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Solving cross-sectoral policy problems: Adding a cross-sectoral dimension to assess policy performance

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Abstract

Many policy problems such as climate change, water pollution, or biodiversity loss originate in one sector or location but deploy their effects elsewhere and so require comprehensive regulation that is both source-directed and cross-sectoral. But, how can we assess a country's cross-sectoral policy performance when it comes to solving complex (environmental) problems? To answer this question, the study examines pesticide regulation in Costa Rica. Synthetic pesticides are widely used to sustain agricultural production, but they constitute a risk for humans and nature. To assess policy performance, both the substantive (policy instruments) and institutional (legislation) aspects of policymaking targeting pesticide risks mitigation are considered for evaluation. More specifically, the policy mix of instruments in respective action plans as well as legislation in respective laws and regulations are analyzed. To assess the cross-sectoral dimension and to add to literature on policy density and intensity, criteria like formulation of objectives, target group integration, coordination and policy instrument types are used. The findings indicate that policy mixes in the water and health sector exhibit high cross-sectoral performance in terms of source-directed instruments, but cross-sectoral performance in the overarching legislation is limited.

1. Introduction

In recent years, comparison of policy mixes across countries or over time has attracted increasing research interest (Rayner et al., 2017; Lieu et al., 2018; Schmid et al., 2020) for a number of reasons. First, there is interest in how countries comply with international pledges when introducing domestic policies (Tobin, 2017; Tobin et al., 2018; Pischke et al., 2019). Second, policy mix comparison can shed light on policy diffusion and learning by highlighting who 'copied' whom or which prospective diffusion pathways seem more promising than others (Metz & Fischer, 2016). Finally, policy mixes are evaluated and compared to assess how well a country performs in addressing a specific problem (Schaffrin et al., 2015; Capano et al., 2019). In this context, policy performance is defined as the policy mix's ability to reach specified targets, without limiting its assessment only to the criteria of effectiveness, but also taking other dimensions of policymaking into consideration. It follows that studies most typically focus on density and intensity to evaluate policy mix performance (Knill et al., 2012), based on the assumption that policy performance improves as more instruments are introduced (density) and their content in terms of scope or budget increases (intensity) (Schaffrin et al., 2015).

To augment the existing literature, the present study argues that assessment of policy performance should be refined to incorporate an additional *cross-sectoral* dimension, especially in the case of complex environmental problems produced by different actors in diverse sectors or affecting different entities (humans, species, and ecosystems). To that end, the study addresses the following research question

How can we assess a country's cross-sectoral policy performance when it comes to solving complex (environmental) problems?

To answer this question, we add two innovations to the existing literature: First, policy performance evaluation is extended to include a cross-sectoral dimension. The ideal cross-sectoral policy mix would include comprehensive instruments that target all sources and/or benefit diverse victims (Lee et al., 2019). In evaluating the quality of policy instruments, we utilize criteria like the share of source-directed (as compared to end-of-pipe) instruments and comprehensive integration of target groups.

Second, the present study extends the assessment of cross-sectoral performance to include both substantive elements (instruments of the policy mix) and institutional aspects (legislation) of policymaking. Laws and regulations specify the policy domain's general objectives and target groups, and assign competences to relevant public and private actors. To evaluate cross-sectoral institutional performance, evaluation criteria should also be including cross-sectoral formulation of objectives, integration of diverse actors groups contributing to the problem, and coordination across agencies and organisations.

This study examines pesticide use in Costa Rican agriculture, which is considered a 'global leader in both, conservation and intensive tropical agriculture' (Fagan et al. 2013, p. 2) and therefore offers a 'typical case' in which to investigate cross-sectoral challenges. Using state-of-the-art and cross-sectoral criteria, the study evaluates the policy mix and laws governing pesticide regulation in relation to drinking water, the aquatic ecosystem, and occupational health. This approach links two previously distinct strands of the literature (Metz & Glaus, 2019): the one that focuses on institutions regulating natural resources (Gerber et al., 2009; McGinnis & Ostrom, 2014); and the other that is invested in the choice of policy instruments (Doern & Phidd, 1983; Schaffrin et al., 2015). We thereby seek to highlight the relevance of substantive and institutional aspects of policy design (Dupuis & Knoepfel, 2015; Tosun & Leininger, 2017) alongside politics and decision-makers' preferences (Howlett et al., 2015; Metz & Ingold, 2017).

Based on systematic search and coding of legal texts, the study results provide insights into the cross-sectoral performance of Costa Rica's policy response to pesticide risks. To our knowledge, this is the first evaluation of Costa Rica's pesticide policy, cross-sectoral or otherwise. In general, this joint evaluation of institutional and substantive aspects of policymaking represents a novel addition to policy performance assessment.

