Governing Water with Market-Based Instruments: Preferences and Skepticism in Switzerland

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Abstract

With an increasing awareness of newly detected but unregulated pollutants in waterbodies, the question arises as to how these emerging issues concerning water quality should be politically addressed. Environmental economists have advocated market-based instruments because of their effectiveness, cost-efficiency, and flexibility. However, lessons from past experiences where market forces were used to solve public problems indicate that issues related to administrative complexities, legitimacy, or uncertainty can arise. Turning the academic debate into an empirical one, this chapter takes an actor perspective and assesses the potential for introducing market-based instruments through the example of Switzerland, a forerunner in developing water policy to control emerging pollutants. Findings show that Swiss policy actors have a preference for command-and-control or voluntary instruments ahead of market-based approaches for reducing emerging pollutants in water.

1. Emerging pollutants - new challenges in water protection policy

Increasing attention has been placed on "emerging pollutants," i.e. synthetic organic chemicals that have only recently been discovered and deemed a concern in waterbodies. Their detection is possible today thanks to improvements in analytical measurement technology (Schwarzenbach et al. 2006). Emerging water pollutants include residues of personal care products, household detergents, cleaning agents, pharmaceuticals used in aging western societies, the fuel additive MBTE, biocides, and metabolites of plant protection products (Hollender, Singer, and McArdell 2008). Some of these products contain substances that have been in use for decades, while others have been introduced to commerce more recently. Nevertheless, in both scenarios, the fact that the risks are often unknown generates increased concern. Contaminants of emerging concern (CECs) lack a regulatory standard to date but may potentially display harmful effects in aquatic life, including toxicity, bioaccumulation, and persistency (USEPA 2008). For example, estrogens which are used in contraceptive pills and constantly emitted to waterbodies due to incomplete elimination in wastewater treatment, have been shown to cause the feminization of fish (Sedlak, Gray, and Pinkston 2000). In general, there is growing evidence about the negative impacts of CECs on aquatic ecosystems (Brodin et al. 2013, Kidd et al. 2007, Mostafa and Helling 2002) and human health (Bercu et al. 2008, Cunningham, Binks, and Olson 2009, Johnson et al. 2008, Rowney, Johnson, and Williams 2009, Touraud et al. 2011). However, due to the large quantity and diversity of substances currently in use, ecotoxic evidence is still lacking for many substances present in water today. Due to the continuous development of new compounds and the potential interaction effects between substances and their metabolites, the assessment of associated risks presents a challenge today and will continue to be in the future. Thus policy makers are left with a decision as to whether to take action regarding emerging substances and if so, which policy instrument mix should be used.

Water quality issues have been addressed in the past by means of two main policy approaches: wastewater treatment and environmental quality norms. These traditional policy responses have come under considerable stress as conventional wastewater treatment has been unable to eliminate numerous emerging pollutants and therefore such pollutants have been steadily transported into the aquatic environment (Wittmer et al. 2010). New wastewater treatment technologies for emerging pollutants including ozonation, membrane filtering, or activated carbon, are in the early phases of development. Questions regarding toxicity levels of transformation products, costs, or energy efficiency have yet to be resolved (Altmann et al. 2012). An environmental quality norms approach regulates compound by compound. Here, toxicology tests and comprehensive fact sheets are needed for every single substance in order to justify its inclusion in a regulation. A compound-by-compound approach is a particularly resource-intensive and continuously ongoing task that must take into consideration the constant engineering of new substances.

While existing approaches to water protection must be rethought, developing an alternative political answer for the issue of emerging water pollutants is complex. Each compound is associated with a unique combination of factors determining its usage, entry-pathway into waterbodies, behavior in the environment, and effects on the ecosystem or on human health. Managing the possible impact of CECs becomes even more intricate. The transboundary effects of certain compounds and the local effects of others reflect the multi-level governance aspect of the issue. Further complexity comes with the involvement of various policy fields, such as environmental protection, chemical and agricultural policy, consumer, health, and workplace safety. Together, these fields need to bring about effective solutions. As CECs represent a complex policy problem, there is no “one-size-fits-all” solution. The search for solutions is not a purely technical endeavor. It is also clearly political. However, the complexities of CECs really challenge the political realm to design appropriate policies that effectively reduce emissions with reasonable costs and administrative efforts. Ongoing innovation ensures that it is highly likely that there will always be “new” emerging concerns on the agenda of water protection policy. To design policies, it is therefore crucial to understand how actors participating in political decision-making generally address new issues, i.e. what types of policy approaches do they consider appropriate when dealing with emerging problems. As a means of highlighting the potential for policy action in the field of emerging water quality issues, the present work explores policy actors’ preferences for different types of policy instruments, including combinations of market-based, command-and-control, and information-based approaches. The main research question is: *Which policy tools do political actors prefer when dealing with emerging issues in water quality policy?*

Environmental economists have propagated the use of market-based instruments (MBI) as particularly effective and cost-efficient in reducing pollution since the 1960s (Downing and White 1986, Stavins and Hahn 1991, Stavins 1989, Stavins 2004, Coase 1960). There has been considerable interest on behalf of the scientific and political community in market incentives due to the potential effectiveness, cost-efficiency, flexibility, and legitimacy of the polluters-pays-principle. Nevertheless, the adoption of MBI remains limited in scope (Sager 2009, Jordan, Wurzel, and Zito 2013) and several challenges with the design of effective MBI in water quality policy persist. For example, the non-uniform mixing of water pollution requires the establishment of differentiated charges or trading ratios, which are difficult to establish (Olmstead 2010). Another design challenge concerns the high transaction costs which stifle the cost-efficiency asset of the market-based approach. MBI are not only difficult to design but may also appear less appealing to policymakers aiming for pollution reduction. In response to the introduction of MBI, for example, targets (such as industry or agriculture) may prefer to pay rather than to abate pollution. Consequently, success of pollution control by MBI is often uncertain, and thus, less appealing to policymakers. Another reason that renders the introduction of MBI less attractive is the illegitimacy of "a right to pollute". As a consequence, the political acceptance of these policy tools has been lagging behind its promises (Cordes 2002). Nevertheless, market-based instruments may be an innovative method to handling new concerns in water quality policy. The use of substances that serve our societies (e.g. medicinal products) can have unintended negative consequences for ecological and human health. These necessitate a search for suitable political solutions. The present study explores the potential for introducing MBI in this cutting edge policy field and poses the question: *Do policy actors opt for market-based instruments when addressing the issue of contaminant of emerging concern in water, and if so, what type of actors support market-based approaches?*

Policy instruments are typically bundled into policy programs which consist of several instruments. As a means of capturing preference profiles, i.e. an instrument mix supported by actors, the present contribution also addresses the question: *Which preference profiles do policy actors adopt and do they exhibit similarities in their preference profiles?*

To answer these questions, the present work begins by providing an overview of the various types of policy strategies and instruments available to governments for the alleviation of pollution in waterbodies. The contribution differentiates between three approaches to water protection policy: source-directed, end-of-pipe, and control. Each of these approaches can be achieved through various types of command-and-control, market-based, and information-based instruments. The next section proposes a definition for policy preference and exposes the methodology (case selection, data gathering, methods of analysis). The results section is subdivided into three parts in order to answer each of the three research questions. First, empirical findings regarding instrument preferences in general, and actors' support for MBI in particular, are displayed. Secondly, preferences by actor types and, thirdly, clusters of actors with similar preference profiles are analyzed. The conclusion elaborates on the potential for policy action, more specifically for the introduction of MBI, in the emerging field of water quality policy.

