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What constitutes agency? Determinants of actors' influence on formal institutions in Swiss waste management

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ABSTRACT

Institutional change is crucial for the transitions of socio-technical systems. This study addresses why some actors have strong agency by uncovering the determinants of their influence on formal institutions. We focused on a recent and major policy process in Swiss waste management as the empirical case. We carried out content analysis of consultation documents, expert surveys, online questionnaire and social network analysis. The resulting data were then analysed with Qualitative Comparative Analysis (QCA) to determine the necessary and sufficient conditions associated with large influence. Results suggest that only several actors have a major influence on the policy output. Possessing material or non-material resources is found to be necessary yet not sufficient, as actors need to exhibit high activity and embeddedness in social networks or articulate a discourse rich in various concepts. By elucidating the configuration of endowments critical for actors' influence on formal institutions, this study yields novel insights into the ingredients of strong agency. The analytical approach we present can be applied to various settings and thus can be pursued for a systematic analysis on the determinants of actors' influence and how it varies with political or organizational context.

1. Introduction

Against the backdrop of increasing anthropogenic pressure on the environment, transition studies is concerned with how transport, energy, agriculture and other systems of provision such as water and waste management can be transformed to more sustainable alternatives (Markard et al., 2012). A defining feature of this field is its conception of the aforementioned sectors as socio-technical systems. In contrast to similar approaches such as sectoral systems of innovation, the notion of *socio-technical system* strongly emphasizes the interrelations between technical artefacts and non-technical elements, such as regulations, organizational interests, user practices and cultural elements (Geels, 2004). While technological change and radical innovation have always been in the spotlight of transitions studies, the importance of institutions and actors' role in shaping institutional structures has only recently gained notable attention (Geels, 2014; Kern, 2015). In fact, transition studies have long been criticized for overlooking the role of politics,

agency and power struggles among the actors (Farla et al., 2012; Markard and Truffer, 2008; Shove and Walker, 2007; Smith et al., 2010). Smith and Stirling (2010) underlined the need for an explicit analysis of power issues and politics in both social-ecological systems and sustainability transitions. This emphasis is indeed crucial because bringing about far-reaching changes in socio-technical systems is likely to spark tensions and power struggles among actors with varying interests.

Considering socio-technical regimes as the dominant institutional rationalities, transitions are conceived to involve processes of institutional change (Fuenfschilling & Binz, 2018). However, due to vested interests in formal institutions such as regulations, laws and policies, inducing change is often a contentious process in which actors struggle for agency to influence institutional arrangements (Duygan et al., 2019; Grin et al., 2011). As a matter of fact, some transitions scholars have defined *agency* as one of the most important determinants of transitions (Farla et al., 2012; Kern, 2015). However, most frameworks in transition research incorporated *agency* weakly or only implicitly (Smith et al.,

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2005). For instance, although the transition management approach focuses on frontrunners as entrepreneurs who initiate or drive transitions (Loorbach, 2010), it is unclear what sort of competences or endowments these actors rely on to bring about change. By relying on the *institutional work* concept, some recent studies made inroads about what strategies and practices actors follow to transform institutions (Brown et al., 2013; Jolly et al., 2016; Saravanan, 2015; Werbeloff et al., 2016). A recent framework integrated the signification, legitimation and domination practices of actors, their power and institutional constraining and enabling factors to enable a more nuanced examination of strategic agency (Novalia et al., 2018). Although these studies describe how agency may unfold in respective cases, they are not conducive for analysing the constitutive elements of agency and exploring the interrelations between them and how they come about to form the agency we observe as an influence on institutional structures. In other words, while the institutional work concept provides valuable insights into the means of transforming institutions, the foundations of these means are left unravelled. Therefore, in our view, the call of Smith et al. (2005) and Kern (2015) for an analysis of agency still remains valid in the sense of understanding what constitutes agency and why some actors are more influential than others.