2. Institutions, Policy Design and Expectations

As outlined in the Introduction to this special issue (Schaub et al., forthcoming), most (wicked) policy problems are currently addressed by more than one policy instrument, so-called *policy mixes* (Schaffrin

et al., 2015). There are different reasons for this, and often the reasons are cumulative. Because wicked problems tend to be cross-sectoral and multi-level, actions typically involve different programmes and jurisdictions (Ingold et al., 2018). Additionally, instruments are rarely abolished; instead, further instruments are introduced over time in pursuit of the same goal (Kivimaa & Kern, 2016; Metz & Glaus, 2019). Finally, a single well-designed instrument (probably source-directed) can potentially solve much of the problem, but such instruments tend to lack public or political support (Metz & Ingold, 2014; Landry & Varone, 2015). Together, these factors account for the prevalence of policy mixes as response to (wicked) policy problems. The present study explores *how* a policy mix meets cross-sectoral requirements. In addition to the well-known criteria density and intensity, we thus add a cross-sectoral dimension to evaluate the policy performance in both, the substantive (policy mix) and the institutional (legislation) aspects of policymaking. While the focus here is on policy design rather than implementation, we acknowledge that the realities of implementation clearly contribute to a policy's problem solving capacity.

Defining policy performance in terms of how well various policy instruments are bundled together as a single mix (Capano & Howlett, 2020), we argue that cross-sectoral coherence and capacity are as relevant to policy performance as the number of instruments (density) and the quality of state intervention (intensity). This approach is summarised in Table 1, which highlights the two innovations (see *italics* for cross-sectoral dimension (criteria) and institutional aspects of policymaking (object).

Table 1. Policy performance: Objects and criteria of evaluation

Objects of evaluation	**Criteria of evaluation**	**Relevant literature**	**Relevant concepts**
Policy mix (substantive)	**Density**	Knill et al. (2012) Bauer & Knill (2014) Schaffrin et al. (2015) Li & Taeihagh (2020) Pollex & Lenschow (2020)	
	Intensity		
	Cross-sectoral dimension	Stein et al. (2016)	Policy coherence (Instrument types)
		Metz and Glaus (2019)	Target group integration
Legislation (institutional)	***Cross-sectoral dimension***	Howlett et al. (2017)	Policy coherence (Formulation of objectives)
		Zinngrebe (2016)	Policy capacity (Coordination)
		Gerber et al. (2020)	Target group integration

2.1 Objects of evaluation: Substantive and institutional aspects of policymaking

Studies of policy instruments and mixes can be assigned to different strands of the literature (see also Tosun & Treib, 2018). First, many scholars are interested in the classification and analysis of policy instruments (for an overview, see Howlett et al., 2015; Metz, 2017) and how they perform, based on

criteria that include coerciveness and moral appeal (Doern & Phidd, 1983; Landry & Varone, 2005). Among these, Vedung's (1998) classification of sermons, carrots and sticks, referring to increasing levels of state intervention, is perhaps the most well known. More recent research has related policy instruments to decision-making processes (Schmid et al., 2020), innovation (Kern et al., 2019), and transition (Rogge & Reichardt, 2016), as well as investigating the capacity of such instruments to alter target group behaviours (Vlek, 2000; Burger et al., 2015; Howlett, 2018).

As such, recent studies explore substantive, institutional and sometimes even procedural aspects of policymaking (see Vito et al., 2020). Metz and Glaus (2019) linked the literature on policy design (Del Rio & Howlett, 2013) to the Institutional Resources Regime (Gerber et al., 2009; Gerber et al., 2020), thereby focusing on policy design as well as on the role of actor perceptions in policymaking. In their alternative approach, Kivimaa and Kern (2016) introduced the concept of 'creative destruction', arguing that new policies can only be successful if they involve the replacement of existing rules, actors and technology supports.

The hierarchical nature and mutual effects of substantive and institutional aspects of policymaking are often implicitly assumed. According to Ostrom's (1990) Institutional Analysis and Development (IAD) framework, policies are embedded in a multi-level arrangement in which the 'constitutional choice level' of laws and regulations specifies general guidelines for tackling a problem while the 'collective choice level' specifies concrete measures for addressing that problem. On this logic, constitutional choice impacts collective choice, and the (cross-sectoral) logic that determines how a law is designed should then also impact the (cross-sectoral) logic of instrument selection (Bauer & Knill, 2014). In contrast, Howlett and Rayner (2007) and Tosun and Leininger (2017) highlighted the impact of substantive policies on institutions. The literature on policy integration suggests that institutional and substantive aspects are strongly entangled (Runhaar, 2016); in other words, policy instruments should target goals outlined in the overarching legislation rather than new policy goals. In turn, collaborative arrangements for policy implementation can affect the institutional anchorage of such collaborations in future decision-making processes (Lange et al., 2013). In summary, the strong entanglement of substantive and institutional aspects of policymaking means that both must be considered in assessing policy performance (see Table 1), without –an a priori– assumption of a causal link in either direction (i.e. from instruments on laws, or vice versa).