2. Policy approaches and instruments for emerging water issues

In order to secure or improve water quality, governments utilize the many policy instruments at their disposal. These can be categorized under three general approaches: source-directed, end-of-pipe, and control (Metz and Ingold 2014). While source-directed strategies aim to mitigate pollution at the source, end-of-pipe approaches eliminate pollution from wastewater. Control strategies do not prioritize pollution reduction, but rather seek to control the level of pollution for further policy action. Each of these three strategies can be achieved by means of various types of policy instruments, which include regulatory (also termed command-and-control), economic (also termed MBI), and voluntary tools (Vedung 1998). Voluntary instruments seek to encourage desired behavior, for example by providing target groups with information or by negotiating agreements (Doris 2007, Weiss and Tschirhart 1994). By contrast, command-and-control instruments directly regulate or impose a certain behavior (Lemaire 1998). MBI are policy tools which indirectly stimulate a desired behavior of target groups through financial incentives (Stavins and Hahn 1991, Olmstead 2010, Rogers, de Silva, and Bhatia 2002). In environmental policy, MBI incentivize environmentally-friendly behavior on behalf of society or the economy by placing a price on pollution (Oates and Portney 2003). MBI can provide "positive" incentives, i.e. promoting desired behavior through reducing the costs of environmentally-friendly practices. Examples of "positive" incentives include subsidies for "green" technologies which intend to incentivize desired practices. MBI can also set "negative" incentives, i.e. discouraging undesired behavior by increasing the costs for activities that pollute the environment. Examples of "negative" incentives include pollution charges or tradable permits that set a price on pollution and therefore deter citizens from treating the environment as a sink for pollution.

2.1 Source-directed policy approaches

Source-directed policy approaches include policy instruments that impose, incentivize, or encourage reducing the use of CECs, or implementing emission reduction measures in order to prevent their release into water. Table 7.1 provides an overview of the different instruments (command-and-control, market-based and information-based) that can be adopted to pursue the source-directed approach in water protection policy and explains each instrument's functioning.

<TABLE 7.1 ABOUT HERE>

As Table 7.1 shows, a number of MBI can be adopted to effectively reduce emerging pollutants at the source (Metz and Ingold 2014). First, a substance charge can be levied to incentivize producers or consumers to reduce the use of substances that raise concern when emitted into waterbodies. The charge can also be levied on products that contain harmful substances. While charges punish environmentally-unfriendly behavior, subsidies set a positive incentive by rewarding "green" action. For example, farmers can be subsidized for adopting agricultural practices that prevent field losses, e.g. increasing buffer zones, or applying fewer plant protection products. Subsidies can also be granted to set an incentive to businesses for developing water-friendly products (e.g. "green pharmacy") or adapting production chains to enable a more efficient use of relevant chemicals.

Although not listed in Table 7.1, emission control may, in theory, also be possible under a permit trading system for emerging pollutants. However, many diverse compounds fall under the category of emerging pollutants. Additionally, trading ratios between different substances which are necessary due to water pollution's lack of uniform mixing, have not been defined to date (Farrow et al. 2005, Hung and Shaw 2005). For example, under the US American Rock River Basin Pilot Trading Program in Wisconsin, each unit of point-source pollution corresponds to 1.75 units of non-point source pollution (Olmstead 2010). One unit of point source pollution abatement corresponds to more than one unit of non-point source pollution because there remain considerable uncertainties over the fate of pollution from diffuse sources (Olmstead 2010). In general, trading ratios may vary between each pair of trading partners. Consequently, the establishment of trading ratios increases the transaction costs of water quality trading programs rendering them difficult to design in a cost-efficient manner.

2.2 End-of-pipe policy approaches

In contrast to source-directed policy approaches, end-of-pipe measures focus on removing or eliminating CECs after their use or release into water. End-of-pipe policies involve different types of instruments that impose, incentivize, or encourage improved wastewater treatment. Conventional municipal wastewater treatment plants (WWTPs) have not been designed to remove most of the substances that fall under CECs which are resistant to biological degradation. Hence, new wastewater treatment technologies must be implemented that can effectively eliminate CECs. One policy option for the reduction of CECs in water is to provide incentives for the upgrade of WWTP with new removal technologies. Another end-of-pipe option involves improvement of waste disposal where products containing CECs have been used by consumers, but their release into water is prevented by waste disposal requirements.

<TABLE 7.2 ABOUT HERE>

Table 7.2 displays the types of MBI that can be adopted for the reduction of emerging pollutants at the end of the pipe. Corrective charges may take the form of emission charges, for example, where volumes of treated wastewater are used as a tax base. Under a more complex system, the charge could be calculated based on concentrations of harmful substances in treated wastewater. Furthermore, subsidies can be allocated to industrial and municipal sewage treatment plants in order to incentivize investments in advanced treatment technology (Metz and Ingold 2014).

2.3 Control policy approaches

Control measures are distinct from source-directed and end-of-pipe approaches in water protection in the sense that they do not directly reduce emissions of substances into waterbodies. Instead, control measures consist of gathering information on occurrence, fate, and risks of CECs in waterbodies in order to lay the ground for future pollution reduction measures. Aside from information gathering and data analysis, this approach typically involves reporting results to higher levels of government. Such accounts, in turn, synthesize information for further decision-making. Control instruments can take the form of mandatory or voluntary programs, both of which can be financially supported by governments.