A similar gap exists in the analysis of a closely related concept, *power*. Different conceptualizations exist in transition literature, varying from Grin's (2012) model of linking different types of power to three levels of multi-level perspective, namely, niche, regime and landscape level, to Avelino and Rotman's power-in-transition framework. In Grin's model, which draws on Arts and Tetenhove (2004), innovation and experiments at the niche level are linked to relational power while the regime level is claimed to possess dispositional power that is embodied in rules, resources and actor configurations. Finally, structural power is depicted on the landscape level. In contrast to such vertical, aggregated power typologies, Avelino and Rotmans (2011) present a horizontal typology in their power in transition framework to draw attention to the relations between power to maintain and power to change or antagonistic versus synergistic power dynamics. The authors defined power as the capacity of actors to mobilize resources to achieve a certain goal, and they distinguish between different forms of power, such as constitutive, innovative and transformative, which can be in a synergistic or antagonistic relationship. Although these conceptualizations are insightful, as we point out above for agency, they do not address what comprises power and why some actors are more powerful than others.

To understand why some actors have more influence than others on institutional structures, in this study, we focus in this paper on a major policy process in Swiss waste management. As the most important policy event of the last several decades in this sector, the Total Revision of the Technical Ordinance on Waste represents an episode in which the formal institutions, namely, "the formal rules of the game" are placed under scrutiny and revised. Changes in formal rules are likely to have ramifications on technologies, professional practices and roles that are closely intertwined. Owing to the stakes in these elements that make up socio-technical systems, actors contend to influence formal institutions such as policies and laws to direct the course of transitions. Our goal is twofold. First, we examine which actors in Swiss waste management have a major influence on formal institutions. By influence, we not only allude to the change of institutions but also to the ability of maintaining them under contention. Second, we seek to uncover what constitutes the agency of these influential actors. In other words, what features or endowments of actors stand out as important for exerting influence on formal institutions? To tackle this question, we operationalize the heuristic we developed earlier (Duygan et al., 2019). Drawing on the insights from organizational studies and institutional sociology, the heuristic conceptualizes agency as the ability to impact institutions, which is fuelled by actors' endowments that enable the conduct of various forms of institutional work. These endowments constituting agency are grouped broadly under the categories of *resources*, *discourse* and *social networks*. In this study, we operationalize two endowments from each category

and use qualitative comparative analysis (QCA) to determine what configurations of endowments are necessary and/or sufficient for a decisive influence on formal institutions such as policies. We thereby present an analytical approach that helps address why some actors have stronger agency, which manifests as a large influence on institutional structures.

This paper consists of seven sections. The next section presents the theoretical foundations of this study and the heuristic we operationalized. The third section introduces Swiss waste management and the policy process examined as the empirical case. We explain our methodology in section four and present the results in section five. In section six, we discuss the findings and its implications for governing transitions in Swiss waste management. In section seven, we then conclude with the summary of key findings and the contributions of this study.

2. Theoretical background

Among the various accounts of the relation between social action and institutions, some have been criticized for being undersocialized, adopting an atomistic view of agents as being barely affected by structures and social relations, while others are faulted as oversocialized for portraying agents as passive followers of structural elements such as norms and values (Granovetter, 1985). For instance, institutional theory has mostly dealt with explaining how institutional structures affect behaviour at the expense of elucidating how institutions are changed (Fuenfschilling and Truffer, 2016). The role of actors in the transformation of institutions gained traction later in *new institutionalism* under the headers of *institutional entrepreneurship* (Eisenstadt, 1980; Di Maggio, 1988) and *institutional work* (Lawrence & Leca, 2009). Institutional work refers to strategic, goal-orientated actions pursued to transform institutions. Drawing on the empirical research published in administrative, management and organizational studies, Lawrence and Suddaby (2006) identified a distinct set of practices and grouped them as different forms of institutional work pertinent for creating, maintaining or disrupting institutions.

