario as ‘better’ or ‘worse’ over another scenario and by what quantum (but not whether it is ‘good’ or ‘bad’ in an absolute meaning). Hence, the indexed measure of utility allows for relative statements of utility, but not for absolute ones (Hajkowicz 2006, p. 124).

The present study adopts the idea of an additive utility function, because poor performance at any one indicator does not necessarily imply zero overall policy comprehensiveness. Low performance at the indicator *pressure on target group* indicates that a policy design poorly compels target groups to adopt a desired behavior by its choice of policy instruments. For example, a country’s production industry could be left free to adopt voluntary CO₂ reduction measures in a time-frame of 5 years. In this example, the regulator abstains from adopting policy instruments that define how industry would have to change their production processes, and therefore, the indicator *pressure on target groups* would attain a low

score. However, the policy design could compensate for this lack of compellingness by defining very high sanctions (e.g., in the form of a tax on production goods) after the 5-year period, if the producing industry does not achieve any CO₂ reductions. In the awareness of being sanctioned after 5 years in the case of non-action, sanctions are likely to compel the industry to take action for the reduction of CO₂ emissions. Another example would be if a policy design mostly relying on persuasion, and at the same time non-compliance with a desired behavior, is highly discouraged by constant reminders, pleas, or alike. For instance, smoking might not be prohibited, but constant warnings on packets of cigarettes, posters in public spaces, TV commercials, educational school programs, and alike might very effectively compel people to stop smoking. Hence, low performance at the indicator *pressure on target groups* can be compensated by high performance at *sanctions*. Nevertheless, the possibility of interdependencies between indicators should be kept in mind, and if proven by future research, a hybrid form of utility function could be considered. The present study applies the aforementioned utility function to the six indicators ($N = 6$) so that $w_i = 1$, because as explained previously in this chapter, no weights are attributed to the composite indicators so far, and $v_i(x_i) = x_i$, as the units of x_i are already scaled between 0 and 1.

2.2.2.5 Sensitivity Analysis

The last step in index construction comprises some form of sensitivity analysis for identifying the most influential indicators (Hajkowicz 2006). Sensitivity analyses serve to identify those indicators that most influence changes in overall index results. The impact of individual indicators can be assessed by the percentage of change in overall results, caused by a percentage change in an individual indicator, holding all other indicators constant. Indicators causing higher changes in overall results are most crucial for the overall index.

As the present study relies on a non-weighted additive utility function, each indicator should have equal importance in the overall index, and therefore, the sensitivity analysis, in a conventional sense, provides no additional benefit. Alternatively, a sensitivity analysis might serve to assess the degree to which eventual estimation errors of indicator performance levels impact overall index results. This assessment might be relevant because some indicators of the index rely on estimations made by the policy analyst, which might be subject to estimation biases. For example, the aim of the indicator *sanctions* is to evaluate whether existing sanctions are high enough to deter the entire target group causing the underlying problem. Some analysts might evaluate the portion of deterred target groups by sanctions slightly differently than others. Let us take the example of analyst A attributing a score of 0.25 to the indicator *sanctions* and analyst B a score of 0.5, while all other indicators attained a score of 1. In such a case, analyst A would estimate the comprehensiveness as high with a score of 0.91 and analyst B would also conclude a highly comprehensive policy design with a score of 0.87. The low difference of 0.04 units, or 4%, indicates that small estimation biases of

one indicator have a very small influence on overall index results. Even if two analysts attributed a score of 0 versus a score of 1 to any one indicator while all others would be kept constant, overall results would vary by 0.1 units or 10%. The evaluation of overall policy comprehensiveness would most likely result in the same conclusion, e.g., a highly comprehensive policy design in both cases.

2.3 Micropollutants Policies Along the Rhine River

2.3.1 *Micropollutants and Rhine River*

With 200,000 km² and 58 million inhabitants, the Rhine catchment area is, together with the Volga and Danube, one of Europe's three biggest river systems (ICPR 2010e). It unites four riparian states (Switzerland, France, Germany, and the Netherlands) with five basin states (Italy, Austria, Lichtenstein, the Belgian region of Wallonia, and Luxembourg).¹² Intensive economic and agricultural activities, as well as population density, pose great pollution threats to the Rhine waters. In fact, a large-scale inventory of the Rhine River basin mandated by the EU Water Framework Directive in 2004 concluded that the chemical status of the Rhine was not sound in 88% of the water body and that various micropollutants were widespread and exceeded threshold values throughout the whole basin.

The high concentration levels of micropollutants can be attributed, among others, to a high consumption of pharmaceuticals by an increasingly elderly population (Sacher et al. 2008). There are over 3000 different pharmaceuticals on the European market today, and general trends suggest an increased consumption in the future with more drugs being used by more people (Clarke and Smith 2011).

A further source of pharmaceutical micropollutants is the intensive livestock raising in the agricultural lands along the Rhine. When manure is applied to agricultural fields, estrogenic and antibiotic substances drain and contaminate both groundwater and surface water (UBA 2014). Even more significant is pollution coming from plant protection products, which have a particularly long half-life in waters and therefore considerably impact the Rhine's ecosystem (ICPR 2010e). In measurements taken between 1990 and 2006, only 7 out of 36 (19%) plant protection products showed statistically significant downward trends in load, which reveals the difficulties in reducing discharges from agriculture (Bach and Frede 2012).

Another compelling reason to examine the case of the Rhine is its great density of industrial plants along its shores. There are six main industrial centers distributed along the course of the Rhine from Switzerland to the Netherlands. Basel, Strasbourg, the Rhine-Neckar area, the Frankfurt-Rhine-Main, as well as the Rhine-Ruhr region, and Rotterdam-Europort are famous for their industrial production, starting from agro-chemicals, medicinal chemical manufacturing, and

¹²ICPR Web site: <http://www.iksr.org/index.php?id=32&L=3> (last access 20.7.12).

nano- and biotechnology, to textiles, metals, construction materials, petrochemicals, refineries, and the food industry. For more detailed insights into the extent and magnitude of diverse pollution sources in the Rhine, see Metz and Ingold (2014).

When considering the entire Rhine basin, all potential sources of micropollutants emissions—residents, agriculture, and businesses—challenge water quality in the countries located along the Rhine. In conclusion, the Rhine River basin constitutes a suitable case study area, because micropollutants pose a considerable and similar threat to the aquatic environment as well as humans living on the shores of all riparian countries. As will be explained in the next paragraph, the Rhine provides a unique case study, not only because waters are affected by micropollutants, but also because the issue of micropollutants has already been noted on political agendas of the Rhine riparian countries.

The Rhine River basin distinguishes itself from other trans-boundary basins suffering from micropollutants, because the riparian states have made a transnational effort to achieve good water quality through their involvement in the International Commission for the Protection of the Rhine (ICPR). In 2008, the ICPR installed a project group on micropollutants that had the task of elaborating on a common river basin strategy as well as policy recommendations to the Rhine community for the reduction of micropollutants from diverse sources.¹³ The existence of this common river basin strategy is pivotal for case selection as it indicates that the issue of micropollutants has been placed on political agendas of the ICPR member states.

Despite the common river basin strategy, the ICPR does not have the competence to adopt legally binding decisions. The ICPR can provide policy recommendations, but has no decision-making power. It is up to ICPR member states to decide upon and implement precise pollution reduction measures. Members of the ICPR include Switzerland, Germany, France, Luxembourg, the Netherlands, and the European Union (Convention on the Protection of the Rhine, Berne, April 12, 1999).

While the Rhine riparian countries, Switzerland, Germany, France, and the Netherlands, are considered for analysis here, the EU¹⁴ and Luxembourg¹⁵ have been excluded. Despite their ICPR membership, the issue of micropollutants does

¹³Mandate for the MIKRO project group of the ICPR, see: <http://www.iksr.org/index.php?id=317&L=3> (last access 13.9.15).

¹⁴This research focuses on country-level policies, because the EU-level regulation is neither encompassing nor satisfactory in addressing Rhine-specific pollution problems. In fact, a comparison between the ICPR's so-called *Rhine 2020 list of substances* and the priority substances under the EU Water Framework Directive (WFD) shows that many Rhine-relevant substances are not subject to EU legislation (see also Sacher et al. 2008; Müller 2011). The WFD requires member states to define river basin-specific substances at the national level to complement the EU legislation (WFD Art. 2 (18), Annex VIII). Hence, the WFD constitutes a baseline that ensures water protection with regard to the most crucial common problems, while detailed provisions must be adopted by the EU member states.

¹⁵Luxembourg was excluded from analysis, because preliminary interviews with the director of the Luxembourg Administration for Water Management of the Ministry of Interior (November 19, 2011) and with two scientists from the Research Centre Henri Tudor (May 11, 2012) revealed that the problem of aquatic micropollutants was known in Luxembourg, but not yet on the political agenda.

not rank high enough on the political agendas of the EU and Luxembourg to justify analysis in the framework of this research. Nevertheless, an overview about the EU legislative framework on water protection is provided in Sect. 2.3.2.

In the four countries under investigation, micropollutants are treated as an issue predominantly belonging to water protection policy. Hence, the present investigation is limited to the policy field dealing with the protection of surface waters. A consequence of this restriction is that the present work does not provide an encompassing overview of the regulatory framework of micropollutants in all relevant policy fields. Instead, the goal here is to establish an in-depth understanding of the latest revision of water protection legislation concerning the reduction of micropollutants in surface waters for each of the four countries. The term *latest revision* is to be understood in relation to this study's data gathering period, between 2013 and 2014.

The study is further restricted to the analysis of national-level policymaking processes, because the adoption of legally binding water protection legislation is to date a responsibility of national governments rather than of the international level, represented by the ICPR or the EU.

In summary, the present cross-sectional analysis relies on the comparison of the same policy issue across Swiss, German, French, and Dutch cases. In order to rule out competing explanations to the key independent variable, cases are selected that display constant factors regarding the policy issue, as well as the field, timeframe, and governance level.

2.3.2 *The EU Policy Framework on Water Protection*

Policies on micropollutants should be understood in the context of the EU regulatory framework, because the EU is considered an important policy driver in environmental protection policy, at least for the EU members Germany, France, and the Netherlands (Switzerland is not a EU member). Although there is no EU directive that specifically targets the reduction of aquatic micropollutants, numerous EU documents deal with the issue in different policy fields. The IPPC Directive¹⁶ (2008/1/EC), for instance, regulates production processes; REACH¹⁷ (EC No 1907/2006) restricts hazardous chemical substances from entering the market, and Directive 2004/27/EC restricts pharmaceuticals from entering the market; the EU Directives 98/8/EG on Biocides and 91/414 EEC on the Certification of Pesticides regulate agricultural uses of chemicals; the Urban Waste Water Directive (91/271/EEC) sets technical standards for sewage treatment plants.

¹⁶EU Directive concerning the Integrated Pollution Prevention and Control.

¹⁷EU Directive concerning the Regulation on Registration, Evaluation, Authorization and Restriction of Chemicals.