<TABLE 7.3 ABOUT HERE>

2.4 Policy instrument mixes – a task that transcends policy fields

In the empirical reality, policy instruments are often combined to become instrument mixes. These are defined as bundles of several policy instrument types (Howlett 2005, Gunningham and Sinclair 1991). Likewise, policy instruments following source-directed, end-of-pipe and control approaches are not mutually exclusive but are often bundled in the form of policy mixes. For example, sales volumes for a specific substance could be capped on a yearly basis for a defined market such as the EU or US to prevent emissions into water. Above the cap, a ban could be introduced for marketing the substance and below the cap a substance charge could be put in place. The substance charge could be earmarked to subsidize advanced treatment technology, where it is necessary to use the substance (e.g. for health purposes). Companies that use the substance, but improve their production processes (where inputs into waterbodies are avoided) could be exempted from the charge if they can prove that their effluents are free of that substance through monitoring and reporting. Subsidies for advice and consulting about advanced treatment or improved production processes could also be part of the instrument mix. Consulting would support pollution reduction measures, which is preferable to a situation where companies pay the charge and continue to emit pollutants.

The example further illustrates that instrument mixes for the protection of water resources typically involve diverse, intersecting policy fields, such as agriculture, industry, health, water, and environmental protection. Another example includes information campaigns. These could be adopted in the health sector to sensitize people for green pharmacy or in the agricultural sector to raise farmers' awareness of the impact of veterinary pharmaceuticals on water quality.

3. Methodology

3.1 Case and data gathering

Water quality represents an example of a public good especially in the case of several countries sharing a river. In an international river setting, upstream polluters have no incentive to decrease pollution as long as they bear the complete costs of abatement, but benefits of clean waterbodies materialize predominantly downstream (Olmstead 2010). MBI have the potential to correct such false incentives by internalizing the costs of pollution control and adhering to the polluter pays principle. At the same time however, transboundary settings can be particularly unfavorable to the introduction of MBI in cases where states fear competitive disadvantages to their national economies. In exploring the prospects for introducing MBI into water pollution control, the present study takes the case of control in Switzerland, a country which lies upstream from many European rivers.

Switzerland represents one of the first countries where the issue of emerging pollutants has entered the political agenda. Between 2007 and 2015, the political debate centered on how to best address emissions from point-sources of pollution, i.e. from municipal WWTPs. Since 2015, Swiss actors have searched for political answers regarding ways in which to reduce emissions from diffuse sources, including agriculture and urban areas.[1] From April to July of 2013, a total of 62 policy actors who were involved in the policymaking process on emerging pollutants in Switzerland were surveyed. Policy actors are collective actors which include agencies, organizations or associations that represent public and private sector interests. Actors were surveyed when they a) participated at least twice in the policy-making process (decisional approach), b) held formal regulatory competences in the field of emerging water pollutants (positional approach), and c) were considered indispensable by experts in the field (reputational approach) (Laumann, Marsden, and Prensky 1983, Knoke 1994). With a

[1] See Website of the Swiss Federal Office for the Environment: https://www.bafu.admin.ch/bafu/en/home/topics/water/info-specialists/state-of-waterbodies/state-of-watercourses/water-quality-in-watercourses/micropollutants-in-watercourses.html (accessed June 27, 2017).

response rate of 68%, survey results from 42 actors[2] (for a list of actors see annex 1) were analyzed. This provides a representative overview of the preferences of all involved sectors (federal agencies, cantons, parliament, political parties; environmental, economic, water, labor, consumer and municipal associations).

3.2 Definition of policy instrument preferences and data

The aim of the present research is to explore actors' preferences towards a variety of policy instrument types from a policy science perspective. The following three aspects help to delimit the concept of preferences as employed here.

First, in order to grasp the concept of instrument preferences, it is useful to distinguish between attitudes and actual behavior (Ajzen and Fishbein 1980). Research on political behavior has indicated that individuals' behavior may deviate from their reported attitudes and hence, introduced the notion of "value-action gap". The term "preference" refers to attitudes and not to behavior. Instrument preferences express actors' positive *attitudes*, i.e. inclination or desire to introduce certain types of policy tools in order to address an underlying policy problem. However, actors' behavior of actively opting or voting for one policy option in the policy-making process may deviate from underlying attitudes and is not considered in this study.

Secondly, one can conceptualize "preferences" as attitudes adopted in a specific stage of the policymaking process, i.e. in policy formulation rather than in the phase of adoption or implementation (Dermont et al. 2016). During policy formulation, where actors review and debate diverse policy alternatives, their policy preferences come into play in the form of attitudes (i.e. positive or negative inclinations). By contrast, the terms "support" or "opposition", as employed here, refer to the voting in parliament for (or against) an actual policy decision in the phase of policy adoption; and the term "acceptance" to the change of behavior during the policy implementation stage. The term "preference" is thus restricted to

[2] Depending on the survey question, between 35 and 42 actors gave their responses.

attitudes of actors towards policy instruments in the policy formulation phase. Based on this definition, policy preferences can be considered a type of "opinion poll" against which the chances of introducing a policy in later stages of the policy process can be evaluated. Likewise, the present study looks at policy formulation where diverse types of state and non-state actors debate over policy options in order to assess the prospects for MBI in water quality policy. *Policy actors* are defined here as collective entities who adopt policy preferences and the desire to transform their preferences into public policy through their participation in the policy-making process (Knill and Tosun 2012, p. 41). Examples of policy actors include parliamentary commissions, governmental or bureaucratic bodies from local, regional, and national levels, political parties, and target or interest groups.

Finally, it is useful to distinguish different hierarchical levels of policy attitudes in order to define the notion of instrument preferences. The Advocacy Coalition Framework establishes a multi-tiered hierarchical concept of attitudes by broadly distinguishing stable deep core and policy core beliefs from less stable secondary aspects (Sabatier and Jenkins-Smith 1993). While secondary aspects refer to preferences for various types of policy instruments, beliefs in general reflect the deeply rooted values underlying instrument preferences. For example, actors may value market liberties and competition very highly. Based on these market liberal values, they may favor MBI over coercive command-and-control instruments. The present research focuses on the lowest, most concrete hierarchical level of policy attitudes by studying which instruments actors prefer in order to address a policy problem such as reducing pollution in waterbodies.

In the above-mentioned survey, respondents were asked to report their policy preferences (from "strongly agree" to "strongly disagree") towards a series of policy instruments for the reduction of emerging pollutants in waterbodies. Table 7.4 provides an overview of the 15 different regulatory, economic, and voluntary policy tools that were surveyed. The preference data was analyzed by means of descriptive statistics, including a correspondence and a cluster analysis.

<TABLE 7.4 ABOUT HERE>

4. Results

4.1 Preferences by type of policy instrument

In the next paragraph, policy actors' instrument preferences towards MBI are assessed in comparison with other policy tools, including various command-and-control and information-based instruments.