2.2 Criteria of evaluation: adding a cross-sectoral dimension

Various criteria have been developed to compare the performance of policy mixes and related institutional arrangements across sectors or countries; among these, density and intensity are probably the most prominent (Knill et al., 2012). *Density* is a proxy for state activity to address a

problem, based on a 'simple' count of instruments integrated in the policy mix, where the density of the mix increases with the number of policy instruments. *Intensity* refers to the quality and content of these instruments and may be evaluated in terms of the budget allocated to implementation of the instruments in a policy mix or sanctions for non-compliance. Perhaps the most prominent indicator of policy intensity is *coerciveness*; the more coercive the policy instruments, the greater the allocated budget and sanctions for non-compliance, the more intense the mix.

A number of studies have investigated both density and intensity (or proxies thereof) of policy mixes to shed light on a country's or jurisdiction's ability to engage in larger socio-technical transitions (Kern et al., 2017; Rogge & Reichardt, 2016; Schmidt et al., 2019) or to address wicked problems such as climate change (Bauer & Knill, 2014). In one policy analysis of pesticide regulation, Lee et al. (2019) concluded that a mix of different policy instruments types and different degrees of state intervention was most effective in reducing pesticide risks. Like other wicked problems, pesticide risks typically arise in one or more sector but may have wider effects. To date, this cross-sectoral dimension has not been explicitly considered when evaluating policy mixes, and we argue here that the environmental policy integration (EPI) literature (Jordan & Lenschow, 2010) suggests diverse pathways to that end.

EPI research proceeds from the normative claim that the environment or, more specifically, sustainability (Norton, 2005), biodiversity (Zinngrebe, 2016) and climate (Widmer, 2018) should be incorporated in other policy sectors. A growing body of analytical work has outlined conceptual and empirical guidelines indicating how one sector or issue (e.g. climate, pesticides, biodiversity) might be anchored in or coordinated with other sectors. These guidelines can also be applied to the cross-sectoral dimensions of policymaking; borrowing from studies of policy coherence and capacity, we identified four criteria for assessing the cross-sectoral aspects of policy performance (see Table 1).

Policy coherence measures the extent to which different objectives and policy instruments in a given sector complement each other without introducing conflicting incentives or compromising effectiveness and efficiency in producing one outcome rather than another (Zinngrebe, 2016, p. 3; see also Tosun & Leininger, 2017). The following cross-sectoral criteria can be borrowed from the policy coherence literature:

- **Cross-sectoral formulation of objectives**: Policy goals and targets should take account of the two (or more) sectors or problems involved. In the present case, for example, this might mean that the drinking water legislation would include concrete targets to reduce pesticides in surface waters.
- **Cross-sectoral instrument types**: Policy instruments must target two or more sectors. For example, a tax on agricultural pesticides might incentivise reduced usage or alternatives

to conventional pesticides, with direct implications for human health, biodiversity conservation and environmental, soil and water protection.

Policy capacity refers to mechanisms and structures that anchor one sector or issue in others (Weidner & Jänicke, 2002; Zinngrebe, 2016). In relation to policy instruments and mixes, this involves establishing assessment procedures, control mechanisms or management routines across different agencies and organisations (Zinngrebe, 2016), providing a further criterion for cross-sectoral evaluation.

- **Cross-sectoral coordination**: The extent to which different sectoral agencies and public or private organisations coordinate and collaborate during policy formulation (for example, through inter-administrative consultation procedures), especially with regard to implementation and monitoring.

Additionally, objectives or instruments need to target the various actors that are either causing the problem or are affected by it, and identifying the 'right' target group is crucial for effective and efficient policy implementation (Mavrot et al., 2019). This is not straightforward in cross-sectoral contexts, as different actors come into play at the source (e.g. industry, agriculture) and at the end of the pipe (e.g. consumers, citizens, households) as potential targets of state intervention. Target group integration is therefore a relevant criterion for policy mix evaluation (Metz & Glaus, 2019), to which we can add an explicit cross-sectoral perspective.

- **Target group integration**: Along with target groups from sectors contributing to the problem in question, policy and introduced policy instruments must also take account of victims of the problem, whether as targets for end-of-pipe measures (e.g. protective clothes for pesticide users) or as beneficiaries of anticipated compensation.

3. Case, methods and operationalisation

To investigate the cross-sectoral performance of Costa Rican policies to reduce pesticide risks, we compared three regimes (drinking water, the aquatic ecosystem and occupational health), evaluating both the mix of policy instruments (i.e. the substantive aspects) and the relevant legislation (i.e. institutional aspects). To assess substantive and institutional cross-sectoral performance, an original coding scheme was developed (see 3.2.2 and 3.2.3), based on the four criteria outlined in 2.2.

3.1 Pesticide use and regulation in Costa Rica

Costa Rica is home to one of Latin America's 'most stable and vibrant democracies' (Lehoucq, 2005, p. 140). As the country relies heavily on agricultural production for export purposes (Wang et al., 2019)

and there is intensive application of agricultural pesticides (Echeverría-Sáenz et al., 2012; Galt, 2014), it was identified as an ideal case study for present purposes. Costa Rica's increasing population means there is also a rapidly growing domestic market (Galt, 2008). Costa Rica is 'the leading consumer of pesticides per hectare of agricultural land in the world' (Araya et al., 2014, p. 9), and the challenges posed by agricultural expansion at the expense of conservation of natural resources are reflected in stringent legislation and exemplary provisions for environmental protection (Fletcher & Breitling, 2012; Fagan et al., 2013;). In short, Costa Rica exemplifies the trade-off between agricultural and economic development and the protection of human and natural resources.