With regard to water policy, the latest encompassing EU reform, the adoption of the Water Framework Directive (WFD 2000/60/EC), aims at reaching a good status of surface waters by 2015. One measure in attempting to achieve this goal is the reduction or phasing out of 33 so-called *priority or hazardous substances*, defined as toxic, persistent, and bioaccumulating, listed in Annex X of the Directive (WFD Art. 1c, Art. 16 and Art. 2(29)).¹⁸ To complement the list of priority substances with concrete norms limiting concentration levels, Article 16(7) of the WFD requires that the EU sets environmental quality norms (EQNs) in a ‘daughter directive,’ i.e., Directive 2008/105/EC, also termed Environmental Quality Standards Directive. Member states are entrusted with the adoption of concrete policy measures for pollution reduction in order to meet the EQNs of the listed substances (WFD Art. 11 and 4).

During the 2012 revision of the priority substance list, twelve new compounds were added to the list (2013/39/EC) after long discussions about the inclusion of pharmaceuticals.¹⁹ As pharmaceuticals were contested by some EU member states, the potential candidate substances, i.e., the anti-inflammatory agent, diclofenac, and two estrogens (17-beta-Östradiol, 17-alpha-Ethinylöstradiol), were finally not included in the priority substance list. Instead, a ‘watchlist’ of substances was established, which entails the mentioned pharmaceuticals. Member states are required to gather monitoring data for all substances on the watchlist in order to support future prioritization (EQSD 2013/39/EC). The inclusion of substances on the watchlist is a signal to EU member states that these substances may soon be regulated.

While the priority substances are of EU-wide concern, member states are required to select additional substances of national or local concern, so-called *river basin-specific substances*, and to define corresponding EQNs (WFD Annex VIII).²⁰ Member states achieve the good state of surface waters only if concentrations of both EU priority substances and river basin-specific substances do not exceed defined quality norms (WFD Art. 2 (18)).

All in all, the WFD requires member states to control the imissions of defined chemical substances in waters. If concentrations exceed EQNs, member states are free to choose how to achieve a decline of pollution levels. Hence, concrete micropollutants reduction policies are still mainly adopted on the member states rather than on the EU level. The following chapters therefore illustrate the national-level policies of the countries bordering the Rhine River, including the EU members Germany, France, and the Netherlands, and the non-EU member Switzerland.

¹⁸See ‘Summaries of EU legislation’ Web site of the European Commission: http://europa.eu/legislation_summaries/environment/water_protection_management/l28180_en.htm (last access May 2012).

¹⁹See Web site of the European Commission: http://ec.europa.eu/environment/water/water-dangersub/lib_pri_substances.htm#prop_2011_docs (last access May 2012).

²⁰<http://ec.europa.eu/environment/water/water-dangersub/> (last access 15.10.2014).

2.3.3 *The Swiss Micropollutants Policy*

2.3.3.1 **Switzerland: The Amendment Process of the Waters Protection Act and Ordinance**

In Switzerland, several research projects (Projekt Fischnetz²¹ on declining fish populations; NFP 50 on endocrine disruptors²²) proved that the presence of micropollutants in Swiss water bodies has a negative impact on the aquatic environment (Burkhardt-Holm et al. 2002). The results of the research projects revealed that municipal sewage treatment plants were a major source of micropollutants in Switzerland. Consequently, the issue entered the political agenda. The Department for Water of the Federal Office for the Environment (BAFU) mandated follow-up research to investigate potential policy options. In 2007, BAFU launched a project titled *Strategy Micropoll for the Optimization of sewage treatment* (see Table 2.17). Several working groups, composed of BAFU, cantons, operators of treatment plants, drinking water associations, science, and industry, were installed to discuss and develop further policy action. As of 2009, BAFU prepared a draft proposal for a revised Waters Protection Ordinance. The draft proposed a technical standard according to which wastewater treatment plants had to reach an 80% cleaning effect of organic micropollutants (draft WPO Annex 3.1, paragraph 2, number 8). This technical standard is held for sewage plants with a population equivalent (PE) of more than 100,000 or to plants between 10,000 and 100,000 PE if they drain into waters used for drinking water purposes or small streams with low dilution ratio (draft WPO Annex 3.1, paragraph 2, number 8).

Applying these selection criteria, about 100 of the 700 existing sewage plants in Switzerland would have needed to upgrade to a new filter in order to comply with the technical standard. The estimated total cost of about 1.2 Billion Swiss Francs was to be paid by the households connected to those 100 treatment plants that upgraded their technology. Between November 2009 and March 2011, the draft ordinance was submitted for a public hearing. A total of 94 actors were officially asked to provide a statement,²³ and others were invited as well to share their opinions concerning the micropollutants policy draft. The majority of the respondents were in favor of political action toward the reduction of aquatic micropollutants, but criticized the unequal distribution of costs.

While the Swiss Parliament had initiated several inquiries in the past, which required the Federal Government to provide information about the existence and negative effects of micropollutants, only in August 2010 did the Parliament's involvement in the policymaking process gain momentum. Both parliamentary chambers adopted a motion (Motion 10.3635) by March 2011 in which they charged the Federal Government with finding a financing solution that respects the

²¹www.fischnetz.ch (last access November 13, 2013).

²²<http://www.nrp50.ch> (last access November 13, 2013).

²³Source: Liste der Adressaten der Anhörung, GSchV; SR 814.201.

polluter pays principle. Since all Swiss households (not just those connected to the 100 selected plants) emit wastewater, BAFU proposed the introduction of a Swiss-wide wastewater charge, capped at a maximum of 9 CHF per year and inhabitant. The revenue raised from the charge was to be used to cover up to 75% of the costs that sewage plant operators pay for the upgrade of their technology. In order to adopt a new charge, not only the Waters Protection Ordinance, but also the Act had to be amended.

At the end of 2011 and beginning of 2012, BAFU worked in consultation with the other federal departments on a proposal to amend the Waters Protection Act. The proposal was discussed in the Swiss Federal Council on April 25, 2012, and was subsequently submitted for a public consultation (April–August 2012). A total of 90 actors were invited to provide a statement, and in the end, 158 actors shared their opinions.²⁴ The respondents still criticized the financing solution. Some actors put forward that the problem should be addressed at the source, and they supported the idea of a charge on those products that contain harmful substances (BAFU 2012). The cantons argued that some open questions remain with regard to the distribution of the costs, as well as the eligibility criteria for reimbursements. In order to integrate the diverse criticisms, BAFU worked on a revised legal draft of the Waters Protection Act. By the end of 2013, the Federal Council sent the finalized draft of the Waters Protection Act to the Parliament. Both parliamentary chambers adopted the legal revisions by mid-2014, and the changes were estimated to come into force by 2016. In the Waters Protection Ordinance that was under revision in 2014, technical standards, selection criteria for treatment plants, and indicator substances have been redefined.

The Swiss policy network, which will be analyzed in Sect. 3.3, represents an aggregated summary of actors' interactions in the aforementioned policymaking process. At the time of the present study, implementation of the adopted policy lay in the future, and hence, network interactions exclude the implementation phase. Also in the future, lay a shift in policy focus from point-source to diffuse pollution. Until 2014, the Swiss regulation of aquatic micropollutants focused on an end-of-pipe approach to reduce point-source pollution from wastewater treatment plants. BAFU's strategy, however, was to shift its focus from point-source micropollutants toward micropollutants from diffuse sources, such as from agriculture, urban areas, and roads, once the revision of the Waters Protection Act and Ordinance is completed.²⁵

²⁴Source: Liste der Adressaten der Vernehmlassung, GSchG; 814.20.

²⁵See Web site of the Swiss Federal Office for the Environment: <http://www.bafu.admin.ch/gewaesserschutz/03716/index.html?lang=de> (last access May 2012).

2.3.3.2 Indexing the Swiss Waters Protection Act and Ordinance

The revised version of the Swiss Waters Protection Act entered into force in March 2014. The aim of the amendment was to guard sensitive aquatic plants, animals, and microorganisms from harmful human-emitted trace substances, i.e., micropollutants (draft WPO, Annex 2.1, paragraph, 11.1f). The Swiss policy design on micropollutants is evaluated below by means of the policy comprehensiveness index and its six composite indicators.

Pressure on Target Groups

The first composite indicator of the policy comprehensiveness index is *pressure on target groups*. One can evaluate the pressure that a policy design places on target groups by assessing the types of policy instruments composing the policy design, and therefore stimulate a reaction by target groups.

- **Policy instruments:** The Swiss policy design on micropollutants builds on a *technical standard* for wastewater treatment plants, a *charge* and *subsidy* to protect waters from negative impacts of point-source micropollutants emitted by sewage plants. More specifically, the technical standard takes the form of filtering requirements for selected plants treating municipal wastewater. According to the Waters Protection Ordinance (draft WPO, Annex 3.1, paragraph 2.8), selected wastewater treatment plants are required to filter 80% of trace substances from raw sewage, which is measured on the basis of indicator substances (Götz et al. 2010a), which will have to be determined.²⁶ Treatment plants are required to upgrade their treatment technology within 20 years, starting from 21.3.2014 (WPA Art. 61a, paragraph 2).

The Waters Protection Act lays down that the investments needed for additional filtering technologies are funded through a charge levied by all Swiss wastewater treatment plants, and respectively, connected inhabitants, through 2040 (WPA Art. 60b). The Federal Government then redistributes the generated funds to cantons, which, in turn, subsidize 75% of the investments of treatment plants for new filters (WPA Art. 61a, paragraph 3).

The Swiss policy design places a high level of pressure on target groups (score of 0.75 in Table 2.16), because wastewater treatment plants are obliged to meet the technical standard as soon as they match the selection criteria (size of sewage plant, sensitivity of waters). There is not much freedom for operators to choose whether or not to comply with the standard once they meet the selection criteria. Subsidies further support target groups in adopting the desired technologies by reducing their investment costs, but the subsidies do not provide more freedom of choice.

²⁶The following Web site states that a total of 12 indicator substances will have to be determined: <https://www.micropoll.ch/faq/> (last access 16.8.15). The exact number of indicator substances to finally enter into the Waters Protection Ordinance remains, however, a matter of political debate.

Table 2.16 Evaluation of the Swiss policy design's pressure on target groups

Indicator	Level of performance	Score
Pressure on target group	High performance: policy instrument mix relying on <i>state authority</i> through a technical standard and relying on <i>economic incentives</i> through a wastewater charge and subsidies	0.75

Sanctions

For the evaluation of the second indicator of the policy comprehensiveness index, one needs information about sanctions as well as the competent enforcement agency of the Swiss policy design.

- **Sanctions:** Article 71 of the Swiss Waters Protection Act levies a fine of 20,000 CHF on infringements. A deliberate offence against the Act can lead to imprisonment for up to 3 years (WPA Art. 79, paragraph 1).
- **Competent enforcement agency:** The Swiss judiciary is responsible for imposing and pursuing sanctions in cases of infringements.

Existing sanctions are high enough to insure that the majority of Swiss wastewater operators will comply with the formulated technical standard for the reduction of micropollutants (score 0.75 in Table 2.17).