<TABLE 7.5 ABOUT HERE>

Results in Table 7.5 show that among the 42 actors who responded to the survey questions, 53.5% support MBI for reducing emerging contaminants. More concretely, 24.3% of the actors reported to agree somewhat with the introduction of MBI and 29.2% strongly agreed. By contrast, 46.5% of the respondents reported that they either disagree somewhat (29.6%) or strongly disagree (16.9%) with reducing emerging pollutants by means of MBI. Although they demonstrate some support for MBI, policy actors remain divided on the aptitude of MBI to reduce water quality issues. Figure 7.1 depicts instrument preferences in greater detail, with 75% of actors supporting an increase in wastewater fees to fund measures for reducing emerging pollutants in sewage treatment plants. Filtering pollution from wastewater constitutes a policy preference even if costs for sewage treatment increase. These results indicate that technical solutions to address water quality problems at the end of the pipe are largely accepted, even if (or because) this means that polluters do not have to change behaviors to abate pollution at the source. In contrast, only 25% of actors reject a fee that funds the technical upgrade of wastewater treatment filters.

By contrast, source-directed MBI such as product charges receive less support. A product charge is a policy tool that addresses the problem at the source. Commodities that contain harmful substances become more expensive, and hence, the product charge incentivizes consumers to buy (or industry to produce) more environmentally-friendly alternatives. 57.1% of the respondents rejected (25.7% disagreed altogether; 31.4% disagreed somewhat) product charges for the reduction of pollution in waters. Motives included high transaction costs associated with the identification and registration of the numerous products that contribute to pollution into waterbodies. Furthermore, the demand for some products, e.g. pharmaceuticals, is non-elastic, and therefore a charge would not incentivize consumers to reduce consumption. In addition, Figure 7.1 shows that 57.5% of the policy actors reject "positive" economic incentives in the form of subsidies for environmentally-friendly behavior, while only 42.5% of actors support it.

<FIGURE 7.1 ABOUT HERE>

In summary, results indicate that Swiss actors reject MBI in the form of product charges or subsidies to reduce CECs at the source whereas they support the increase of wastewater fees to address CECs at the end-of-pipe. Disputes remain concerning MBI, especially when comparing the results for MBI with those for command-and-control or information-based instruments. On average, 84.5% of actors support the introduction of traditional command-and-control instruments in matters of emerging concern for water quality. Examples of regulatory instruments include bans of certain contaminants or environmental quality norms that set concentration limits for selected substances in waterbodies. In Figure 7.1, one can see that, with 95% agreement, actors' support is highest with regard to best-environmental-practices (BEP). BEPs are typically employed to control pollution from agriculture. Among others, BEPs define the correct application of pesticides in order to reduce run-off from agricultural fields. Policy actors also supported information-based instruments, e.g. voluntary measures on behalf of polluters, or information campaigns sensitizing people to adopt an environmentally-friendly behavior. It is noteworthy however, that almost all respondents (97.5%) considered further research essential for better understanding the risks of emerging pollutants, their sources, and their entry paths into the environment.

When comparing the results for actors' consent towards MBI (53.5%) with actors' support for regulatory (84.5%) and information-based instruments (86.1%) it becomes evident that more skepticism exists towards MBI than towards other policy alternatives. Actors' instrument preferences show that command-and-control and information-based instruments are still deemed appropriate for water pollution control, whereas the support for MBI lags behind. As a consequence, the introduction of MBI is less likely to transpire than is the adoption of traditional or soft policy tools for the reduction of emerging pollutants in waterbodies.

In a next step, actors' instrument preferences are examined in greater detail by analyzing individual actors' preferences for instrument mixes. To do so, the correspondence analysis[3] shown in Figure 7.2 illustrates where actors (represented by dark blue dots) diverge most. More specifically, Figure 7.2 indicates on which policy instruments (represented by red arrows), or mixes thereof, actors diverge most. It also shows the primary preferences of each single actor.

The red arrows for product charges (pcharge) and voluntary instruments (volunt) point in opposite directions. This illustrates how those policy instruments explain most of the

[3] The correspondence analysis in form of a biplot shows two dimensions, which explain most of the variance of actors' instrument preferences. In technical terms, the goal of the correspondence analysis is to look for systematic, internal variance in the data, without considering exogenous variables for the explanation of preferences. The two dimensions of the correspondence analysis together only explain about 43% of the internal variance, which means that actors' instrument preferences exhibit only a medium-level of systematic variance.

variation in the data. If actors diverge, they tend to favor one over the other and rarely favor both simultaneously. Subsidies for the upgrade of wastewater treatment technology (subsi) and authorization restrictions (authrestr) are orthogonally distributed to preferences for charges and voluntary instruments. Again, if actors diverge, they tend to either be in favor of technological upgrades or authorization restrictions, but rarely of both simultaneously. The four different dimensions effectively reflect varying approaches to water protection with a) market-based approaches (represented by pcharge), b) voluntary measures (volunt), c) command-and-control (authrest), and d) technical solutions (subsi). Instruments belonging to the same family point in the same direction, which means that they capture a similar dimension of actors' instrument preferences. For example, the instruments belonging to the family of voluntary instruments, such as research, private public partnerships (ppp), or information campaigns (info), all point in the same direction. Likewise, there is a cluster of MBI represented by product charges and wastewater fees. Of note is that Swiss actors strongly associate subsidies with technical end-of-pipe measures because other technology-promoting instruments such as subsidies for investments in advanced sewage treatment technology and best available techniques (bat), point in the same direction. Most of the variance in the cluster of command-and-control instruments is explained by authorization restrictions (authrest). Nevertheless, preferences for instruments from the same family of command-and-control instruments such as environmental quality norms (eqn), use restrictions (userestr), disposal requirements (disposal), or emission limits (el), point in the same direction and therefore capture a similar aspect of actors' preferences. All in all, results for other instruments also reflect the four clusters and further confirm that actors are most divided upon market-based, voluntary, command-and-control, and technical approaches to water protection.

Actors' location in Figure 7.2 further illustrates their preferences in the form of instrument mixes. For example, the Christian Democratic People's Party (CVP) is positioned towards information-based instruments including research, information campaigns, and voluntary measures. Pro Natura, an environmental protection organization, exhibits a contrasting preference profile by pointing towards economic measures including product charges and wastewater fees. It is noteworthy that associations representing the interests of cantons (e.g. KVU), large cities (ERFA), and municipalities (KI/SSV/SGV), who are responsible for the implementation of sewage treatment, support technical approaches for the improvement of wastewater technologies (bat, subsi). Finally, it is worth highlighting that actors located closest to the center in Figure 7.2 have the most equilibrated preference profiles. The Department for Water within the Federal Office for the Environment (BAFU-W/UVEK) who led this policy process, can be located at the center of the biplot. This reflects the actor's position as a neutral coordinator of the policy process.