On the one hand, the institutional work relevant for creating institutions deals with the reconstruction of rules that determine access to material resources, reconfiguring actors' belief systems or changing the meaning systems by introducing new abstract categories. These include *advocacy*, defined as the 'the mobilization of political and regulatory support through direct and deliberate techniques of social suasion' (Lawrence and Suddaby, 2006, p. 221) or *theorizing*; 'the development and specification of abstract categories and the elaboration of chains of cause and effect' (p.221). On the other hand, the institutional work for maintaining institutions ensures the compliance with rule systems and the reproduction of norms and belief systems such as *mythologizing*, which is the act of 'preserving the normative underpinnings of an institution by creating and sustaining the myths regarding its history' (p.230). Finally, institutional work pertinent for disrupting institutions consists of practices such as undermining the mechanisms of compliance with institutions. These practices may include disengaging rewards and sanction mechanisms as well as *disassociating moral foundations and assumptions* associated with a set of rules, technologies and routines.

While institutional work literature sheds light onto the purposeful, strategic actions pursued to transform institutions, it does not address what enables them. Hence, there is a lack of insight into the endowments required to perform these actions and what among them are critical for influencing formal institutions. To address this gap, we reviewed the activities or features of actors mentioned under the rubric of institutional entrepreneurship and institutional work in an earlier study (Duygan et al., 2019). As a result, we deduced *resources*, *social networks* and *discourses* as three distinct categories of endowments that actors rely on to perform different forms of institutional work practices. *Resources* may include material assets in the form of infrastructure and technological elements, financial capital, monetary stocks as well as intellectual or human capital. *Social networks* refer to actors' relational

ties, which may be instrumental in retrieving information, building alliances and mobilizing interests. *Discourses*, containing the beliefs, preferences and visions of actors can be seen as a means of expressing interests and influencing cognitive rationalities, norms and sentiments. More detailed information, including the operationalization of endowment categories, is given in [Section 4.2](#).

Some institutional work practices may require actors to mobilize endowments from all categories while others may primarily rest on a single one. For instance, to engage with advocacy, actors may have to rely on their resources, network and discourses, whereas the latter may mostly suffice for a practice such as mythologizing. Hence, actors may not need to be superior with respect to all endowments. Depending on the institutional context and the practices that have higher leverage therein, certain configurations of endowments may matter more. For instance, in a closed and majoritarian political setting, the relative importance of lobbying and hence financial resources and networks may be more prominent compared to a consensual and open setting where actors' discursive abilities may be crucial for deliberation and suasion. Broader institutional arrangements can also constrain agency by conditioning the distribution of endowments among actors in a political subsystem. However, the question of how actors acquire their endowments and the potential interrelations among different endowment categories³ are not within the scope of this study. Having conceptualized agency as the capability of actors to influence institutional structures, we seek to elucidate in this study what set of endowments is associated with the larger influence exhibited by some actors, which we refer to as *strong agency*. In order to tackle this question, we focus on a major policy process that represents a contestation on formal institutions in Swiss waste management. The empirical case is introduced in the next section.

3. Empirical setting: Policy change in Swiss waste management

Swiss waste management presents itself as an ideal case to analyse agency along the research objectives we highlighted above. A major policy process took place recently with the Total Revision of the Technical Ordinance on Waste which dates back to 1990. As the single most important policy event of the last three decades in the sector, the revision represented an opportunity to induce a significant transformation in regulative institutions with impacts on a far-reaching scale. Covering the entire field of waste management, the ordinance outlines how waste should be managed and what standards, technologies or management activities need to be in place. Even though the ordinance does not directly impose any technology-related constraint, it nevertheless influences what technologies will feasibly meet the technical and quality requirements specified. In a similar vein, one can expect changes in the 'rules of the game' to have a significant impact on several further aspects, such as incentive structures, distribution of resources, power relations, entrance of new actors and legitimacy of practices. Actors have large incentives to influence the policy output in their favour. Thus, policy processes can be seen as highlight events where tensions among actors and agency come into the fore and become easier to observe. As suggested by [Lawrence and Suddaby \(2006\)](#): "The agency that underlies institutional work is most visible and accessible during times of profound institutional change – when institutions are being created or destroyed. It is during those moments that the institutional fabric or taken-for-granted-ness is torn and the inner workings of institutions and the intentions of actors are made available for all to see" (p. 242). Therefore, policy processes as such are not only important for shaping institutional arrangements that underpin socio-technical regimes, thereby triggering or hindering transitions; from a research perspective, they also provide an opportunity for attaining greater insights into

³ Different endowment categories may be interrelated in the sense that actors may rely on their network to acquire some of their resources or form new relational ties through their discourses or by mobilizing resources.

agency and its determinants.