3.2 Operationalisation of key variables

Following a summary of 'state-of-the-art' criteria for assessing policy mixes (3.2.1), this section details cross-sectoral additions to coding schemes for the substantive (3.2.2, Table 2) and institutional aspects of policymaking (3.2.3, Table 3).

3.2.1 Density and intensity of policy mixes (substantive)

To evaluate the instrument mix, we analysed the 15 programmes and action plans that comprise all measures targeting pesticide risk reduction (see list of documents in Supplementary Material (SM)). In total, 38 policy instruments were found to address pesticide risk reduction.[1] Of those, 17 related to the drinking water mix, 14 to the aquatic ecosystem mix and 15 to the occupational health mix. Some instruments were clearly associated with more than one mix while eight instruments targeted pesticide risk reduction but were not associated with any of the three relevant mixes (e.g., in the agricultural sector only).

To begin, the three different policy mixes were evaluated in terms of the state-of-the-art criteria density and intensity.

- **Density ratio**: Density was operationalised here as the simple count of policy instruments in one mix (Schaffrin et al., 2015). The share of instruments addressing the drinking water-pesticide nexus was calculated as a percentage of all instruments regulating pesticide risks, and this procedure was repeated for the other regimes. This way, each of the 38 instruments was assigned a 'regime tag' referring to drinking water, aquatic ecosystem or occupational

[1] Policy instruments were extracted systematically in a two-step process. First, the documents were scanned for keywords such as 'pesticides', '(agro)chemicals', 'pollution' and 'risk', and documents that did not contain these terms were excluded from the data analysis. Second, within the 15 selected programmes, instruments specifically targeting pesticide risk reduction (e.g. incentives for cleaner production or public awareness campaigns to sensitize the public about risks) were extracted and assigned to the three policy mixes. Some instruments overlap across mixes.

health. For example, as the National Action Plan for Food Security makes payments to farmers for ecosystem services, impacting directly on pesticide risk reduction in the drinking water sector and influencing the aquatic ecosystem, this instrument is associated with both of those regimes.

- **Intensity (Balance)**: Coerciveness and state intervention are traditionally key indicators (Vedung, 1998, see also Pacheco-Vega, 2020). However, Schmidt et al. (2019) have recently argued that the mix with the most coercive instruments is not necessarily the most effective; instead, a balance of different instrument types facilitates implementation of fundamental or controversial changes. In this sense, a combination of softer and more stringent instruments seems more acceptable to a significant portion of the target group(s) (Dermont et al., 2017). Each of the 38 instruments was categorized as persuasive, market-based and/or regulative.

3.2.2 Cross-sectoral performance of policy mixes (substantive)

In line with the conceptual argument elaborated above, two criteria can be advanced for evaluating the cross-sectoral performance of policy mixes. As outlined in 3.2.1, the same 38 instruments were evaluated in this way.

- **Source-directed versus end-of-pipe**: From policy fields regulating pollution and chemical substances, we know that source-directed measures (e.g. substance bans, taxes) have the greatest cross-sectoral effects but lack political support (Metz & Ingold, 2014, Lee et al., 2019). This largely reflects opposition to those policy instruments from the designated target group, who are likely to favour less costly and more flexible measures (Metz & Ingold, 2017; Pedersen et al., 2020), and leads to the introduction of end-of-pipe solutions. In the case of pesticide risk reduction, these measures may involve the promotion of improved application equipment and practices to reduce risks to human health (Lee at al., 2019). These targeted end-of-pipe measures usually relate to a single sector, but comprehensive pesticide risk reduction requires action across policy fields; source-directed measures are more cross-sectoral in nature. For example, a source-directed measure such as a tax can influence multiple sectors to protect environment, water and humans. Accordingly, the 38 instruments were classified as source-directed, end-of-pipe or both.
- **Target group integration:** This criterion was used to evaluate whether policy instruments addressed actors that contribute to the problem or benefit from risk reduction (Metz & Glaus, 2019). We assessed whether actors belonged to the same or different sectors and whether they were aligned across the entire food value chain (from production to transportation to consumption). As Petersen et al. (2020) demonstrated, even a single target group can be heterogeneous and may react differently to the same policy instruments—not least because

they may belong to diverse sectors or different stages on the food value chain. Inductive inquiry yielded nine categories of target group: drinking water operators (public and private), employees, employers, farmers, general public, health professionals, industry, polluters in general, and public authorities. Not all of the nine appear in all three mixes; for example, health professionals appear in the occupational health mix but not in the other two. For each of the 38 instruments, the analysis extracted the target group(s) and counted the number of target groups associated with each regime.