<FIGURE 7.2 ABOUT HERE>

4.3 Preferences by type of actor

Figure 7.3 shows rejection and support levels of policy instruments by actor type in order to address the question of whether certain actor types prefer MBI over others. Black to dark grey squares illustrate rejection and light grey to white illustrate support. Industrial and agricultural actors strongly refuse economic instruments including product charges, wastewater fees and subsidies. Actors representing the interests of the economy do not necessarily favor MBI, even if these instruments are said to be economically efficient for society according to economic theory (Stavins 1989, Andersen and Sprenger 2000). These results indicate that a policy instrument's ability to target individual actors and affect their budget is what matters to them; in other words, whether an actor is on the winning or losing side of the policy. In contrast, the cost-efficiency of a policy matters less to the individual actor because cost-efficiency concerns society in general and not necessarily the individual actor. Here, actors seem to associate MBI (sproduct charges or subsidies) with (transaction) costs for themselves rather than with cost-efficiency.

Industrial and agricultural actors also reject strong governmental control in the form of authorization restrictions (authrestr) or monitoring requirements (contr). Additionally, federal state actors and political parties approach economic instruments consisting of product charges and subsidies with hesitation. In most cases, all the others, i.e. scientific, environmental, water, regional, and local actors, acknowledge the need to take policy measures for the reduction of emerging pollutants in waterbodies and agree with most types of policy intervention that serves the purpose of water protection. Overall, results highlight that there is potential for concerted policy action in the underlying case. Half of the actor groups are open to varying instrument types as long as water protection is ensured. However, important actor groups especially industrial and agricultural associations and to some extent state actors and political parties, particularly object to policy intervention in the form of MBI.

<FIGURE 7.3 ABOUT HERE>

4.4 Clusters of actors with similar preference profiles

The cluster dendogram in Figure 7.4 illustrates (dis)similarities in actors' instrument preference profiles. Actors clustered closer together exhibit similar preference profiles. The higher one moves up on the dendogram, the more relaxed similarity conditions become. On a general level, actors cluster into four groups. When pairing the information about clusters with the coloring of actor labels in Figure 7.2 (see above), one obtains a detailed picture of the instrument preferences for each cluster. Accordingly, the first "orange" cluster (when reading Figure 7.4 from left to right) consists of the Basel Chamber of Commerce (HKBB), Economiesuisse, the Swiss Employers' Association (ECON/SAV), and the Swiss Trade

Association (SGV). Also located in this cluster of economic associations is the Swiss People's Party. Together they oppose most policy action in the field of emerging issues in water protection and only agree with voluntary measures on behalf of society or the economy. The second, “green” cluster includes all actors between Ecotox Centre (OEKOTOX) and World Wide Fund For Nature Switzerland (WWF). The cluster signifies environmentally-oriented actors who favor concrete, binding policy action and therefore support all types of policy instruments except for voluntary ones. In the third “yellow” cluster are state and non-state actors who do not generally object to policy action, but mostly favor soft policy instruments, which either inform about pollution (e.g. through research or information campaigns) or control pollution in waterbodies (e.g. through environmental quality norms) but do not yet reduce pollution. The fourth, “blue” cluster includes all the actors between the Conference of Heads of Cantonal Offices for Environmental Protection (KVU) and the Swiss Water Association (VSA). This group represents a mix of actors who generally favor policy action for the reduction of emerging pollutants in waterbodies and therefore opt for a diversified instrument mix.

In summary, the orange cluster consists of opponents to policy action or advocates of non-binding measures. In contrast, the green cluster defends the necessity of political action by means of binding instruments. Illustrated in the yellow cluster are moderate actors who favor policies that lay the ground for future action where such action is necessary. Following the rationale where some action is still better than no action, the blue cluster is populated by actors who generally support policy action via any instrument.

<FIGURE 7.4 ABOUT HERE>

5. Conclusion

The aim of this chapter is to assess the types of policy instruments which actors consider appropriate in addressing emerging water problems and to shed light on the potential for introducing MBI by analyzing Swiss policy actors' instrument preferences. Preferences are defined by actor type and profiles for mixes of policy instruments are explored.

Empirical results indicate that there remain barriers for the application of MBI in influencing emerging issues in water quality policy. Overall, the surveyed actors remain divided on the use of MBI for water pollution control. Policy actors prefer wastewater fees for a technical end-of-pipe solution over source-directed measures, such as product charges or subsidies for environmentally-friendly practices. Industrial and agricultural actors are particularly averse to MBI, indicating that they associate those instruments with rising costs (for themselves) rather than with cost-efficient environmental protection (for all). In more general terms, the perception of the target group as to whether they will benefit or loose from an introduced policy clearly impacts their instrument preferences. The fact that a vast majority of survey respondents support command-and-control and information-based instruments to control pollution in waterbodies affirms their skepticism towards economic incentives.

If policy preferences are considered as an "opinion poll" on the basis of which the chance of introducing a policy in later stages of the policy process can be evaluated, one may conclude that MBI still struggle to become a widely supported trend in water policy. This conclusion is confirmed by the 2014 revision of the Swiss Waters Protection Act (31.3.2014) for the reduction of CECs from point-sources of pollution in waterbodies. Rather than introducing a market-based and source-directed approach, the Swiss policy follows a technical end-of-pipe strategy and focuses on the technical upgrade of WWTPs for the elimination of CECs from treated wastewater.

To date, it is individuals (companies, farmers, households) that profit from using the environment as a sink, whilst it is society as a whole that bears the costs for pollution abatement. Despite its potential to change such imbalances by making polluters pay for their discharges, MBI have thus far not successfully developed into a generally-accepted water trend for the reduction of CECs in Switzerland. Present results suggest that emerging issues follow the same logic as previously made observations did in revealing the limitations of political support for MBI. This is in comparison to the use of traditional command-and-control instruments within the realm of environmental policy (Cordes 2002, Harring 2015). As such, barriers must be broken before MBI can be successfully adopted in environmental policy (Cordes 2002). The literature has discussed many reasons why MBI face acceptance difficulties, including policy design questions i.e. the detailed provisions specifying to whom, for how long and on which level a policy applies (Howlett 2011, Howlett and Rayner 2007). Crucial questions in literature remain unanswered concerning the design of well-accepted MBI.