In the rest of this section, we provide brief contextual information on Swiss waste management in terms of its current state, major challenges faced and disputed issues. Switzerland has a long tradition of thermal waste treatment, with its first plant built in Zurich in 1904 ([Spoerri et al., 2010](#)). About 48% of the municipal solid waste (MSW) generated is treated at 30 municipal solid waste incineration (MSWI) plants ([Haupt et al., 2016](#)). The energy produced from waste processing at these plants corresponds to 5% of the heating and 3% of the electricity demand in Switzerland ([Dettli et al., 2014](#); [Rytec, 2013](#)). These figures make MSWI plants the second largest source of renewable electricity⁴ in Switzerland after hydropower plants. The other 52% of MSW are recycled (i.e. materially recovered) and contains a variety of streams, such as glass, paper, cardboard, batteries, PET bottles, aluminium cans, textiles, food and gardening waste and waste electrical and electronic equipment. Due to the landfill ban on burnable waste introduced in 2000, no MSW is directly landfilled. The absence of direct flows to landfills and the relatively high collection rates make Swiss MSW management one of the better-performing systems globally ([Wong Sak Hoi, 2016](#)).

On the other hand, Switzerland has one of the highest amount of MSW generated per capita in the world, and further improvement is needed in fostering closed-loop recycling and reducing the environmental impact of waste management ([Hanser et al., 2006a](#)). To address these issues, in 2008, the Swiss Federal Office for the Environment (FOEN), the country's environmental protection agency, reviewed the effectiveness of the ageing national waste policy ([Hanser et al., 2006b](#)). The review highlighted aspects that needed to be improved and outlined the principles of a new waste policy that ensures reliable, secure and environmentally friendly waste management as well as the economically and socially viable use of resources and waste treatment. To initiate alignment of Swiss MSW management along these principles, FOEN decided to undertake a total revision of the waste ordinance, which dated back to 1990 ([FOEN, 2011](#)). A consultation process took place in which local authorities, industry and trade associations, private companies, and environmental non-governmental organizations (NGOs) were invited to send their comments on the draft ordinance in the form of a written statement (i.e. position papers). The actors were provided an official template to express their suggestions and concerns on a general level, indicate their support or objections to specific articles and reformulate the articles they would like to see revised and their arguments for doing so. The revision process ended in December 2015 and the new ordinance came into effect in January 2016 ([Swiss Federal Council, 2016](#)). The position of actors on these debates and their arguments have been analysed in depth elsewhere ([Duygan et al., 2018](#)). This study focuses on how agency is distributed in Swiss waste management, who the influential actors are and what configuration of endowments stand out as crucial for having a large impact on this policy process.

4. Methodology

As explained in [Section 2](#), we conceptualize agency of actors to be founded upon a number of endowments that we categorized as: resources, social networks and discourses. While we consider these categories as complementary, one or two of these categories can be more important depending on the institutional context. This means that to have a strong agency (i.e. larger influence), actors do not have to be superior with respect to all categories of endowments. Furthermore, there could be not just one but several different configurations conducive for a strong agency. Below we explain the methodology we adopted to tackle our research objectives.

As a configurational comparative method, Qualitative Comparative

⁴ Given the biogenic content of MSW, half of the energy produced from MSWI plants are accounted as renewable energy in Switzerland ([Swiss Federal Council, 1998](#)).