Inclusiveness of Target Groups

The third composite indicator assesses the inclusiveness of the Swiss approach with regard to targeting those groups that emit micropollutants, and relies on the following information:

- **Target groups:** The target groups of the studied policy design are *wastewater treatment plants* and their respective operators, such as municipalities, that have to change their purification procedures. Swiss inhabitants, who finance the technical upgrade, do not qualify as a target group, because they are not required to change their behavior as a consequence of the introduced policy.
- **Criteria defining target groups and exceptions:** The technical standard only applies to the largest sewage plants, measured in population equivalents, or to smaller plants if they drain into small rivers, with a low dilution ratio, or into waters used for drinking water purposes. The exact selection criteria are to be determined in a revised Waters Protection Ordinance as of 2015. Explicitly excluded from the policy are industrial sewage treatment plants, which must neither comply with the technical standard nor pay the 'micropollutants charge.' Moreover, the agricultural sector does not represent an explicit target group of the above analyzed policy design, because agricultural emissions are mostly diffuse. This exemption might change in the future, though, as the Swiss policy strategy was explicitly to focus, first, on point-source pollution from wastewater treatment plants and, second, to expand policy action to diffuse sources.
- **Target groups contributing to the policy problem:** Micropollutants are emitted by point sources of pollution including households, as well as by

Table 2.17 Overview of the Swiss policymaking process

Amendment of the Swiss Waters Protection Ordinance	
Trigger Before 2007	Research (NFP 50, Project <i>Fischnetz</i>)
	Administrative decision about putting micropollutants on the agenda
Concept phase 2007–2009	<i>Strategy Micropoll for the Optimization of sewage treatment</i> (2007–2012)
	BAFU report (Umweltwissen 17/09) and mandated studies on the reduction of micropollutants from sewage
Elaboration Nov. 2009	Draft of the amended Waters Protection Ordinance
Consultation Nov. 2009–July 2010	Public hearing on the draft ordinance (November 27, 2009–April 30, 2010)
Amendment of the Waters Protection Act	
Trigger August 2010– March 2011	Motion of the Council of State's Committee on the Environment, Spatial Planning and Energy about a funding solution for the elimination of trace substances in wastewater that respects the polluter pays principle, adoption by both parliamentary chambers (10.3635)
Concept phase April 2011–April 2012	BAFU reports (Umweltwissen 1214) and mandated studies on financing technical solutions for the reduction of micropollutants
Elaboration 2011–2012	Draft of the amended Waters Protection Act
Consultation Spring 2012– Spring 2013	Interdepartmental consultation on the draft Waters Protection Act
	Federal Council discusses the draft Waters Protection Act (April 25, 2012)
	Public consultation on the draft Waters Protection Act (April 25, 2012–August 31, 2012)
Finalization May 2013–Spring 2014	Revision of the draft Waters Protection Act
	Federal Council receives revised draft of Waters Protection Act (June 2013)
Parliamentary Phase End 2013–Spring 2014	Federal Council forwards draft and dispatch to the Parliament (BBl 2013 5549, June 26, 2013)
	Discussion in the Council of States (October 10, 2013)
	Discussion in the National Council (March 3, 2014)
	Adoption by both parliamentary chambers (March 21, 2014)
Implementation	Coming into force of amended Waters Protection Act March 31, 2014
	Implementation from 2016 (estimated) until December 31, 2040

agricultural and industrial producers connected to municipal and industrial wastewater treatment plants (for a more detailed description of emission sources, see Sect. 1.1). Moreover, micropollutants are emitted by diffuse sources of pollution including agriculture, settlements, or transportation.

A medium level of performance (score 0.5 in Table 2.18) is attributed to the indicator *inclusiveness* here, because scientific results suggest that the 50% load reduction of micropollutants can be achieved in surface waters through improved

Table 2.18 Evaluation of the Swiss policy design’s inclusiveness

Indicator	Level of performance	Score
Inclusiveness	Medium performance: <i>Half</i> of the emission of micropollutants is targeted by the policy	0.5

wastewater filters (Abegglen and Siegrist 2012, p. 52). By targeting point-source pollution, emissions from all polluters connected to wastewater treatment plants, including households, industry, settlements, and agriculture, are reduced, which leads to a 50% load reduction. The other 50% of loads, which are not reduced by the Swiss end-of-pipe approach, stem from industrial wastewaters not connected to municipal treatment (so-called direct dischargers), and from diffuse sources of pollution.

In summary, a medium level of inclusiveness characterizes the Swiss policy (score of 0.5) because addressing point-source pollution leads to a 50% load reduction and includes household, urban, agricultural, and industrial sources of emissions, but excludes all diffuse emissions.

Proportionality: Solution Versus Problem Scale

The fourth indicator of the policy comprehensiveness index evaluates whether a policy design establishes a match between problem scale and its solution level and builds on the following information:

- **Competent jurisdictional level for implementation:** The Swiss Waters Protection Act is a federal law, which is applicable on the national jurisdictional level. Wastewater treatment plants that match the selection criteria must upgrade their filtering technology no matter where on the Swiss territory they are located.
- **Problem scale:** Wastewater treatment plants are scattered throughout Switzerland, and wherever they exist, they continuously emit micropollutants into waters (Gälli et al. 2009). Hence, emissions from sewage treatment plans cause problems on the national scale.

The Swiss policy applies to the national level, and likewise, emissions from micropollutants by wastewater treatment plants are of national-level concern. When restricting the focus to micropollutants emitted by wastewater treatment plants, the problem scale and solution level of the Swiss policy design correspond to one another (score of 1 in Table 2.19).

Table 2.19 Evaluation of the Swiss policy design’s proportionality

Indicator	Level of performance	Score
Proportionality	Complete performance: <i>National solution</i> level corresponds to the <i>national problem scale</i>	1

Directness: Dispersion of Decision-Making, Financing, and Implementation

The fifth indicator, directness, concerns the dispersion of decision-making, financing, and implementation tasks. The less dispersed those tasks are, the less frequent are clearance points as well as a displacement goals between the original intentions of a policy design and its actual implementation. Conversely, a high score for that indicator signifies that one entity is involved in all three tasks, which should reduce the number of clearance points and, hence, increase the likelihood that a policy is implemented as intended when the policy was adopted. To evaluate directness in the Swiss case, one needs the following information about the entities of deciding, financing, and implementing:

- **Decision-making entities:** The legislature charged the Federal Government to propose a policy for the reduction of micropollutants in surface waters. The executive, i.e., the Swiss Federal Council, then accepted the draft proposal for an amended Waters Protection Act, prepared by the Federal Office for the Environment, and forwarded it to the legislature. Finally, both chambers of the legislature adopted the amendments for the reduction of micropollutants. While the executive and legislature decided on the Act, the bureaucracy, namely the Federal Office for the Environment, prepared and adopted the Waters Protection Ordinance, which entails more detailed and technical provisions.
- **Distribution of costs:** For the technical upgrade of wastewater treatment plants, an estimated sum of 1.2 Billion Swiss Francs must be invested in additional filtering technologies. The Waters Protection Act states down that the Federal Government levies a charge from all Swiss wastewater treatment plants until 2040 (WPA Art. 60b). The charge is passed on to the inhabitants connected to treatment plants. The severity of the charge is calculated based on the size in population equivalents of sewage plants and is legally capped to a maximum of 9 CHF per inhabitant per year. As soon as sewage plants adopt a filtering technology for the elimination of micropollutants, they (and their connected inhabitants) are exempted from the charge (WPA Art. 60 b, paragraph 2). The exemption also applies to those sewage plants that voluntarily invested in micropollutants filtering technology after January 1, 2012. In a second step, the Federal Government redistributes the generated funds to cantons, which, in turn, are able to compensate wastewater treatment operators for 75% of the investments for new filters (WPA Art. 61a, paragraph 3). To promote mergers, 75% of the costs for the construction of canalization, linking smaller treatment plants to larger and more efficient ones, may also be compensated. To summarize, Swiss inhabitants and selected sewage treatment plants bear the costs for investments. The Federal Government levies a charge from inhabitants and redistributes funds to cantons. Cantons then subsidize sewage treatment operators for 75% of their investment costs.
- **Competent agency for (supervision of) implementation:** According to Article 45 of the Swiss Waters Protection Act, the cantonal level is responsible for the implementation of sewage treatment plants' technical upgrade. Article 46 states

that the Federal Government coordinates and maintains control of implementation. In the case of micropollutants, the Federal Government automatically controls implementation by levying the wastewater charge and redistributing it to the cantons (WPA Art. 60b, 61a).

From the aforementioned insights, one can conclude that the Swiss Federal Government is involved in all three tasks: deciding, financing, and implementing. The accumulation of tasks reduces the number of clearance points and the risk of goal displacement. As one authority is involved in all three tasks, a high score for directness is attributed to the Swiss policy design (score of 0.75 in Table 2.20) as one authority is involved in all three tasks (deciding, funding, and control of implementation).

Bindingness

To assess the degree to which a policy design is compelling, the policy comprehensiveness index builds on the indicator *bindingness*. In order to assess the level of bindingness of a policy design, the type of policy document is used as a proxy here.

- **Type of policy document:** The Swiss policy on micropollutants is a legally binding obligation laid down in the Waters Protection Act and Ordinance. Financial aspects (charge and subsidy) are dealt with in the Waters Protection Act, while technical requirements for wastewater treatment plants are fixed in the Waters Protection Ordinance.

Through its adoption on the level of a law, the Swiss policy on micropollutants signals a high level of commitment on a longer time horizon, and thus stability. Additionally, the amendment of the Swiss Waters Protection Act led to the involvement of the Swiss legislature in the decision-making process, which further indicates a high level of authority. In conclusion, the Swiss policy design signals both stability and authority and therefore attains a high level of bindingness (score 0.75 in Table 2.21).

Table 2.20 Evaluation of the Swiss policy design's directness

Indicator	Level of performance	Score
Directness	High performance: Implementation is <i>controlled and subsidized</i> by the <i>Federal Government</i> <i>Implementation</i> is passed on to the <i>Cantons</i>	0.75

Table 2.21 Evaluation of the Swiss policy design's bindingness

Indicator	Level of performance	Score
Bindingness	High performance: <i>medium-term</i> binding	0.75

Summary of Index Results for the Swiss Policy Design on Micropollutants

The index results summarized in Table 2.22 reveal that the Swiss policy design has the ability to comprehensively reduce the problem of micropollutants in surface waters (score of 0.75). The Swiss policy is designed as a compelling regulation for target groups (pressure 0.75, sanctions 0.75), implementers (directness 0.75), and the state (bindingness 0.75), which considerably increases its chances of being implemented in reality. Moreover, the Swiss policy design addresses aquatic micropollutants in an effective and efficient way by targeting a sufficient proportion of potential emitters (inclusiveness 0.5) and by having adopted a national-level solution for a national scale problem (proportionality 1.0). This design demonstrates that the Swiss end-of-pipe approach can be an effective way of designing a public policy, which has the potential to comprehensively reduce micropollutants in waters.