Table 2. Evaluating policy mix performance: State-of-the art and cross-sectoral criteria

State-of-the art criteria	***Cross-sectoral criteria***
Density: Number of instruments addressing pesticide risk reduction in each of the three regimes (share of the 38 instruments)	**Source-directed versus end-of-pipe**: Share of source-directed or end-of-pipe instruments (or both) in each policy mix
Intensity: Share of persuasive, market-based and regulative instruments in each policy mix	**Target group integration**: Share of target groups across sectors and along food-value chain

Both state-of-the art and cross-sectoral criteria were used in this research (see SM for a summary of the coding scheme).

3.2.3 Cross-sectoral performance of the legislation (institutional)

The institutional analysis included highest-level legal texts such as laws, decrees or ordinances (see SM for complete list). These legal documents regulate the three regimes (drinking water, aquatic ecosystems and occupational health) and address conflicts between those regimes and pesticide use. After systematic screening of the websites of all relevant Ministries and examination of the Constitution and the Civil Code, we compiled a list of 21 relevant legal texts. Eight of these documents related to drinking water, eight to the aquatic ecosystem, and six to occupational health; some of the documents overlap—for example, the General Health Law relates to both the drinking water and occupational health regimes. Five other legal documents were considered relevant to all three regimes as general framework documents that shape those regimes indirectly (e.g. Law on Plant Protection, Constitution of Costa Rica).

To evaluate institutional cross-sectoral performance, we borrowed three criteria from the IRR, which are traditionally used to assess so-called 'institutional coherence'. These state-of-the-art criteria were refined to gain a cross-sectoral perspective (see Table 3) on the formulation of objectives (i.e. relating pesticide use directly to drinking water, aquatic ecosystem and occupational health), the definition of target groups, and the coordination across administrative agencies and public and private organisations.

Table 3. Evaluating institutional performance: State-of-the-art and cross-sectoral criteria

State-of-the-art criteria	*Cross-sectoral criteria*
Formulation of objectives: Definition of the collective problem and objectives of state intervention	**Cross-sectoral formulation of objectives:** Problem definition: pesticide use and regime; objectives formulated to relate the regime directly to pesticide use.
Target group integration: Logics of intervention based on specifying who/what is causing the problem	**Target group integration:** Assignment of target groups to the nine categories (drinking water operators (public and private), employees, employers, farmers, general public, health professionals, industry, polluters in general, public authorities); cross-sectoral performance assessed as high if target groups are distributed across sectors and along the food-value chain.
Institutional coordination: Agencies with responsibility for designing and implementing public policies	**Cross-sectoral institutional coordination:** Different agencies coordinate policy design and implementation actions across sectors and between public and private spheres.

Adapted from Gerber et al. (2009); only the cross-sectoral criteria (in grey) were used (see SM for a summary of the coding scheme).

4. Results

4.1 Density, intensity, and cross-sectoral performance of the three policy mixes

The three policy mixes constituted 40–50% of the instruments in the 'overall' mix addressing pesticide risk reduction. Among slight nuances, the *density* ratio (number of instruments in the regime relative to the 38 pesticide risk reduction instruments) ranges from 44% (drinking water mix) to 39% (health) and 36% (aquatic ecosystem) (see Figure 2c in SM).

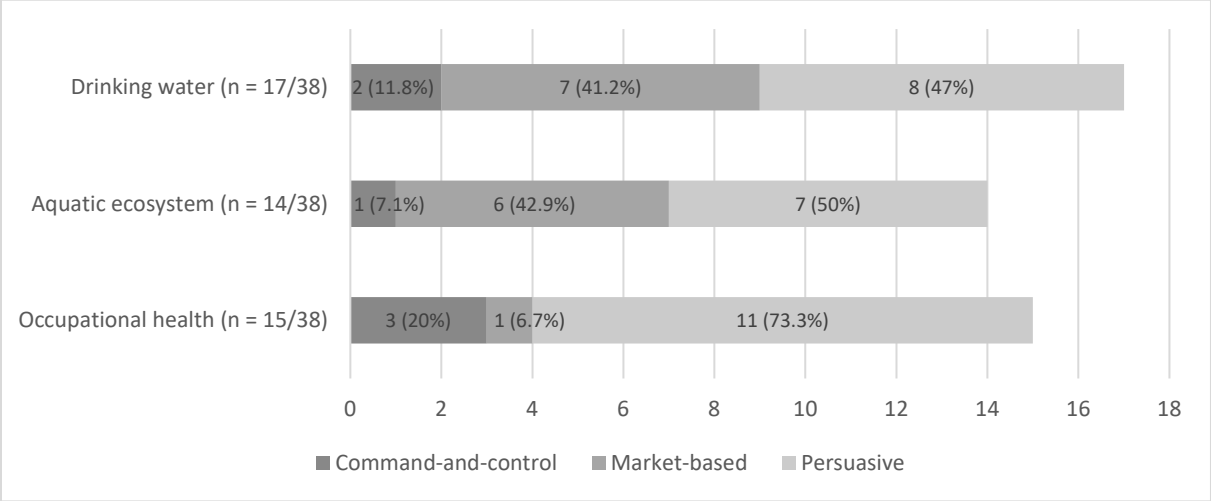

Figure 1a. Density and intensity (balance) of policy mix.