Analysis (QCA) matches our intent to uncover the configurations (i.e. necessary and sufficient conditions) of endowments that associate with strong agency. In contrast to variable-orientated conventional multivariate techniques such as regression analysis, which examines the net effects of different elements, QCA represents a different approach in which set-theoretic reasoning is applied to determine causal conditions that are sufficient and/or necessary for the occurrence of an outcome (Ragin, 2008). As a result, QCA embodies three distinct features enabling the handling of multiple conjunctural causality (Schulze-Bentrop, 2011). These features are named as *multidimensionality*, *equifinality* and *heterogeneity* and are highly relevant for our research objectives.

Multidimensionality stands for the generation of an outcome by a combination of causal conditions (i.e. conjunctural) rather than a single condition or variable. Equifinality indicates the possible existence of multiple paths (i.e. different causal conditions) leading to the same outcome. Hence, QCA does not yield one causal model that fits the data but allows the exploration of several paths associated with the outcome of interest (Berg-Schlosser et al., 2009). Heterogeneity refers to the change in the effect of a condition on an outcome depending on the presence of other conditions (i.e. the effect of condition A may be positive in combination with condition B but negative in combination with condition C⁵). The ability of QCA to deal with causal complexity is an important asset for a rigorous analysis of agency. As presented, we conceptualize agency as a configurational entity composed of the combination of its constituent elements (i.e. actors' endowments). Therefore, the multidimensionality feature of QCA that untangles the conjunctural effect of conditions is particularly suitable for our analysis. We also presume that there is not just one but several different paths for the build-up of agency. Given all these reasons, QCA suits our empirical analysis well.

QCA has been applied for various research problems in sustainability transitions and innovation literature. Prior studies have used QCA to compare the performance of national and regional innovative systems and determine the factors that are linked to their success or failure (Crespo and Crespo, 2016; Khedhaouria and Thurik, 2017; Osunmuyiwa and Kalfagianni, 2017; Proksch et al., 2017). Likewise, to find the determinants of innovation at the firm level (Eggers et al., 2020; Speldekamp et al., 2020). (Eggers et al., 2020; Speldekamp; 2020) QCA was also used to compare the expansion of renewable energy shares and policies across a set of countries and discover conditions linked to the progress of renewable energy transitions (Andreas et al., 2017; Hess and Mai, 2014).. However, to the best of our knowledge, no study has applied QCA before to analyse agency.

We explain our methodology in the following order:

- Selection of cases (i.e. actors in this study)
- Identification of the outcome of interest (i.e. the dependant variable)
- Identification of causal conditions relevant for the occurrence of the outcome (i.e. independent variables)
- Measurement of conditions and outcome in each case
- Analysis of the data with set-theoretic techniques

In this study, we follow the QCA terminology which refers to dependant variables and explanatory factors as *outcome and conditions*, respectively. As the agency of collective actors has been analysed, the

⁵ Interaction effects as such can also be investigated within regression analysis. However, Grofman and Schneider (2009) have argued that the interaction of metric variables is not the same as the intersection of conditions, especially in fuzzy sets. While the former is an algebraic multiplication, the latter follows the minimum scoring rule. Furthermore, in regression analysis, the two-way interaction effects are often examined, whereas unravelling causal complexity also requires an analysis of higher-order interactions, such as three-way and four-way, which regression analysis is not designed to handle (Schneider & Wagemann, 2012).

cases in our study correspond to private and administrative organizations that took part in the policy process. The outcome we examine is the agency expressed with the perceived influence of each actor on the policy output. In other words, some actors have stronger agency, which manifests itself through larger influence on the policy output. As explanatory variables, we operationalize six causal conditions from the endowment categories, namely, resources, social networks and discourses. The next sub-sections provide more details regarding each of the steps mentioned above.