2.3.4 The German Micropollutants Policy

2.3.4.1 Germany: The Adoption Process of the Surface Water Ordinance

The German Surface Water Ordinance was mainly triggered by the need to respond to European legislation (see Table 2.23). Traditionally, the adoption of water legislation was controlled by the German Länder (German constituent states), and hence, every Land had its own water legislation.²⁷ In 2000, when the EU WFD (2000/60/EC) came into force, the transposition into Länder-level legislation lagged behind in several German Länder. Hence, the EU Commission sued Germany for insufficient implementation of the WFD in 2005. In response, Germany underwent a large federal reform in 2006 during which the competence to adopt water legislation was passed on to the national level.²⁸ In order to then transpose the WFD, and particularly its daughter directive, the Environmental Quality Standards Directive (EQSD 2008/105/EC), into uniform national regulation, a new federal ordinance was drafted as of 2008. Because of the many technical details required by the EU framework, the new regulation was formalized on the level of an ordinance and, thus, it complements the German Water Management Law (WHG). The so-called Surface Water Ordinance (OGewV) is relevant with regard to micropollutants, because the OGewV determines environmental quality norms for a list of

²⁷The federal state had the right to enact framework directives (Rahmengesetzgebungskompetenz des Bundes), i.e., the Water Resource Act (WHG). Bound by this framework, the Länder adopted their own state-level water legislation.

²⁸Water legislation today follows the ‘competition principle’ (konkurrierende Gesetzgebungskompetenz des Bundes) according to which the Länder adopt their own water laws until the federal state enacts a nationwide and uniform legislation overruling the state-level.

Table 2.22 Performance of the Swiss policy design after the policy comprehensiveness index

Indicators of the policy comprehensiveness index	Scores
Pressure on target groups	0.75
Sanctions	0.75
Inclusiveness	0.5
Proportionality	1.0
Directness	0.75
Bindingness	0.75
Overall index score	0.75 (high)

Table 2.23 Overview of the German policymaking process

Adoption of the German Surface Water Ordinance (OGewV)	
Trigger Before 2008	Implementation of the WFD 2000/60/EC and EQSD 2008/105/EC in Germany Reform of the federal system 2006
Concept phase 2008–2010	Working group on environmental quality norms (BLAK-UQN) (15./September 16, 2008)
	General meeting of the Working Group on Water (22./September 23, 2009; March 25./26, 2010)
	74th Conference of Environmental Ministers (July 11, 2010)
Elaboration 2010	Draft proposal prepared by the Environmental Ministry with support from the Environmental Protection Agency (March 29, 2010)
Consultation Nov. 2010	Interdepartmental consultation
	Public hearing (November 2010)
Finalization Spring 2011	Revised draft prepared for the Cabinet of Ministers
	The Cabinet adopts the Surface Water Ordinance (March 16, 2011) and forwards it to the Federal Council
	Debates in the committees of the Federal Council (March 17, 2011)
Adoption Summer 2011	The Federal Council's committees propose amendments (May 17, 2011, 153/11)
	Adoption of the Ordinance conditional upon 25 amendments by the Federal Council in its 883th session (May 27, 2011)
	Approval of the requested amendments by the Cabinet of Ministers (June 22, 2011)
Implementation As of Aug. 2011	Coming into force of the Surface Water Ordinance (July 27, 2011)

river basin-specific (micro)pollutants. As such, concentration limits are defined for a number of substances. If a substance exceeds its limit, further political measures have to be taken to reduce immissions.

In order to identify river basin-specific (micro)pollutants, Länder were asked to report those substances, which are particularly relevant to each Land's waters. In order to carry out these reports, the Länder established a working group on

environmental quality norms (EQN) (*Bund-Länder-Arbeitskreis UQN*). In several meetings throughout 2009 and 2010 of the Working Group on Water (LAWA) and the Conference of Environmental Ministers of the Länder, the Länder discussed and decided upon a common position. The Länder had very divergent ideas about the strictness of EQN and the amount of substances to be regulated. Their common position, which posits a 1:1 implementation of European directives, can therefore be interpreted as the smallest common denominator (74. UMK, TOP 34). The reason for this goes back to a decision made in October 2006 during the 67th Environmental Ministers Conference of the Länder, according to which they opposed a general legally binding introduction of a fourth purification stage to eliminate micropollutants from sewage water.²⁹ For the same reason, the Länder opposed the listing of substances beyond EU legislation. EQNs for new types of pollutants could force the Länder to improve wastewater treatment technology.

To insure continuity, the Federal Environmental Ministry drafted the OGewV together with the Environmental Protection Agency on the basis of the water laws of the Länder (*LAWA Musterverordnung*, 2 July 2003). After a two-year long concept phase, the draft of the amended Surface Water Ordinance proposed EQNs for 13 new substances—new compared to the previously existing Länder-level legislation—because they were found in comparably higher concentration levels in waters (draft OGewV Annex 5). The Environmental Ministry submitted the proposal to an interdepartmental—as well as public—consultation in 2010. For the consultation, the Ministry invited 32 actors to provide a statement.³⁰ There is no information available about the number of statements actually given. After making some adjustments, the Environmental Ministry submitted the draft to the Federal Cabinet of Ministers. The Federal Government adopted the Surface Water Ordinance on March 16, 2011, and sent the draft to the Federal Council, the parliamentary representation of the Länder on the national level. Debates within the Federal Council's committees revealed that the Länder opposed the listing of some new substances, such as pharmaceuticals, because the costs of compliance were considered too high of a burden for households or other water users (153/11). Finally, the Federal Council adopted the OGewV, but requested a total of 25 changes on May 27, 2011. After the Federal Government adopted the changes, the amended Surface Water Ordinance came into force in July 2011. The final Ordinance excluded five out of the 13 newly proposed substances (carbamazepine, fenpropimorph, triphenyl phosphate, sulfamethoxazole, uranium) by referring to the ongoing revision of the EQSD on the European level. The German 2011 substance list is regularly updated according to the newest scientific insights, as well as to the revisions of EU legislation.

The German policymaking process on micropollutants was based on the claim that a broad societal debate would be necessary to define tolerable pollution levels in

²⁹See Web site of the Environmental Minister Conference: <http://www.umweltministerkonferenz.de/Dokumente-UMK-Dokumente.html> (last access May 2012).

³⁰Source: Schreiben an die Verbände from August 16, 2010.

waters prior to the need for political action. Moreover, the German Länder put forward that before measures on micropollutants would be taken by sewage plants, relevant substances, costs, and energy intensiveness had to be well understood. In order to comply with these requirements, a great amount of research on micropollutants was carried out by the German Federal Environmental Agency, the Environmental Agencies of the Länder, various universities, and water associations.³¹

The policy network emerging from the aggregated interactions among policy actors in the aforementioned policymaking process will be subsequently analyzed in Sect. 3.3. As with the case of Switzerland, the implementation phase is excluded from analysis as it lay in the future at the time of the present research project.

2.3.4.2 Indexing the German Surface Water Ordinance

In 2011, Germany adopted its new federal water ordinance. The aim of the German Surface Water Ordinance is the protection of surface waters in general (OGewV, Art. 1), which, among others, includes the protection of waters from micropollutants.

Pressure on Target Groups and Policy Instruments

The first indicator of the index captures the degree of pressure exerted by a policy design on target groups. In this regard, the types of adopted policy instruments provide a helpful indication for the level of pressure of a policy design.

- **Policy instruments:** The German Surface Water Ordinance sets *environmental quality norms* for a total of 162 river basin-specific substances against which the ecological status of water bodies must be evaluated (OGewV, Annex 5). The defined EQNs establish mandatory limits on acceptable concentrations of (groups of) substances in waters. EQNs being exceeded represent a signal to the federal government and Länder (constituent states) governments that further policy measures are needed (Metz and Ingold 2014).

Although pollution reduction measures must be adopted by the German Länder if EQNs are violated, the Ordinance does not specify which measures are to be taken in such cases. In general, Länder deal with transcendences of emission limits on a case-by-case basis. If a responsible polluter can be identified, compliance with the discharge authorization and the best-available technology is verified. With no detected infringements, the responsible administration attempts to consult the respective polluter about voluntary retention measures (interviews with State of Rhineland-Palatinate (RLP), March 13, 2014; State of Baden-Württemberg (BAWÜ), April 4, 2012; State of Hesse (HES), March 13, 2014).

³¹Research funded by the Federal Ministry of Education and Research: <http://www.riskwa.de/de/94.php>; research funded by Federal Ministry of the Environment: <http://www.bmu.de/forschung/ufoplan/doc/40881.php>; research funded by NRW: <http://spurenstoffe.net/index.php/de/projekte> (last access May 2012).

Taking a closer look at the Länder located along the Rhine, one finds heterogeneous approaches to the reduction of aquatic micropollutants. In North Rhine-Westphalia and Baden-Württemberg for instance, some operators of wastewater treatment plants *upgraded filtering technology on a voluntary basis* in order to eliminate micropollutants.³² North Rhine-Westphalia launched a governmental *subsidy* program (*Ressourceneffiziente Abwasserreinigung*) in February 2012, which incentivizes sewage operators to invest in further filtering technology (interview with State of North Rhine-Westphalia (NRW), March 27, 2012). In addition, projects exist to introduce legally binding, stricter *technical standards* for wastewater treatment plants, which would require investments in new technology for the elimination of micropollutants. To date, upgrading treatment technology remains a voluntary action on behalf of operators. North Rhine-Westphalia, Baden-Württemberg, and Rhineland-Palatinate established a competence center (or *expert network*) on anthropogenic micropollutants in order to exchange experiences with the elimination of micropollutants in wastewater treatment plants (interviews with State of North Rhine-Westphalia (NRW), March 17, 2014; Württemberg (BAWÜ), April 4, 2012; Rhineland-Palatinate (RLP), March 13, 2014). Politically, however, Rhineland-Palatinate, Bavaria, and Hesse rejected the end-of-pipe solution to date. These Länder put forward that emissions from households were not the primary source of pollution, but rather from agriculture or industry (interviews with State of Hesse (HES), March 13, 2014; State of Bavaria (BAY), April 26, 2012). Rhineland-Palatinate therefore pushed for a *restriction of pesticides and veterinary medicinal products* on the EU-level and postulated an EU-wide strategy to minimize pollution from antibiotics used in livestock farming (interview with Rhineland-Palatinate (RLP), March 13, 2014).

In summary, there is no common micropollutants policy on the Länder level, which is not surprising given the context of German federalism.

Although the policy design builds on state authority, the adoption of EQN represents only a ‘soft’ pressure on target groups to change their behavior. On the one hand, German Länder are under some pressure because they are required to monitor a list of substances and comply with specified EQN of the Surface Water Ordinance. On the other hand, they have ample freedom in defining concrete measures for the reduction of micropollutants that exceed defined concentration limits. Considering the type of policy instrument adopted, the German policy design places a medium degree of pressure on target groups to take action regarding micropollutants reduction measures (score of 0.5 in Table 2.24).

A general drawback of the EQN approach is its difficulty in compiling a comprehensive list of all critical substances, which are present in undesirably high concentrations levels in waters. Pharmaceuticals, for example, were not yet listed in the 2011 version of the German Surface Water Ordinance, which also reduced

³²See Web site of the Ministry of the Environment of NRW: <http://www.umwelt.nrw.de/umwelt/wasser/abwasser/mikroschadstoffe/index.php> (last access May 2012).

Table 2.24 Evaluation of the German policy design's pressure on target groups

Indicator	Level of performance	Score
Pressure on target group	Medium performance: policy instrument relying on 'soft' state authority through environmental quality norms	0.5

pressure on the respective target groups to act. Wastewater treatment plants, for example, would be under much more pressure to act and invest in 'pharma filters' if pharmaceuticals had then been listed.