As a consequence, policy makers are responsible for adapting economic theory to the political reality and for designing concrete policy instruments. However, this translation process may prove difficult as policymaking follows its own rationality (Bressers and Huitema 2000). For instance, while environmental economists evaluate policy tools against their effectiveness and cost-efficiency, policy makers consider additional criteria such as preferences, equity, legitimacy, visibility, or feasibility. Thus, when market-based instruments are employed as policy tools, they transgress the institution-free world of the market and enter the broader institutional context of politics. As a consequence, the design of economic instruments may deviate from the ideal model as described by environmental economics, and also prove less effective or cost-efficient (Hahn 1989).

Hence, not only market rules but also political dimensions should be taken into consideration when designing MBI. Further research is needed in order to understand the policy design conditions under which policy actors would be most confident when it comes to market-based approaches. Furthermore, research on the factors driving instrument preferences from a comparative perspective would aid researchers in this field to better evaluate the circumstances under which MBI could eventually become a well-accepted trend in water policy.

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Table 7.1: Source-directed policy instruments of water protection		
Category	*Instrument*	*Explanation*
Regulatory	**Substance bans**	Complete prohibition of a certain compound with the goal of a cessation of pollution
	Restrictions/use restrictions	Constraints to the placement on the market or the use of a substance in specific points in time or zones (e.g. buffer zones)
	Authorization	Evaluation-dependent authorization of chemicals based on their predicted risks to human health and the environment[4]
	Best environmental practices (BEP)	Mandatory codes of conduct to reduce emissions
MBI	**Product charges**	Tax levied on products containing hazardous compounds in order to incentivize consumers to reduce or change consumption behaviors
	Substance charges	Tax levied on hazardous compounds in order to incentivize producers to change production processes or substitute chemicals with less hazardous alternatives.
	Subsidies for "green" action	Financial support from governments in return for environmental commitments by the private sector
Voluntary	**Information campaigns**	Transfer of knowledge or persuasive reasoning on how to avoid aquatic pollution
	Voluntary agreements between private and public sectors	Non-legally binding agreements negotiated on a case-by-case basis between single firms and a public authority fixing environmental targets or specific mitigation measures (e.g. changes in the production chain)[5]

[4] Such evaluations can also take into account principles of green chemistry such as "rational design" or "benign by design", i.e. easy and fast degradability of chemicals after their use. Considering the full life cycle of chemicals will lead to a different understanding of the functionality and environmental properties of chemicals and incentivize the manufacturing of degradable chemicals.

[5] These private-public agreements can also be legally binding. In such cases, agreements do not classify as voluntary instruments.

Table 7.2: End-of-pipe policy instruments of water protection		
Category	*Instrument*	*Explanation*
Regulatory	**Best available technique (BAT)**	Definition of the best technology for improved wastewater treatment
	Technical standards	Definition of performance standards for wastewater treatment (e.g. treatment capacity) without requiring a specific technology
	Disposal requirements	Standards of correct waste disposal, e.g. consumer-level „take-back“ programs for pharmaceuticals
MBI	**Effluent/emission charges**	Tax on using water bodies as a sink for discharges in order to incentivize emission reduction
	Subsidies for improved wastewater treatment	Financial support from governments to incentivize operators to invest in advanced wastewater treatment; or to promote research on improved wastewater treatment
Voluntary	**Advice**	Support from governments in form of information, advice, and consultancy about improved wastewater treatment
	Voluntary agreements on wastewater treatment	Non-legally binding agreements negotiated on a case-by-case basis between wastewater treatment operators and a public authority to improve wastewater treatment practices

Table 7.3: Control instruments of water protection		
Category	*Instrument*	*Explanation*
Regulatory	**Imission limits / environmental quality norms (EQN)**	Definition of a mandatory cap to concentration levels of defined substances in water bodies
	Emission limit	Definition of a mandatory cap to concentration levels of defined substances in effluents of defined sources
	Registries	Cadaster registering defined information, such as the sales or the marketing volumes of a substance, or the releases of chemicals from point sources (e.g. Pollutant Release and Transfer Registers)
	Monitoring	Mandatory gathering of information about the occurrence of substances in water bodies
	Reporting	Mandatory compilation and analysis of defined information on the state of the aquatic environment
MBI	**Subsidies for monitoring**	Financial support from governments for monitoring activities
Voluntary	**Voluntary agreements on control measures**	Non-legally binding agreements negotiated on a case-by-case basis between polluters and public authorities on voluntary EQNs or monitoring activities

Table 7.4: Overview about surveyed instrument preferences

	Variable	Description of instrument
Regulatory	authrestr	Authorization
	userestr	Restrictions/use restrictions
	disposal	Disposal requirements
	bat	Best available technique (BAT)
	bep	Best environmental practice (BEP)
	eqn	Immission limit/environmental quality norm (EQN)
	el	Emission limit
	control	Reporting, monitoring, registries
MBI	pcharge	Product charge
	wwfee	Effluent/emission charge
	subsi	Subsidies for improved wastewater treatment
Voluntary	volunt	Voluntary agreements
	info	Information campaigns, advice
	research	Research
	ppp	Voluntary agreements between private and public sectors called private-public partnerships or public-public partnerships (PPP)

Note: See boxes in chapter 2 for an explanation of each single instrument

Table 7.5: Mean preferences for grouped instruments

Instruments	Strongly disagree	Disagree somewhat	Agree somewhat	Strongly agree
Mean regulatory instruments	4.4%	13.2%	39.3%	45.2%
Mean MBI	16.9%	29.6%	24.3%	29.2%
Mean voluntary instruments	3.4%	11.4%	43.8%	42.3%