4.1. Case selection

In this study, cases are collective actors (i.e. organizations) that were identified on the basis of the official invitation list of FOEN, which contained around 100 actors. However, additional actors took part in the consultation process, leading to a total number of 214 participants. Owing to the large amount of time and resources required, a sample of actors was analysed in this study. Our sampling procedure took the official list of invitees as the basis, with assumption that actors on the official FOEN list were the most relevant and important ones for Swiss waste management. We then gathered a panel of experts, including representatives from the administration, industrial organizations and consulting sector and asked them to review the list and mark those actors that should not be left out of the analysis. This step resulted in a list of 55 actors. However, for methodological reasons (mostly related with social network analysis) and limitation of human resources, we had to reduce it to a manageable sample. Therefore, we consulted the experts again to determine the most crucial ones, which amounted in the end to 33 key actors. Given that two of the actors did not participate in the online survey (see below) that we subsequently conducted to collect data about the conditions, the final number of actors included in the analysis was 31. As shown in Table 1, the sample consisted of collective actors, such as administrative bodies, cantons⁶ and economy and waste management organizations, as well as an NGO that represents a cluster of several environmental NGOs in the field of waste management. For confidentiality reasons, the names of these organizations are not disclosed, and each is anonymized using numbers from 1 to 31. The list, including the descriptions of actors and their corresponding numbers, is provided in the supplementary material (SM) Table 1. FOEN was not included in this final sample as it hosted the entire process and served as

Table 1
Actor groups included in the analysis.

Actor category	Number of actors in the sample (N = 31)	Examples
Cantons	8	Two French, five German and one Italian-speaking canton
Administrative organizations	3	Committee of cantonal offices for the environment, specialist organization of Swiss municipalities and communities
Waste management organizations	9	Recycling organizations, incineration plant operators, composting and anaerobic digestion plant operators
Economy and trade organizations	10	Trade associations, corporate unions and cement plants
NGO	1	A cluster of several environmental NGO active in the field of waste management

⁶ "Swiss Confederation has 26 cantons representing administrative subdivisions. For convenience, they can be considered as states or regional governments.

the single legislative body that all the other actors tried to influence. As a matter of fact, all the position papers submitted within the consultation process were addressed to FOEN.

Furthermore, because the FOEN and not the parliament passes the revision of the ordinance, political parties did not officially engage with the revision by disclosing written statements. However, they might have provided financial, political or legal means of support to other actors. In fact, it is not uncommon in Switzerland for members of political parties to also be part of the executive board or even the president of private companies or industrial organizations.

4.2. Identification and measurement of outcome and conditions

This section explains the operationalization of the outcome and conditions, which required the use of further methods such as surveys, discourse network analysis and social network analysis. Table 2. below summarizes the outcome and conditions operationalized along with the methods and software used for their operationalization.

4.2.1. Outcome: influence on the policy output as the indicator of agency

We assessed the strength of actors' agency with the reputational approach which is extensively used in political science and policy research to measure the power or influence of actors (Fischer and Sciarini, 2015). The measure relies on eliciting the perceives reputation or influence of a given actor by others found in the same political sub-system. Actors in a network are arguably in a better position to judge their peers compared with others outside the system (Fischer, 2014). Although the actors' evaluations may be subject to bias, their perceptions also hold the key to understanding their actions in the system. Having defined agency as the capability of actors to impact institutions, we assessed the strength of actor's agency by their perceived influence. The actors in our sample were asked to indicate the ones that had a decisive influence on the policy process. The influence of each actor was then determined by counting the number of times it was mentioned by its peers, excluding self-nominations. This question was asked to respondents through an online survey (conducted with Qualtrics survey software), in which we also collected information concerning social network analysis (see Section 4.2.2). The survey took place in the fall of 2016. Thirty-three actors in our initial sample were contacted and 31 replied to the survey, resulting in a response rate of 94%. It should be noted that with influence we do not necessarily imply introducing changes. The influence on policy output can also include maintaining

Table 2
Overview of operationalization of the outcome and conditions (*RES_MAT*, *RES_NONMAT*, *NETW_OUTDEG*, *NETW_BETW*, *DISC_CONCEPT*, *DISC_BETW*). Methods and software used to measure the outcome and conditions are shown in the third and fourth columns, respectively.