Sanctions and Competent Enforcement Agency

The Surface Water Ordinance does not specify how exceeding the defined EQN would be sanctioned. Hence, the level of performance on that indicator equals zero here (score of 0 in Table 2.25).

Inclusiveness of Target Groups

When contrasting all the groups contributing to the emissions of micropollutants to the target groups of the German policy design as below, the German approach cannot be considered particularly inclusive in addressing the entire sources of pollution (score of 0.25 in Table 2.26).

- **Target groups:** The primary target groups of the policy design comprise of all *German Länder*, which are required to comply with the EQNs. Although *Länder* represent the direct target group of the policy, they do not emit micropollutants. The 'real' emitters of micropollutants, however, are only indirectly targeted by the policy because they do not have to change their behavior and processes at first. Emitters only need to change their behaviors if concentration limits are exceeded. The *indirect target groups* of the policy design are defined by the substances listed in the Surface Water Ordinance and include point-source and diffuse emissions from agriculture and industry.
- **Criteria defining target groups and exceptions:** The EQNs apply to German surface waters in general, and therefore, all German *Länder* are required to monitor the listed substances. However, the costs and efforts of monitoring these substances might diverge for the different monitoring stations, because from the

Table 2.25 Evaluation of the German policy design's sanctions

Indicator	Level of performance	Score
Sanctions	No performance: <i>no</i> existing sanctions	0

Table 2.26 Evaluation of the German policy design's inclusiveness

Indicator	Level of performance	Score
Inclusiveness	Low performance: <i>Small parts</i> of the sources of emissions are targeted by the policy	0.25

162 listed substances, only those that are expected to exceed half of the formulated EQN in annual mean must be monitored (OGewV, Annex 5(2)). These specifications may lead to a situation where certain monitoring stations have to monitor fewer substances than others.

Implicit to the Surface Water Ordinance is another criterion defining exceptions of target groups. The list of 162 substances in the Surface Water Ordinance represents a selection of undesired substances in waters. Hence, all substance groups that are not listed also exclude the respective emitters as (indirect) target groups of the policy design.

- **Target groups contributing to the policy problem:** Micropollutants are emitted by point sources of pollution, namely municipal and industrial wastewater treatment plants, and all inhabitants, as well as agricultural, and industrial producers connected to the plants. Moreover, diffuse sources of pollution emit micropollutants including agriculture, settlements, or transportation.

The German Länder are responsible for complying with defined EQN, but the real emitters of micropollutants, i.e., the society or economy, are not directly required to adapt behavior or procedures as a consequence of the introduced policy. If Länder detect exceedances in waters, it remains a challenge to detect the responsible emitter. A further challenge then is to negotiate changes in procedures or behavior on behalf of the identified emitter. I therefore estimate that only a small fraction of the groups or individuals emitting micropollutants are actually targeted by the policy.

Proportionality: Solution Versus Problem Scale

When contrasting the jurisdictional solution level to the scale on which the listed micropollutants occur, one can evaluate the level of proportionality of the German policy design.

- **Competent jurisdictional level for implementation:** The German Surface Water Ordinance is a federal regulation that applies to Germany on the national jurisdictional level.
- **Problem scale:** The problem scale of those micropollutants that are listed in the Ordinance depends on the exact substance of interest. Although the substance list of the Surface Water Ordinance reflects only those selected substances that exhibited critical concentration levels on a larger scale in the past, the problem scale still varies depending on the exact substance (the selection of substances was explained in the previous Sect. 2.3.4.1). A precise chemical substance might cause problems on the local, regional, national, or even international scale.

In conclusion, a national solution level contrasts a mixed problem scale. Certain substances of the national list may be detected on the local or regional scale, but not on the national scale. For substances that are of regional or local concern, the solution level is larger than the problem scale, because in principle all listed substances have to be monitored. The German policy design attempts to circumvent such situations of disproportionality by requiring monitoring only when the concentrations are expected to exceed half of the formulated EQN in annual mean

Table 2.27 Evaluation of the German policy design's proportionality

Indicator	Level of performance	Score
Proportionality	High performance: The defined solution level can be larger than the problem scale for certain listed substances	0.75

(OGewV, Annex 5(2)). As such, the policy design enables a flexible adaptation of the regulation to local circumstances. Moreover, situations where the solution scale is larger than the problem scale are minimized. To summarize, the German policy design establishes a high level of proportionality between problem scale and its solution level (score of 0.75 in Table 2.27).

Directness: Dispersion of Decision-Making, Financing, and Implementation

One may evaluate the directness of the German policy design when analyzing the distribution of decision-making, financing, and implementation tasks.

- **Decision-making entities:** The draft proposal of the Surface Water Ordinance was prepared by the Federal Ministry for the Environment and then adopted by the Federal Government and the Council of Constituent States. The latter is the parliamentary representation of the German Länder on the federal level.
- **Distribution of costs:** German Länder are required to monitor the list of substances defined in the Ordinance and pay for the related costs. The Ordinance does not specify who bears the costs for pollution reduction measures in cases where concentration limits are exceeded.
- **Competent agency for (supervision of) implementation:** The German Länder are required to comply with defined EQN and are responsible for the implementation of micropollutants reduction policies if concentrations exceed the defined limits. Moreover, Länder are required to regularly report monitoring results to the Federal Ministry for the Environment that supervises the correct implementation of the Surface Water Ordinance.

In the German case, goal displacement is unlikely, because the Federal Ministry for the Environment controls the correct implementation of EQNs. Moreover, the policy design is highly direct, because the German Länder are involved in deciding, financing, and implementing the policy design. This way, the number of clearance points is reduced to a minimum. Since one authority is involved in all three tasks (deciding, funding, and implementation), the German policy design is evaluated as highly direct here (score of 0.75 in Table 2.28).

Table 2.28 Evaluation of the German policy design's directness

Indicator	Level of performance	Score
Directness	High performance: <i>Implementation</i> and <i>financing</i> are executed by the <i>German Länder</i> , and implementation is <i>controlled</i> by <i>Federal Ministry</i> for the Environment	0.75

Table 2.29 Evaluation of the German policy design’s bindingness

Indicator	Level of performance	Score
Bindingness	Medium to high performance: <i>short-term to medium-term</i> binding	0.625

Bindingness and Type of Policy Document

The type of policy document adopted can be considered a proxy for the level of bindingness of the German policy design.

- **Type of policy document:** The German policy on micropollutants is a legally binding obligation laid down in the Surface Water Ordinance. Since ordinances can be amended much faster than constitutions or laws, they signal a lower degree of bindingness. In fact, the German substance list is regularly revised (approximately in intervals of four years) based on new scientific insights and amended EU priority substances.

On the one hand, the ordinance is binding because it was passed by the legislature and constitutes applicable law. On the other hand, ordinances can be amended more easily than constitutions or laws. Taking both into account, a level of performance between medium and high was attributed to the German policy design on the indicator *bindingness* here (score of 0.625 in Table 2.29).

Summary of Index Results for the German Policy Design on Micropollutants

Table 2.30 shows that the German policy design achieves a medium level of comprehensiveness in addressing the problem of micropollutants in waters (score of 0.48). The design’s main weakness is its lack of inclusiveness in addressing liable target groups (inclusiveness 0.25). Rather than reducing emissions of micropollutants, the policy design only controls concentration levels in waters. Moreover, the policy design does not highly compel target groups (pressure 0.5, sanctions 0) to immediately take measures regarding the reduction of micropollutants. Nevertheless, the German policy is designed as a compelling regulation for implementers (directness 0.75), i.e., the Länder, and for the state (bindingness 0.625), which considerably increases the chances that the defined EQNs are respected. The policy design establishes vertical effectiveness and efficiency by enabling a flexible adaptation of monitoring requirements to local circumstances (proportionality 0.75).

Table 2.30 Performance of the German policy design after the policy comprehensiveness index

Indicators of the policy comprehensiveness index	Scores
Pressure on target groups	0.5
Sanctions	0
Inclusiveness	0.25
Proportionality	0.75
Directness	0.75
Bindingness	0.625
Overall index score	0.48 (medium)

2.3.5 The French Micropollutants Policy

2.3.5.1 France: The Adoption Process of the ‘Plan Micropolluants’

In contrast to Germany, France holds a policy document that specifically targets micropollutants. The *Micropollutants Plan 2010–2013* explains the global national strategy toward aquatic micropollutants.³³ The Plan builds on previous actions of the French Government toward pollution of waters (see Table 2.31). Most importantly, the Micropollutants Plan complements and updates the National Action Plan against Pollution of Aquatic Environments from Dangerous Substances (PNAR, Décret n°2005-378, 20.4.2005; Arrêté 30.6.2005; Arrêtée March 21, 2007) from 2005, which transposes the EU Dangerous Substance Directive into national law (74/464/EEC). Crucial in this plan is the initiation of the National Research Action on Dangerous Substances in Water (RSDE) (Circulaire February 04, 2002; Circulaire January 05, 2009), according to which wastewater treatment and industrial plants are required to monitor their effluents and report the results to the French Government. The acquired knowledge of sources, entry paths, and concentrations of pollutants in waters revealed that micropollutants contaminate aquatic environments in France and that further action is needed. Hence, the Ministry of Ecology invited a large number of concerned actors, i.e., the national ministries of both health and agriculture, Water Agencies, and water providers, as well as scientific, societal, and economic actors, to meet and elaborate on measures for the reduction of micropollutants (meetings on July 9, 2009 and January 1, 2010).

Additionally, the National Agency for Water and Aquatic Environments (ONEMA) organized an event titled *Aquatic Micropollutants Days* (March 10, 2010–March 12, 2010) to gather expertise on the presence of micropollutants in waters from different scientific angles. Almost 150 experts from Water Agencies, research, laboratories, engineering, ministries, and governmental agencies presented their latest results and discussed potential policy measures to reduce micropollutants in waters. Based on these debates, the Ministry of Ecology drafted the Micropollutants Plan in March 2010 and submitted the draft for a public hearing in April. Annex 4 of the Micropollutants Plan indicates that 24 actors were consulted. The Department of Water and Biodiversity (DEB) of the French Ministry of Ecology reported in an interview, held in the framework of this research project on October 18, 2013, that only a few actors provided a statement. After revisions were made to the document between May and June 2010, it was sent to the National Water Committee (CNE). The latter is the French *water parliament*, which votes on all water-related policy documents of the French Government. On July 6, 2010, the CNE adopted the Micropollutants Plan, and on October 13, during the meeting of the Council of Ministers, the Government gave its consent. One year after the adoption of the Micropollutants Plan, a follow-up report was published on the

³³See Web site of the French National Environmental Ministry: <http://www.developpement-durable.gouv.fr/Les-micropolluants-dans-les.html> (last access May 2012).