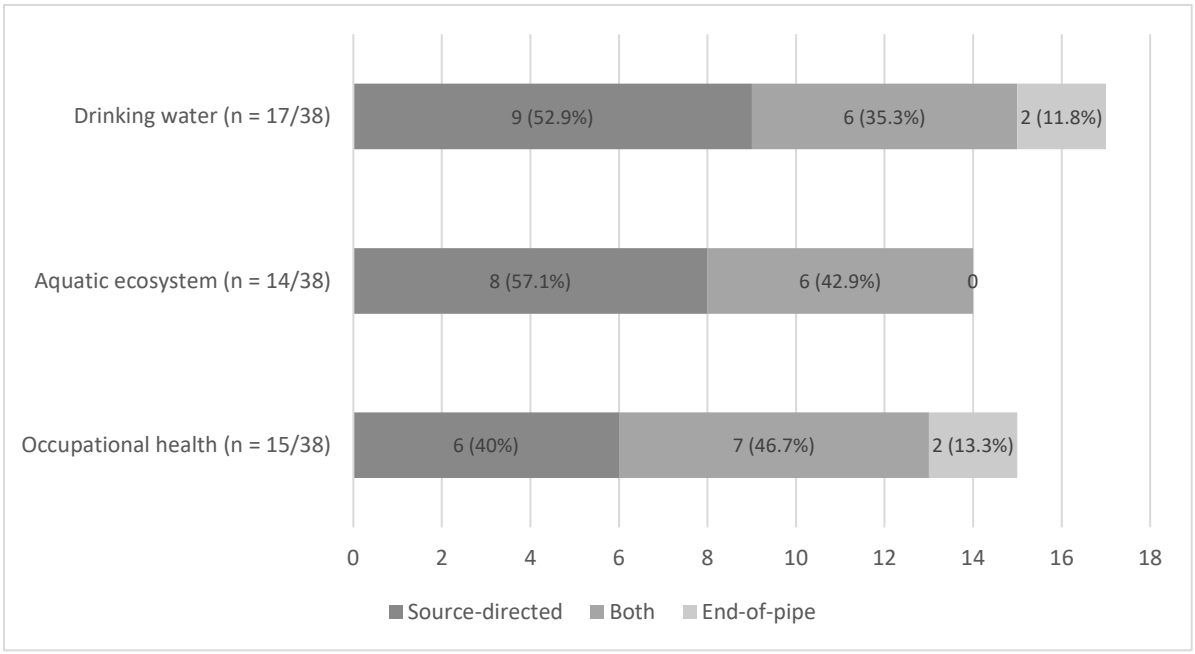

Figure 1b. Cross-sectoral performance of policy mix (source-directed versus end-of-pipe).

Regarding density, the two water mixes are quite *balanced* in terms of market-based and persuasive instruments. Few command-and-control instruments appear in any of the three mixes. The occupational health mix is unbalanced, focusing almost exclusively on persuasive instruments. All three mixes returned similar scores for *cross-sectoral performance* evaluated through source-directedness; across the three mixes, 85–100% of the instruments are source-directed or have a source-directed component (e.g. tackling the problem at source through substance bans or taxes, in contrast to water filters that are end-of-pipe).

While there were no major differences between the three policy mixes, some specific details are worthy of mention. The drinking water instrument mix is quite intense; the key reference documents are the Water Agenda (2013), the National Water Policy (2009) and the National Plan for Integrated Water Management (2008). In addition, more recent and more cross-sectoral documents explicitly target protection of drinking water against pesticide use. This policy mix treats diffuse pesticide contamination as a collective problem primarily requiring market-based and persuasive instruments (with only two command-and-control measures). These include subsidies for farmers adopting best agricultural practices and economic penalties for diffuse agricultural contamination. More than half of the political measures in the mix are source-directed, and the mix spans the entire food value chain, including relevant target groups such as industry, pesticide distributors, drinking water operators and, most importantly, farmers (see Table 5). In conclusion, the drinking water policy mix is both dense and intense, with a significant share of source-directed instruments, but it is less intense in terms of balance (for overall performance assessment, see Table 4).

The same is almost true for the instrument mix addressing the reduction of pesticide risks for the aquatic ecosystem. The mix is quite intense; key documents include the National Water Policy (2009) and the National Plan for Integrated Water Management (2008). More recent documents in the agricultural sector also target the reduction of pesticide risks for the aquatic ecosystem. All instruments have a source-directed component, and no instrument is exclusively end-of-pipe (e.g. environmental quality norms). General polluters and (most importantly) farmers and industry are addressed in the aquatic ecosystem mix (see Table 5). However, it is less balanced than the drinking water policy mix (Table 4), with only one command-and-control instrument (i.e. land use planning and division into catchments to avoid pollution). A majority of the instruments are persuasive (e.g. good agricultural practices, public-private partnerships) or market-based (e.g. subsidies for good agricultural practices). In conclusion, the aquatic ecosystem mix is less dense and less intense than the drinking water mix (Table 4), with no end-of-pipe instruments and fewer command-and-control instruments.