N=42

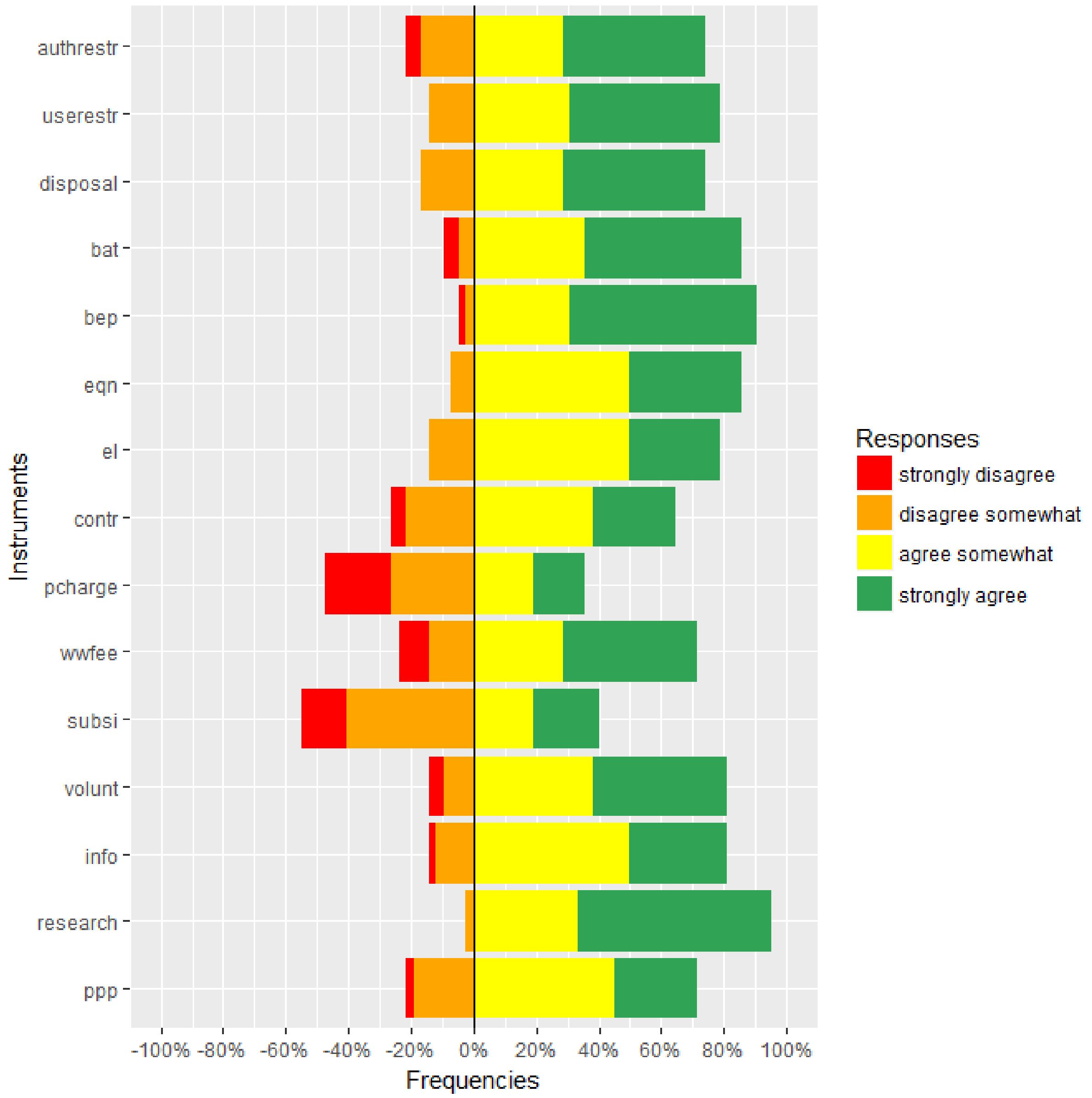
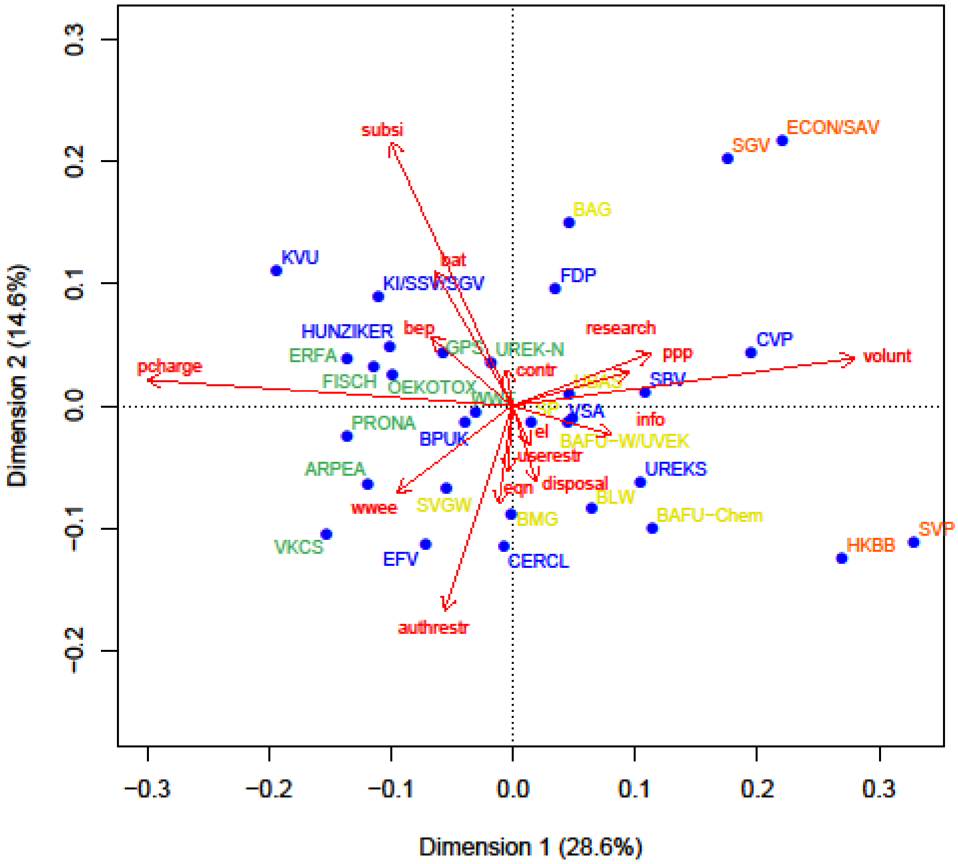

authrestr
userestr
disposal
bat
bep
eqn
el
contr
pcharge
wwfee
subsi
volunt
info
research
ppp
Instruments
-100%
-80%
-60%
-40%
-20%
0%
20%
40%
60%
80%
100%
Frequencies
Responses
strongly disagree
disagree somewhat
agree somewhat
strongly agree

Figure 7.1



subsi
ECON/SAV
SGV
BAG
KVU
bat
FDP
KI/SSV/SGV
HUNZIKER
bep
research
ERFA
GPS
UREK-N
ppp
CVP
volunt
pcharge
contr
SBV
FISCH
OEKOTOX
VSA
PRONA
info
BPUK
BAFU−W/UVEK
ARPEA
userestr
UREKS
disposal
wwee
SVGW
eqn
BLW
BMG
BAFU−Chem
SVP
VKCS
HKBB
EFV
CERCL
authrestr
Dimension 2 (14.6%)
Dimension 1 (28.6%)
0.3
0.2
0.1
0.0
−0.1
−0.2
−0.3