Table 2.31 Overview of the French policymaking process

Adoption of the French micropollutants plan	
Trigger Before 2009	Dangerous Substance Directive 76/464/EEC
	PNAR National Action Plan against Pollution of Aquatic Environments from Dangerous Substances
	RSDE National Research Action on Dangerous Substances in Water
Concept phase 2009–2010	Meetings to elaborate on the Micropollutants Plan (July 9, 2009 and January 1, 2010)
	<i>Aquatic Micropollutants Days</i> organized by ONEMA (March 10, 2010–March 12, 2010)
Elaboration March 2010	Draft proposal prepared by the Ministry of Ecology
Consultation April 2010	Public hearing (January 1, 2010–April 30, 2010)
Finalization May–June 2010	Revisions of the draft proposal
Adoption July–Nov. 2010	Approval by the National Water Committee (CNE) (July 6, 2010)
	Approval by the Council of Ministers (October 13, 2010)
Implementation Since 2011	Follow-up report on <i>Micropollutants in aquatic environments. Timeframe 2007–2009</i> (published on October 17, 2011)
	Conference on micropollutants <i>Micropollutants Plan 2010–2013: state of progress achieved in one year</i> (October 18, 2011)

presence of micropollutants in French waters (October 17, 2011) and a conference was organized to discuss the progress made in one year (October 18, 2011).

Overall, a comparably short policymaking process contrasts a rather broad and encompassing policy strategy toward micropollutants. Despite its non-bindingness, the Micropollutants Plan is a promising first step in preparing a broader toolbox of legally binding policies as of 2014. Section 3.3 presents an aggregated summary of actors' interactions during the aforementioned policymaking process in the form of policy networks. The implementation phase that took place after 2014 is not covered by the policy network, since it lay in the future of the present study.

2.3.5.2 Indexing the French 'Plan Micropollutants'

In France, a global national strategy toward aquatic micropollutants was adopted in the form of the *Micropollutants Plan* in 2010.³⁴ The Micropollutants Plan provides an overview of the already-existing legal instruments on both the EU- and national-level targeting micropollutants; it points to remaining regulatory as well as

³⁴See Web site of the French National Environmental Ministry: <http://www.developpement-durable.gouv.fr/Les-micropolluants-dans-les.html> (last access May 2012).

knowledge gaps and establishes the future policy and research agenda. In the context of French water governance, such a strategic document provides guidance to the Water Agencies, which are otherwise free to adopt their own water protection policies. The Plan's purpose, therefore, is not only to propose measures for the reduction of micropollutants, but also most importantly to prioritize actions for Water Agencies.

Pressure on Target Groups and Policy Instruments

The Micropollutants Plan is structured into 4 axes, which reflect the priorities of the French Government: (1) reducing emissions at the source; (2) improving the knowledge of water quality and making data accessible; (3) improving scientific (technological) knowledge for monitoring waters; and (4) evaluating and communicating progress in pollution reduction. A total of 22 specific policy measures explain how each of these 4 axes is achieved in practice and provide an indication of the degree to which target groups feel pressured to take action. Hereafter, I outline a selection of the 22 proposed measures in order to provide a general understanding of the French policy design.

- **Policy instruments:** A first example of policy measures included in the Micropollutants Plan is action numbers 2 and 7 which deal with the introduction of national legally binding *EQNs* to reduce emissions from particularly relevant substances. Action number 3 concerns *banning* the most dangerous substances from being marketed on EU and national levels. The French Government mainly focuses on the ban of plant protection products and biocides, due to results from a large roundtable conference on the environment in 2009 (*Grenelle de l'environnement engagement n° 129*). The political aim is to prohibit a total of 40 pesticides from the market for which substitutes exist by 2010. For compounds lacking substitutes, the goal is to reduce their use by 50% over the next 10 years (compared to 2010). In order to achieve this goal, alternative agricultural practices are financially incentivized (*Plan ECOPHYTO 2008–2018*). *Subsidies* originate from the so-called *diffuse pollution charge* that farmers are required to pay on pesticides. The Micropollutants Plan also postulates the need to improve this financial incentives scheme for a more effective reduction of pesticides use (action number 4 and 11).

In handling point-source pollutants, the Micropollutants Plan announces more detailed *monitoring* (action number 5) in order to better understand emissions into waters (action number 13). The French legislator already set a list of defined micropollutants that have to be monitored by specific industries and wastewater treatment plants (circulaire DGPR January 5, 2009 and circulaire DEB September 29, 2010). Only those industries, which represent a particular risk for the environment, so-called 'installations classées pour la protection de l'environnement (ICPE),' are required to self-monitor the defined compounds. To make monitoring information accessible for research and the government, a nationally integrated *database* on water was installed in 2010, the 'schéma

Table 2.32 Evaluation of the French policy design's pressure on target groups

Indicator	Level of performance	Score
Pressure on target group	Low performance: policy plan proposing an instrument mix and relying on persuasion	0.25

Table 2.33 Evaluation of the French policy design's sanctions

Indicator	Level of performance	Score
Sanctions	No performance: <i>no</i> existing sanctions	0

national des données sur l'eau (SNDE)' (action number 6), whereby industrials directly report their monitoring data into the national database on water.

While the Micropollutants Plan prioritizes source-related measures, it also includes some end-of-pipe ideas. For classified industrial plants, the Micropollutants Plan proposes the definition of *technical standards* to improve wastewater treatment (action number 7). Many more measures are outlined in the Plan; some target waste management, while others establish actor networks or private–public partnerships. The *Micropollutants Plan* also includes projects for future policy plans, for instance, on pharmaceuticals (“PNRM Plan National sur les Résidus de Médicaments dans les Eaux,” May 30, 2011). In summary, the Micropollutants Plan represents a collection of proposed measures for the reduction of micropollutants. The adoption of the propositions into legally binding regulations remains to be seen.

The Micropollutants Plan fulfills an important signaling effect: It demonstrates that the topic of aquatic micropollutants is on the political agenda, and gives priority guidelines to the Water Agencies. So, even if Water Agencies are not constrained by the proposals of the Plan and are free to adopt their own water protection policies (interview with AGENCE, February 20, 2014), they may still be persuaded to take action. Therefore, a low score was attributed to the French policy design on that indicator (score of 0.25 in Table 2.32).

Sanctions and Competent Enforcement Agency

The Micropollutants Plan does not define sanctions. Therefore, the French policy design attains a score of zero for the indicator *sanctions* (score of 0 in Table 2.33).

Inclusiveness of Target Groups

The French policy design neither specifies target groups nor exceptions, but rather proposes a broad range of measures for the reduction of micropollutants from diverse sources. Hence, particularly positive to the French approach is its inclusiveness with regard to diverse sources of micropollutants, as well as the coverage of a wide range of potential policy measures targeting all parts of the society and the economy (score of 0.75 in Table 2.34).

Table 2.34 Evaluation of the French policy design's inclusiveness

Indicator	Level of performance	Score
Inclusiveness	High performance: <i>Important parts</i> of the sources of emissions may be targeted	0.75

Proportionality: Solution Versus Problem Scale

Proportionality can be evaluated when contrasting solution level with problem scale.

- **Competent jurisdictional level for implementation:** In the context of French water governance, policies are adopted on the level of water basins, which are delimited by Water Agencies. Although the Micropollutants Plan represents a national-level policy plan, it does not change the fact that policies are adopted and implemented on the basin level, because Water Agencies are not bound to the guidelines of the Plan.
- **Problem scale:** The French Micropollutants Plan places an emphasis on the complexity of the phenomenon of aquatic micropollutants and considers all types of substances, sources of pollution, and entry points into the aquatic environment. When considering micropollutants in its entirety, the scale of the problem depends on the exact chemical substance of interest and can range from local to international.

On the one hand, the French Micropollutants Plan leaves Water Agencies the flexibility to adjust their policies on micropollutants to the circumstances in water basins. In this regard, the solution level can be fine-tuned to the scale on which a problematic chemical substance causes problems. For substances detected in waters on the national scale, on the other hand, the basin-level solution might be smaller than the national problem scale and lead to policy designs, which are not encompassing enough to comprehensively reduce pollution. In conclusion, a medium performance level is attributed to the French policy design on that indicator (score of 0.5 in Table 2.35).

Directness: Dispersion of Decision-Making, Financing, and Implementation

To evaluate the directness of the underlying policy design, the architecture of the French water governance should be taken into account, which is highly decentralized compared to traditional French centralism.

Table 2.35 Evaluation of the French policy design's proportionality

Indicator	Level of performance	Score
Proportionality	Medium performance: Mostly, problem scale and solution level are likely to <i>match</i> , but for substances detected on the national scale, the defined solution level by water basin could be <i>smaller</i> than the problem scale	0.5

Table 2.36 Evaluation of the French policy design's directness

Indicator	Level of performance	Score
Directness	Low performance: <i>Implementation and financing</i> are executed by the French <i>Water Agencies</i> , and <i>implementation is not strictly controlled</i> by the national <i>Ministry of Ecology</i>	0.25

- **Decision-making entities:** The Micropollutants Plan was drafted by the Ministry of Ecology, approved by the cabinet of Ministers (government), and then adopted by the French water parliament called *Comité Nationale de l'Eau*. Nevertheless, it remains an enterprise driven by the Ministry of Ecology.
- **Distribution of costs:** Water Agencies, i.e., the water basin-level authorities, have budgetary independence from Paris as they levy their own tax, i.e., a pollution charge paid by classified industrial plants. It is their responsibility to finance pollution reduction measures.
- **Competent agency for (supervision of) implementation:** The implementation of water protection policies lies within the realm of Water Agencies. To date, it is not specified who would supervise the implementation of these policies if concrete reduction measures on micropollutants were adopted.

Theoretically, water protection policies are adopted, financed, and implemented (or supervised) by Water Agencies, which would strongly indicate for a direct policy. In the present case, however, the Micropollutants Plan is a national-level policy document, while implementation and financing is a task of Water Agencies. While the Plan was elaborated on the national level, the adoption of more concrete policies for the reduction of micropollutants in waters, as well as the funding of the measures, is left to the basin level. Since Water Agencies did not design the Micropollutants Plan, and additionally, implementation is not controlled by the national level, ample room is left for goal displacement. The underlying policy design is less direct because the tasks of deciding, funding, and implementing are dispersed between several authorities, and hence, a low level of performance is attributed to the French policy design on directness (score of 0.25 in Table 2.36).

Bindingness and Type of Policy Document

The score for bindingness is estimated by considering the type of policy document adopted.

- **Type of policy document:** The Micropollutants Plan is not a legally binding policy document, but rather an action plan, which suggests a collection of possible measures to Water Agencies.

Although the Plan is technically not legally binding, it still provides a signal to the Water Agencies, which are therefore more likely adopt micropollutants reduction measures. Therefore, a low score is attributed to the French policy design for bindingness (score of 0.25 in Table 2.37).

Table 2.37 Evaluation of the French policy design's bindingness

Indicator	Level of performance	Score
Bindingness	Low performance: existing document, but <i>non-binding</i>	0.25

Table 2.38 Performance of the French policy design after the policy comprehensiveness index

Indicators of the policy comprehensiveness index	Scores
Pressure on target groups	0.25
Sanctions	0
Inclusiveness	0.75
Proportionality	0.5
Directness	0.25
Bindingness	0.25
Overall index score	0.34 (medium/low)

Summary of Index Results for the French Policy Design on Micropollutants

The index results in Table 2.38 reveal that the French policy design achieves a medium to low level of comprehensiveness in addressing the problem of micropollutants in waters (score of 0.34). The policy is designed as a very flexible tool and therefore has the potential to address micropollutants in an effective and efficient way (inclusiveness 0.75, proportionality 0.5) depending on the exact substance of interest. The downside of the policy design is that it is not compelling to target groups (pressure 0.25, sanctions 0), nor to implementers (directness 0.25), or the state (bindingness 0.25).