Measures to protect occupational health from pesticide risks are mentioned in seven documents, most importantly the National Policy for Occupational Health (2015), the National Action Plan for Occupational Health (2015) and the Action Plan for the Strengthening of Responsible Pineapple Production and Trade in Costa Rica (2013). The occupational health mix mainly targets public authorities, with only three command-and-control measures that include programmes to educate the population about the health risks of pesticide use and the introduction of inspectors to monitor working conditions. The great majority of persuasive instruments in this mix target bottom-up capacity building (beginning with farmers) to enhance awareness about the risks of pesticide use. As in the other two, the occupational health mix is intense in terms of source-directedness (Table 4) but specifically targets two important groups: the State in its role as health risk educator and farmers as targets of public media campaigns and awareness raising programmes (Table 5).

In conclusion, the three policy mixes are comparable in terms of their significant *density and cross-sectoral performance*, although the aquatic ecosystem mix is a little less developed (Table 4). In terms of *intensity*, all three mixes are characterised by their limited use of command-and-control measures, especially in the case of the occupational health mix, which relies almost exclusively on persuasive instruments.

4.2 Cross-sectoral performance of the legislation

We evaluated *cross-sectoral formulation of objectives* in the drinking water regime as *medium* (see Table 4). The Regulation on Drinking Water Quality establishes maximum permissible levels of pesticide residues for risk reduction. However, there is no legal definition of a measurable objective in this context (such as overall pesticide use reduction by a certain percentage). *Target group integration*

was also evaluated as *medium*. The drinking water regime targets specific users and risk reducers, but there is no mention of the agricultural sector even though it is a major source of water pollution in Costa Rica (Table 4). *Cross-sectoral institutional coordination* was again evaluated as *medium*. Policymaking competences related to pesticide risk reduction for drinking water are assigned to a range of clearly identified government agencies, including the Ministry of Health, the Ministry of Agriculture, the State Phytosanitary Service and others. This indicator only achieved a medium rating because of the lack of coordination across these agencies, no one of which is assigned bundled responsibilities or leads decision-making.

In the aquatic ecosystem regime, we evaluated *cross-sectoral formulation of objectives* as *medium* because (as in the drinking water regime) no overall objective is mentioned (e.g. reduction of pesticides by a specified percentage). Nevertheless, pesticide use is considered problematic in this regime, notably in the Regulation for the Evaluation and Classification of the Quality of Surface Waters, which limits the permissible amount of organochlorine and organophosphate compounds in surface waters. Additionally, the Biodiversity Law and associated regulations invoke the precautionary principle and define environmental damage to reduce risks to the aquatic ecosystem. As in the drinking water regime, *target group integration* was assessed as medium because farmers and the agricultural sector are not considered relevant target groups. *Cross-sectoral institutional coordination* was also evaluated as medium; although competences are assigned to various clearly identified government agencies (e.g. the Ministry of Environment and Energy), there is again a lack of clear coordination.

In the case of occupational health legislation, *cross-sectoral performance* almost achieved a *maximum* rating. Occupational health is considered a matter of general public interest, and the Labor Code establishes the need to protect workers' health, preventing damage to their physical and mental integrity and preventing work-related risks. In addition, the Health Law and other relevant decrees clearly identify pesticide use as potentially contributing to accidents and illnesses. However, as the occupational health regime again lacks any specific policy objective (e.g. reducing pesticide poisoning to a specified level), we evaluated *cross-sectoral formulation of objectives* as *medium*. In contrast, *target group identification* was evaluated as *high* because the current occupational health regime targets agricultural workers and producers, as well as industry and pesticide distributors. These target groups are typically users or at-source actors whose behaviour can influence risk prevention. As risk reducers such as employers, medical staff and public authorities are also mentioned, target group identification is quite comprehensive. *Cross-sectoral institutional coordination* was also assessed as *high* because while different ministries (Labor, Transport and Health) share responsibilities in their own sectors, an overarching agency ensures coordination of occupational health-related matters.