Agency and its constituting elements (Duygan et al., 2019)	Outcome and Conditions	Methods	Software
Agency	Influence on the policy output measured by reputational approach	Online Survey (response rate: 94%)	Qualtrics
Resources	Material resources (<i>RES_MAT</i>) Nonmaterial resources (<i>RES_NONMAT</i>)	Survey (Expert Interviews)	None (paper-pen)
Networks	Degree centrality (<i>NETW_OUTDEG</i>) Betweenness centrality (<i>NETW_BETW</i>)	Social Network Analysis	Qualtrics, UCINET
Discourse	Abundance of concepts (<i>DISC_CONCEPT</i>) Betweenness centrality (<i>DISC_BETW</i>)	Content Analysis Discourse Network Analysis	Discourse Network analyser

existing regulations, keeping particular issues off the agenda or resisting against the demand for more radical changes.

4.2.2. Conditions: operationalizing the constituent elements of agency

This section explains the operationalization of conditions derived from the endowment categories introduced earlier: resources, social networks and discourses

i) Resources

We operationalized two distinct types of resources: material and non-material, which can be likened to Giddens' (1984) conceptualization of allocative and authoritative resources. The first group consists of physical-material resources, which include technical artefacts and the infrastructures actors own or operate, as well as capital and human resources in the form of labour. The second type is non-material resources and consists of intellectual resources in the form of knowledge, technical, political or judicial expertise that strengthen the access and presence in decision- and policymaking venues. The same expert panel that was consulted for the sampling rated actors' material (*RES_MAT*) and non-material resources (*RES_NONMAT*) based on the definitions we provide above. For the rating, 6-point Likert scale was used, in which the score of 1 denoted very low resources, 2 was low, 3 was rather low, 4 was rather high, 5 was high and 6 was equal to very high resources.

i) Discourses

To review the discourses of actors, we analysed their written commentaries (i.e. position papers) on the draft ordinance issued by FOEN. Through these commentaries, actors were invited to state whether they agreed or disagreed with articles in the draft ordinance and were offered to provide their propositions and arguments for the re-formulation of articles. Most of these position papers were written in accordance with the formal structure outlined by FOEN. Some actors added an open-ended cover letter to emphasize the changes or arguments they advocate. The commentaries varied from several up to 90 pages.

Two conditions were investigated concerning actors' discourse in these position papers. The first is *concept abundance (DISC_CONCEPT)*, which represents the number and diversity of concepts that actors referred to in relation to their argumentation and framing. The assumption behind this condition is that frames referring to a variety of technical, environmental, societal and political concepts are more likely to reach a wider audience and thus draw more support. This relates to some of the dimensions that Geels and Verhees (2011) identified as important for a strong framing such as centrality, experiential commensurability and macro-cultural resonance. The second condition is the actors' position within discourse networks consisting of several coalitions (*DISC_BETW*). Actors holding moderate beliefs or sharing discursive elements with various coalitions might be well suited to serve as mediators or brokers bridging different coalitions. Especially in adversarial policy settings, brokers can play a crucial role in the establishment of agreements, and thus their presence is deemed to be highly important⁷ (Ingold and Varone, 2011). As a result, they can use their strategic position as a leverage to influence policy output.

Both conditions were operationalized by running a content analysis of written commentaries. The concepts used by the actors were identified inductively by reviewing the entire texts. The concepts were coded only if they were used in relation to an argument (i.e. to strengthen an argument). The analysis revealed a list of 60 different concepts, which are provided in Table SM 2. A diversity rate corresponding to the fraction a/b in the formula below was then calculated for each actor by dividing the number of different concepts the actor referred to by the

⁷ Actors might also be deliberately framing their views to make themselves eligible for strategic roles in brokerage or mediation.

total number of concepts identified (i.e. 60). Finally, the score for each actor was derived by multiplying the diversity rate by the total number of occasions when an actor referred to a concept (Eq. (1)).

$$S = (a / b) * c \tag{1}$$

S = score of an actor

a = number of different concepts mentioned

b = total number of different concepts identified in the entire sample

c = number of occasions a concept was used a/b = diversity rate

For instance, an actor receives a score of 15 if it refers to 20 different concepts 45 different times [(20/60)*(45)] or refers to 30 different concepts only once [(30/60)*(30)]. The index takes into account the fact that some concepts might be used only once while others are repeated multiple times. However, the index does not consider the efficiency of argumentation (number of concepts used per argument) as it primarily assesses how arguments are framed with respect to variety and frequency of concepts used to strengthen their salience.