2.3.6 The Dutch Micropollutants Policy

2.3.6.1 The Netherlands: Policy Project on Pharmaceutical Micropollutants

The Dutch policymaking process on micropollutants is different from the ones in Switzerland, Germany, and France because it has centered on a specific group of substances, namely pharmaceuticals. The other countries under investigation have framed the issue broadly, including plant protection products, as well as industrial and household chemicals. And yet, what renders the phenomenon of micropollutants new to policy agendas are pharmaceutical residues in water. The Dutch policy in particular has been addressing this new policy problem in a separate policy-making process, in addition to the already-existing policies on pesticides (Action Program Diffuse Sources September 30, 2009) or industrial pollution in waters (*Besluit kwaliteitseisen en monitoring water 2009*), since early 2000. The question as to whether pharmaceutical residues could cause a problem in the environment was taken up by the Dutch Parliament in 1997 (see Table 2.39). The Second

Table 2.39 Overview of the Dutch policymaking process

Dutch policymaking process on measures for the reduction of pharmaceutical micropollutants	
Trigger 1997–2004	1997–2001: Tweede Kamer inquiry to Minister of Environment concerning risks arising from endocrine substances in waters resulting in <i>Strategienota Omgaan Met Stoffen—SOMS</i> Report <i>Milieurisico's van geneesmiddelen</i> , Gezondheidsraad (no. 2001/17) RIZA reports <i>Vergeten stoffen in Nederlands oppervlaktewater</i> (no. 2001-020) and <i>Estrogens in the aquatic environment</i> (no. 2002-001)
Concept phase 2005–2013	Introduction of a working group on veterinary and human pharmaceuticals in water bodies (<i>Interdepartementale werkgroep (dier)geneesmiddelen en het watermilieu</i> , Kamerstuk no. 28808-35, April 26, 2005) Report concerning results of working group on February 21, 2007 (Kamerstuk no. 28808-39) Implementation of pilot measures, e.g., monitoring, wastewater treatment (elektronisch patiënten dossier, Kamerstuk no. 30535/27625-19, September 30, 2009) Position paper by VEWIN on diffuse water pollution (<i>Uitvoeringsprogramma Diffuse Bronnen Waterverontreiniging</i> , January 2010)
Elaboration 2007–2014	Environmental Ministry informs the Second Chamber (Tweede Kamer) on policy options and pilot measures (Kamerstuk no. 28808-39, February 21, 2007; no.30535, September 30, 2009; no. 27625-281, September 4, 2012; no. 27625-305, June 25, 2013)
Parliamentary Involvement Since 2013	Inquiry by Groenlinks on the state of improved wastewater treatment (no. 27625-281, March 25, 2010) Meeting of <i>Vaste Commissie voor Infrastructuur en Milieu</i> to discuss results of pilot measures (June 27, 2013) Motion 27625-299 and 27625-300 calling for regulation of pharmaceutical micropollutants in waters Parliamentary roundtable conference on pharmaceuticals and water quality (<i>Geneesmiddelen en waterkwaliteit</i> , January 30, 2014)
Further research Since 2013	Report on Screening micropollutants in Dutch surface water (<i>Evaluatie screening RWS 2011-2012. Rapportage screeningsonderzoek van microverontreinigingen in de Nederlandse oppervlaktewateren van Rijkswaterstaat</i> , September 20, 2013) BTO/KWR report pharmaceuticals in drinking water (<i>Voorkomen en voorkomen van geneesmiddelen in bronnen van drinkwater</i> , Nov 2013) Position paper by VEWIN on pharmaceuticals (<i>Geneesmiddelen</i> , January 2014)

Chamber commissioned the Minister of the Environment to assess the potential risks arising from endocrine substances in the environment. As a result of the inquiry, hormone active substances were added to the Dutch strategy aiming at the correct and safe usage of chemical substances to protect humans and the environment in 1999 (*Strategienota Omgaang Met Stoffen—SOMS*).

When the Dutch Health Council, an independent scientific and highly influential advisory body in the Netherlands, released a report on the risks caused by pharmaceuticals in the environment in 2001, awareness of policy makers rose (*Gezondheidsraad Nederland, 2000: Milieurisico's van geneesmiddelen*). Hence, a number of research projects were launched in order to better understand the sources of the problem. Among others, the former³⁵ National Institute for Integrated Freshwater and Wastewater Management reported on estrogens in the aquatic environment (RIZA report no. 2002-001).

In response, an interdepartmental working group (*Interdepartementale Werkgroep (Dier)Geneesmiddelen in het Watermilieu*) was formed to prepare potential policy measures for the reduction of emissions from both human and veterinary pharmaceuticals in Dutch surface waters in 2005 (Kamerstuk nr. 28808-35). To integrate diverse fields of expertise, the working group consisted of the former Ministry of Housing, Spatial Planning and the Environment (VROM), the former Ministry of Transport and Water Management (V&W), the former Ministry of Agriculture, and Nature and Food Quality (LNV); moreover, public research institutes were part of the working group, i.e., the National Institute for Public Health and the Environment (RIVM), the former National Institute for Integrated Freshwater and Wastewater Management (RIZA), the Institute for Coast and Sea (RIKZ), and the Medicines Evaluation Board (CBG) which assesses the risks of pharmaceuticals (cf. document Tweede Kamer, 2005). The working group's results were reported to the Parliament in February of 2007 (Kamerstuk nr. 28808-39). Recommendations included a more purposeful usage and prescription of pharmaceuticals, and the consideration of environmental impacts by medical doctors; separate treatment of highly burdened urine or wastewater from hospitals and nursing homes; and investments in green pharmacy with higher biodegradability or absorption levels by the human body.

As a consequence, the Dutch Government made funds available to implement pilot measures in order to lay the ground for the formulation of policies (September 30, 2009 nr.30535/ 27625-19). A number of pilot measures were implemented. The Water Board Regge en Dinkel, for instance, launched a monitoring project in order to detect concentration levels of pharmaceuticals in surface waters. When the results suggested that a number of substances could be detected, some at comparably high levels (above 0.5 µg/l), the Water Board discussed potential measures with

³⁵The Dutch administration was restructured in 2010, which lead to the dissolution and merger of several ministries and agencies. Hence, several Dutch actors, which participated in the policy process on pharmaceutical micropollutants, did not exist anymore at the time of data gathering. They obtained the prefix 'former' or 'ex' in their acronym.

pharmacists and medical doctors. As funds were lacking, no further policy action was undertaken (interview with Waterschap Vechstroom on March 11, 2014).

When similar experiences took place in the other parts of the country, the Association of Dutch Drinking Water Companies (VEWIN) published a position paper in 2010 calling for progress, and increased efforts in reducing micropollutants. Drinking water companies are confronted with rising costs as trace amounts of micropollutants in surface waters force drinking water plants to invest in more and more sophisticated (and expensive) filtering technology.

To meet the call for action of the drinking water sector, the Environmental Ministry published three consecutive letters, which inform (the Second Chamber) about the progress of pilot measures, and presented potential policy options (February 21, 2007 nr. 28808-39; September 30, 2009 nr.30535; September 4, 2012 no. 27625-281; June 25, 2013 no. 27625-305). The first letter pointed out three different strategies to reduce pharmaceuticals in waters: first, the *load approach* ('Vrachtenbenadering') which refers to introducing a fourth treatment step for the elimination of pharmaceuticals from wastewater; second, the *concentration approach* ('Concentratiebenadering') which implies the improvement of the dilution ratio of receiving water bodies; and third, separate treatment of highly pharma-contaminated urine through the separate collection (called urine separation), and treatment of hospital or nursing home wastewater (February 21, 2007 nr. 28808-39). When this agenda did not lead to a revision of legal texts, the political party Groenlinks addressed an official inquiry to the Government concerning the state of improved wastewater treatment in March 2010 (March 25, 2010 no. 27625-281).

The adoption of concrete policy measures was then delayed by the 2012 political turbulences in the Netherlands, which resulted in the resignation of the Dutch Government and new parliamentary elections. Only in 2013 did the policymaking process gain new momentum. On June 27, 2013, the parliamentary Committee for Infrastructure and Environment held a meeting to discuss the results of the pilot measures (September 30, 2009 nr.30535, Tweede Kamer, 2013b). As a result, the Dutch Parliament adopted a motion charging the Dutch Government to adopt EQNs to limit concentration levels of pharmaceuticals in surface waters (motion 27625-299 and 27625-300). To promote concerted action, the Dutch Parliament organized a roundtable conference—a stakeholder gathering—on pharmaceuticals and water quality on January 30, 2014. Politicians, governmental actors, researchers, medical experts, and members from the pharmaceutical industry were present and debated source-directed and end-of-pipe measures (document Tweede Kamer, 2014). During the discussions, pharmaceutical industry representatives expressed doubts concerning the existing scientific knowledge on the effects of pharmaceutical residues in waters, and thus, they subsequently called for further research. The Department for Water Management (RWS report September 20, 2013), the Watercycle Research Institute (BTO/KWR report *Voorkomen en voorkomen van geneesmiddelen in bronnen van drinkwater*, Nov 2013) as well as numerous Dutch universities, continue to conduct research on pharmaceuticals in Dutch water bodies. At the same time, however, actors, such as the drinking water association VEWIN, maintain that measures should already be taken.

The 15-year-long policymaking process did not yet lead to the adoption of a concrete policy output. Rather, actors are still working on problem definition (e.g., research, pilot measures), which generally characterizes early stages of policy-making processes. Numerous actors have expressed their frustration regarding the lengthy process and the lack of concrete measures (interviews with Water Board March 11, 2014, UvW April 10, 2014, KWR April 11, 2014, RWS April 15, 2014, RIWA April 23, 2014, VEWIN April 28, 2014). Nevertheless, Sect. 3.3 analyzes the policy networks emerging from the described policymaking process. The continuation of the policymaking process after January 2014 lay in the future of the present study and is therefore not considered here.

2.3.6.2 Indexing the Dutch Policy Project on Pharmaceutical Micropollutants

Already in the early 2000s, the Netherlands put the topic of aquatic micropollutants on the political agenda and thus was the first Rhine riparian country that discussed the issue politically. Particular to the Dutch policy debate is its focus on pharmaceutical micropollutants, while other countries consider all types of pollutants in small concentrations. Agricultural or industrial pollution in waters is generally not a new phenomenon in European politics, while pharmaceutical residues represent a new challenge. Despite the progressive policy debate in the Netherlands, the 15-year-long policy process did not yet lead to the adoption of a concrete policy output, and actors are still working on problem definition at the time of the present study. Hence, there is not yet an adopted policy output that could be evaluated here, and therefore, the proposed policy ideas are classified below in a slightly abbreviated analysis.

Even if the Dutch policy process under investigation remained without concrete policy outputs, there are policies within other policy subsystems which might contribute to water protection from micropollutants, but that are not studied here. Among those are, for example, policies on pesticides that belong to the subsystem of agricultural policy (Action Program Diffuse Sources September 30, 2009) or policies on industrial pollution (*Besluit kwaliteitseisen en monitoring water 2009*).

Pressure on Target Groups and Policy Instruments

During the Dutch debate on pharmaceutical micropollutants in waters, a number of policy instruments were proposed.