Table 4. Performance of the policy mix and legislation

	Indicator	Drinking water	Aquatic ecosystem	Occupational health
Policy mix (substantive)	Density	High (1)	High (3)	High (2)
	Intensity	Medium (1)	Medium (2)	Low (3)
	Source-directed versus end-of-pipe	High (2)	High (1)	High (3)
	Target group integration	High (1)	High (2)	High (3)
Legislation (institutional)	Cross-sectoral formulation of objectives	Medium (1)	Medium (2)	Medium (3)
	Target group integration	Medium (2)	Medium (2)	High (1)
	Cross-sectoral institutional coordination	Medium (2)	Medium (2)	High (1)

Numbers in brackets indicate ranking of the three regimes for each indicator (1 being the first, 3 the last rank)

Table 5. Target group overlap

Regime	Target groups outlined in the legislation	Target groups in the policy mix	Overlap
Drinking water	Drinking water operators General public Public authorities	Drinking water operators General public Public authorities Farmers Industry Polluters in general	50%
Aquatic ecosystem	Drinking water operators General public Public authorities	Drinking water operators General public Public authorities Farmers Industry Polluters in general	50%
Occupational health	Employees Employers General public Health professionals Public authorities	Employees Employers Farmers General public Health professionals Industry Public authorities	62.50%

5. Discussion and conclusion

In this article, we proposed an approach to evaluating the cross-sectoral performance of policy mixes and overarching legal texts involving a refinement of earlier work on policy density and intensity (Schaffrin et al., 2015) and institutional coherence (Gerber et al., 2009; see also Metz & Glaus, 2019). To that end, we added four criteria that take explicit account of the cross-sectoral dimension in evaluating policy performance: objectives formulated across sectors, target groups identification

across diverse sectors, cross-sectoral administrative coordination and different types of policy instruments.

The study analysed pesticide risk reduction in Costa Rica and evaluated how well policy mixes and the relevant legislation take account of pesticide risks in the water and occupational health sectors. From a substantive perspective, we conclude that the cross-sectoral performance of policy mixes related to pesticide risk reduction in these sectors is high. More specifically, in respect of density ratio, almost half of the instruments in the three policy mixes form part of Costa Rica's overall risk reduction instrument portfolio, and more than half of these measures are source-directed. At the institutional level of laws and regulations, cross-sectoral performance ranges from medium to high in all three regimes (Table 4), as they address the issue of pesticide risks, identify the most relevant target groups, and establish cross-sectoral coordination.

The occupational health regime over-performs in cross-sectoral terms (Table 4); in this regard, two details are of particular interest. First, while density and substantive and institutional cross-sectoral performance are rated high, intensity is low in this regime. Coercion is low, and the policy mix almost exclusively comprises persuasive instruments. We can therefore conclude that cross-sectoral performance is not inevitably associated with output performance or effectiveness. Second, although persuasive and 'soft' instruments are generally considered less effective than their more coercive counterparts, command-and-control or market-based instruments are less attractive in certain policy sectors and domains for several reasons. For example, an order prohibiting the flushing of drugs down the toilet for water safety reasons can never be monitored or controlled because of privacy issues. Alternatively, taxing health products because they contain substances that impact negatively on the environment is likely to disadvantage only poorer households, and such inequalities are not desirable. Typically, then, the health sector as a political domain employs persuasive instruments that are effective only if they deliver convincing information or evidence to the target group. These examples confirm the importance of cross-sectoral performance in developing a theory-based account of how well a policy mix might cope with complex or wicked problems. However, other criteria such as different aspects of intensity remain relevant when evaluating the effectiveness or long-term effects of a policy mix (Metz & Glaus, 2016, Baker et al., forthcoming).

In general, the present findings indicate that cross-sectoral performance as outlined in the legal texts correlates with the cross-sectoral policy mix. However, this is not true for all of the applied criteria; for example, it is notable that most of the instruments in all three mixes are source-directed. The mix thus goes further than the legal texts in this cross-sectoral aspect. The same is true of target group integration (Table 5); in this regard, the mixes go further than the legal texts, which take account of fewer target groups. This raises the question of whether the policy mixes as outlined in the action

plans, which are usually introduced much later than the legal texts, are compensating for a lack of cross-sectoral performance at the institutional level. This issue relates back to the literature on feedback effects and the interplay of policies, processes and institutions (Rogge & Reichardt, 2016; Runhaar, 2016; Schmid et al., 2020).

The present study is qualitative, and while comparing different regimes (water and health) it refers to a single case. To fully evaluate the added value of integrating the cross-sectoral dimension in the assessment of policy performance, further comparative and longitudinal research is needed. For example, qualitative comparative analysis may help to disentangle the diverse factors that determine policy performance. By clarifying the criteria for simultaneously evaluating substantive and institutional aspects (see Metz & Glaus, 2019) or issues of design and implementation (Rogge & Reichardt, 2016), it may be possible to develop a more complete picture of a policy's ability to address a given problem and the relevance of the cross-sectoral dimension. Finally, assigning a definitive time-stamp to articles of legal texts and the introduction of the policy instruments may help to clarify how policy feedback works or fails to work (Schmid et al. 2020).

At a practical level, what do these findings mean for Costa Rica's approach to pesticide risk reduction? The policy instrument mix seems fairly complete and tackles the problem at the source. The challenge now is to ensure the effective and efficient implementation of the different measures at all institutional levels and across different sectors. In this sense, cross-sectoral challenges persist throughout the design and implementation stages in terms of the substantive, institutional and procedural aspects of policymaking.

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