Figure 7.2

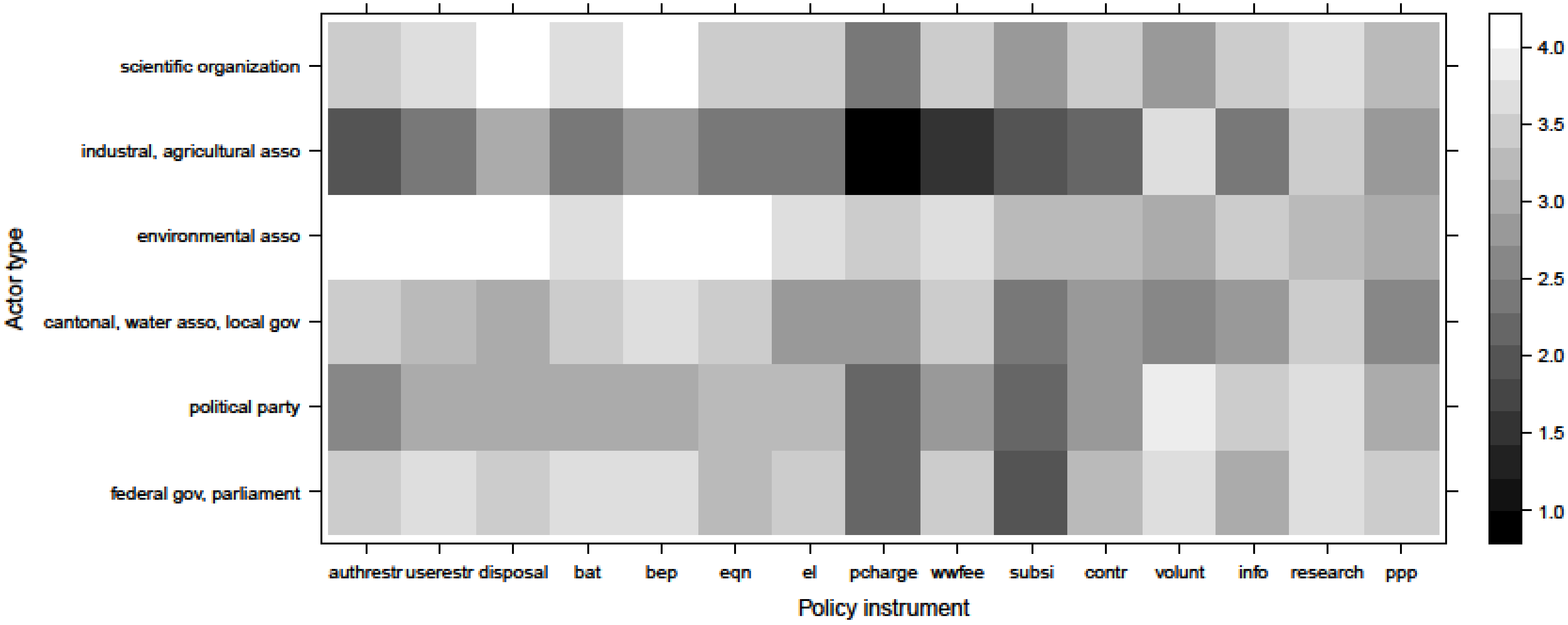

scientific organization
industral, agricultural asso
environmental asso
cantonal, water asso, local gov
political party
federal gov, parliament
Actor type
authrestr
userestr
disposal
bat
bep
eqn
el
pcharge
wwfee
subsi
contr
volunt
info
research
ppp
Policy instrument
4.0
3.5
3.0
2.5
2.0
1.5
1.0

Figure 7.3

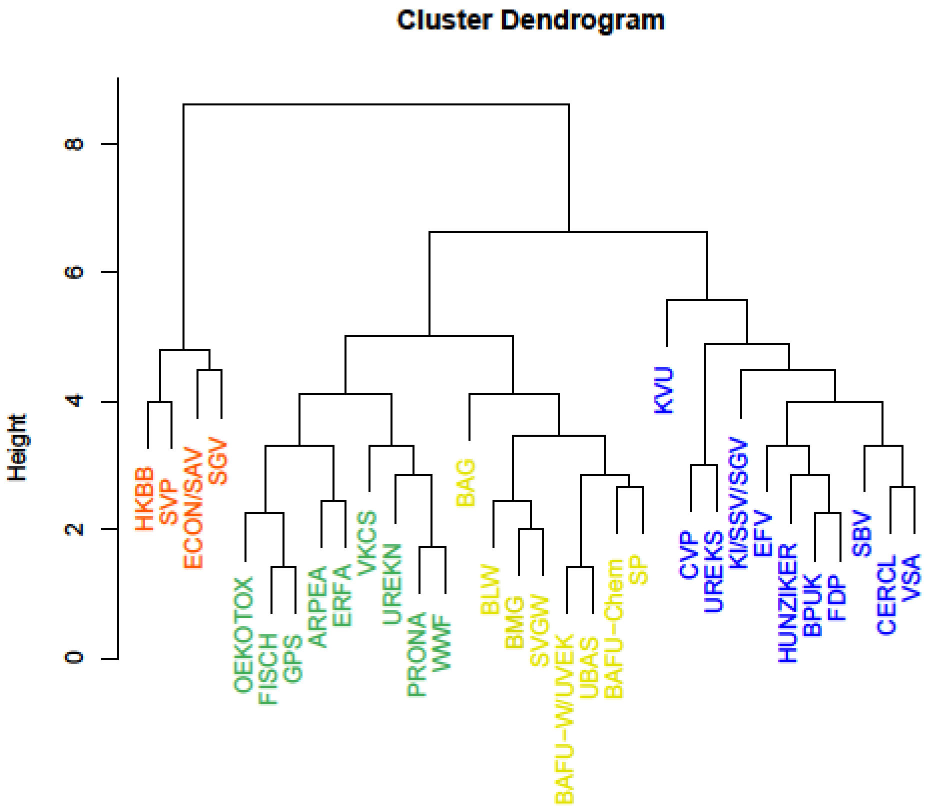

Cluster Dendrogram
Height
0
2
4
6
8
HKBB
SVP
ECON/SAV
SGV
OEKOTOX
FISCH
GPS
ARPEA
ERFA
VKCS
UREKN
PRONA
WWF
BAG
BLW
BMG
SVGW
BAFU–W/UVEK
UBAS
BAFU–Chem
SP
KVU
CVP
UREKS
KI/SSV/SGV
EFV
HUNZIKER
BPUK
FDP
SBV
CERCL
VSA

Figure 7.4