- **Policy instruments in discussion:** The policy discussion evolved from a more source-directed to an end-of-pipe approach. An interdepartmental working group first proposed source-directed measures, such as green pharmacy or reduced prescriptions of pharmaceuticals in the year 2007, which was difficult to regulate. The Ministry for the Environment therefore proposed an end-of-pipe alternative, such as improving wastewater treatment and charged a consultancy to estimate the costs of upgrading. The engineering company Grontmij calculated the costs

for technical improvement of all—not just selected—wastewater treatment plants, which resulted in very high cost estimates (interview with Union of Water Boards (UvW), April 10, 2014). As a result, the Government did not opt for this solution either. According to an interview with the Ministry of the Environment in 2014, the Dutch approach now considers the entire cycle, from the source to the end-of-the-pipe, and supports the society or the economy in their voluntary efforts to reduce pharmaceutical pollution in waters (Ministry for Infrastructure and Environment (IenM), April 10, 2014). The idea here is to take into account the changing role of government and not to construct policies from a top-down approach. Instead, the Ministry seeks to make use of the ‘power of society,’ by promoting a debate on potential societal solutions and connecting involved actors. Following the idea of an ‘energetic society,’ *voluntary measures* are preferred to legal state-imposed policies (interview with Ministry for Infrastructure and Environment (IenM), April 10, 2014).

As the proposed policy ideas are not constraining, a score of 0 was attributed to the indicator (score of 0 in Table 2.40).

Sanctions and Competent Enforcement Agency

Sanctions are not formulated as long as no policy is adopted (score of 0 in Table 2.41).

Inclusiveness of Target Groups

The Dutch perspective is to find a policy solution for human and veterinary pharmaceutical residues in water bodies. Since pharmaceuticals represent a specific subgroup of micropollutants, the Dutch policy is less inclusive compared to all chemical substances contributing to the problem. Nevertheless, a score of 0.5 was attributed for inclusiveness in Table 2.42, because many different target groups

Table 2.40 Evaluation of the Dutch policy design’s pressure on target groups

Indicator	Level of performance	Score
Pressure on target group	No performance: <i>No policy instruments</i> adopted	0

Table 2.41 Evaluation of the Dutch policy design’s sanctions

Indicator	Level of performance	Score
Sanctions	No performance: <i>no</i> existing sanctions	0

Table 2.42 Evaluation of the Dutch policy design’s potential for inclusiveness

Indicator	Level of performance	Score
Inclusiveness	Medium performance: <i>Half</i> of the sources of emissions may be targeted by the policy	0.5

comprise the pharmaceutical sector. Among those are the pharmaceutical industry, pharmacists, medical doctors, and patients, which have all been named as potential future target groups in the framework of the Dutch policy debate.

Proportionality: Solution Versus Problem Scale

The proportionality of a future policy design can only be anticipated here. Considering the architecture of Dutch water governance, it is likely that the implementation of a future policy on pharmaceutical micropollutants takes place on the jurisdictional level of Water Boards. Such implementation would be advantageous where emissions display regional differences, so that policy design could be tailored to these variations. However, numerous micropollutants, including human and veterinary pharmaceutical residues, are likely to exist on the national scale, considering that the Netherlands is a very densely populated and cultivated country. While the problem scale might be national, the solution may exist at the Water Board level. Hence, the problem scale is likely to be larger than the solution level for some substances. Building on this reasoning, a medium-level performance for the indicator proportionality was estimated for a future policy project (score of 0.5 in Table 2.43).

Directness: Dispersion of Decision-Making, Financing, and Implementation

No matter how a future policy will be designed, its implementation is likely to be a task of the water boards since the latter are responsible for wastewater treatment and for issuing discharging permits. The adoption and funding of micropollutants policies are likely to come from another body because of missing majorities in water boards and resource shortages. Due to the involvement of several authorities responsible for deciding, funding, and implementing, and a probable lack of supervision of implementation, the potential for a direct policy design was estimated as low here (score of 0.25 in Table 2.44).

Table 2.43 Evaluation of the Dutch policy design’s potential for proportionality

Indicator	Level of performance	Score
Proportionality	Medium performance: Mostly, problem scale and solution level are likely to <i>match</i> , but for substances detected on the national scale, the defined solution level by Water Board basin could be <i>smaller</i> than the problem scale	0.5

Table 2.44 Evaluation of the Dutch policy design’s potential for directness

Indicator	Level of performance	Score
Directness	Low performance: <i>Implementation</i> is passed on to <i>Water Boards</i> , the task of <i>decision-making</i> and <i>financing</i> is likely to be taken over by <i>another entity</i>	0.25

Table 2.45 Evaluation of the Dutch policy design's bindingness

Indicator	Level of performance	Score
Bindingness	No performance: <i>no</i> existing legal document	0

Table 2.46 Performance of the Dutch policy design after the policy comprehensiveness index

Indicators of the policy comprehensiveness index	Scores
Pressure on target groups	0
Sanctions	0
Inclusiveness	0.5
Proportionality	0.5
Directness	0.25
Bindingness	0
Overall index score	0.2 (low)

Bindingness and Type of Policy Document

Lastly, the score for bindingness was estimated at zero for now (score of 0 in Table 2.45). Although the policy process has shown some output through the adoption of pilot projects for the reduction of pharmaceutical pollution in water bodies, these measures remain voluntary and sporadic so far.

Summary of Index Results for the Dutch Policy Design on Micropollutants

The index result shown in Table 2.46 reveals that the Dutch policy design has not comprehensively addressed the issue of micropollutants so far (score of 0.2). Since the Dutch policy remains a project, it can compel neither target groups (pressure 0, sanctions 0), nor implementers (directness 0.25) or the state (bindingness 0) to act. Nevertheless, the proposed ideas on how to reduce veterinary and pharmaceutical micropollutants have the potential to rather effectively and efficiently reduce pharmaceutical micropollutants in waters on behalf of potential emitters (inclusiveness 0.5) by quite well adapting problem scale and solution level (proportionality 0.5).

2.3.7 Summary of the Comprehensiveness of Policy Designs on Micropollutants

Table 2.47 summarizes the assessment about policy designs' degree of comprehensiveness with regard to reducing micropollutants in waters as elaborated above. According to the policy comprehensiveness index, Switzerland possesses the comparably most comprehensive policy design. Germany's design displays a medium degree of comprehensiveness. A medium/low rating can be assigned to France and a low one to the Netherlands.

Table 2.47 Performances of the studied policy designs after the policy comprehensiveness index

Indicators	CH	G	F	NL
Pressure on target group	0.75	0.5	0.25	0
Sanctions	0.75	0	0	0
Inclusiveness	0.5	0.25	0.75	0.5
Proportionality	1	0.75	0.5	0.5
Directness	0.75	0.75	0.25	0.25
Bindingness	0.75	0.625	0.25	0
Policy comprehensiveness index	0.75 (high)	0.48 (medium)	0.34 (medium/low)	0.2 (low)

The ranking of the policy designs confirms that Germany, France, and the Netherlands lag behind the policy innovator of Switzerland. This dichotomy is a reflection of Swiss policy design effectively contributing to the reduction of micropollutants in surface waters, and therefore being considered comprehensive. The German policy design, on the contrary, relies on monitoring the quality of surface waters, which neither reduces emissions nor improves water quality in the first place. Nevertheless, the German policy design has the potential to effectively improve water quality if further pollution reduction measures are adopted. Both the French and Dutch policy designs remain vague, and hence, improvements of water quality in these countries are less certain.

The ranking of the policy designs also reflects the fact that the four Rhine countries focus on different aspects of the policy problem and have diverse approaches to address aquatic micropollutants. The Swiss approach consists of a confinement of the problem to insufficient wastewater treatment, at least initially. Hence, the amended Waters Protection Act and Ordinance introduce technical standards, which require selected wastewater treatment plants to filter 80% of micropollutants from their wastewater. The Swiss end-of-pipe approach can be characterized as particularly pragmatic and strategically clever: pragmatic, because an entire range of industrial agricultural, household, and pharmaceutical substances can potentially be eliminated through improved wastewater treatment; and strategic, because the regulation of wastewater treatment might be a comparably feasible endeavor in a political environment favorable to clean water. The focus of the Swiss policy design on one aspect of a more complex phenomenon successfully resulted in a comprehensive policy design.

The other three Rhine countries, in contrast, feared the costs of investments in new wastewater filtering technology and therefore have not yet followed the Swiss example. With a larger territory, more inhabitants, and a different sewage treatment structure, France and Germany argued that, compared to Switzerland, a much higher number of (small) treatment plants would need investments. A fourth treatment step for wastewater plants would be a particularly costly project, which has so far lacked the necessary political support (interviews with French Ministry of

Ecology (DEB) October 18, 2013, German State of Rhineland-Palatinate (RLP) April 17, 2012, German State of Bavaria (BAY) April 26, 2012).

Compared to the Swiss end-of-pipe approach, the German EQN approach was evaluated here as less comprehensive. The German policy design must be understood in the context of federalism, where the federal state sets concentration limits, and the *Länder* adopt pollution reduction measures where necessary to comply with the limit. The adopted EQN in the German Surface Water Ordinance focuses on the control of concentration levels of agricultural and industrial emissions. This way, point-source as well as diffuse pollution is considered. Pharmaceutical residues in surface waters are not listed and remain unregulated in the timeframe of this study because of the opposition of the German *Länder*.

With regard to the French approach, in particular, micropollutants are framed as comprehensively as possible, when considering all types of pollutants, sectors, and levels. The National Government adopted a holistic strategic orientation in the Micropollutants Plan, a non-legally binding policy document, and proposed policy measures for all potential sources of emissions. Of all the propositions, the national Government has to-date mainly focused on commissioning research on micropollutants in order to set the foundations for future policies. The reticence of the French national Government may seem surprising considering that France is well known for its centralism. However, France is highly decentralized when it comes to water governance. The adoption of measures for the reduction of micropollutants in waters has consequently been a task of Water Agencies thus far, which often work on a case-by-case basis.

The Dutch situation is similar to the French one in that the Dutch Water Boards, to date, have adopted some pilot measures. The national policy process has not yet resulted in a concrete policy output. Nonetheless, the Dutch case is the only one with a clear focus concerning the risks arising from human and veterinary pharmaceutical residues in waters. Source-directed as well as end-of-pipe policy solutions have been proposed, but also rejected.

In conclusion, the EU member states France, Germany, and the Netherlands display a less-comprehensive policy design for the reduction of micropollutants than does Switzerland. One reason for this lag lies in the EU membership itself. Clearly, certain policy issues are best dealt with on the EU level. However, EU membership seems to provide false incentives if member states claim policy action on behalf of the EU, but then fail to achieve consensus on a comprehensive EU policy design. The case of micropollutants is an example of a situation where the EU regulation, here the WFD, provides for a general framework and leaves concrete pollution reduction measures to the member states. The member states, in turn, wait for further action on the EU level and in the meantime adopt incomprehensive policy designs at best. It remains to be seen whether future national measures will go beyond research and case-by-case decisions, and propose effective ways of reducing micropollutants in surface waters.

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Metz, F.

2017, XXVI, 317 p. 10 illus., Hardcover

ISBN: 978-3-319-55692-5