For the second condition, we took into account the actors' position in discourse networks. We reviewed the comments on two articles of the draft ordinance addressing waste prevention and waste treatment. These debates span the whole waste management sector and thus yield the policy core beliefs of actors (Sabatier, 1998). Discourse Network Analysis was used with the software Discourse Network analyser (DNA 1.32) to generate an actor congruence network (i.e. actor-by-actor network) in which actors that share similar policy beliefs or preferences are connected to one another (Leifeld, 2012). Faction analysis was then used to identify the coalitions (Everton, 2012). Further details about how the analysis was run and the coalitions identified can be found in Duygan et al. (2018). Discourse network analysis revealed discourse coalitions and actors that bridge those coalitions. Although visualization helps pinpoint such actors rather easily, one formal measure assessing this is *betweenness centrality*. It indicates to what extent an actor is located on the shortest path between two other actors (Everton, 2012). As the ties among actors in discourse networks corresponded to policy preferences shared mutually, actors with high betweenness centrality represented the ones that have mutual preferences with several coalitions and thus act as a bridge among them. To determine the centrality scores of actors, the software UCINET (Borgatti et al., 2002) was used and Freeman's (1978) node of betweenness centrality was utilized as the betweenness centrality measure.

i) Social networks

Actors' relational ties and their embeddedness in social networks can enable or constrain their potential to influence, with social capital being one of the concepts addressing this phenomenon (Prell, 2012). To assess the activity and embeddedness of actors two of the widely used centrality measures, degree and betweenness centrality were utilized (Prell, 2012). *Degree centrality* indicates the direct ties (i.e. relations) that actors have with others. In directed networks where ties among actors are not symmetrical, *out-degree centrality* denotes the ties that actors send out to others; in other words the relations they initiated. On the other hand, *in-degree centrality* denotes the ties that actors receive. In our analysis, we used out-degree centrality (NETW_OUTDEG), because it indicates how active actors are in initiating relations with others in a network. As explained in the sub-section above, *betweenness centrality* (NETW_BETW) shows to what extent an actor is involved in linking other actors that would otherwise not be connected with one another. While degree centrality is associated with the activity of an actor, betweenness centrality can indicate the strategic position of an actor in the network. As discussed above, actors that link different actors or groups may not only be potential brokers but because of their unique position they can also control the flow of resources such as information within the network. Other actors in the social network are likely to depend on the few actors with high betweenness centrality (Everton, 2012; Prell, 2012).

The centrality measures were derived from the analysis of collaboration networks in Swiss waste management, which was gathered through the online survey mentioned in Section 4.1. The participants were provided with the list of actors that attended the consultation process and asked to mark those actors they collaborated with – which does not necessarily mean they had complete agreement on the issues – for the revision of the ordinance. The software UCINET (Borgatti et al., 2002) was used to analyse the collaboration network and calculate the out-degree and betweenness centrality of actors.

4.3. QCA analysis

Based on set-theoretical reasoning, QCA explains the interactions among social phenomena in terms of set relations (Ragin, 2008). For example, the claim that “all developed countries are democratic” in fact rests on a set-theoretic argument because it assumes the set of developed countries to be a subset of democratic countries. This relation is illustrated below in Fig. 1, with set X denoting the set of developed countries and Y the democratic countries. The relation would mean that being a developed country is sufficient to be a democratic country, and a contradiction of this claim could stem from the presence of developed countries that are not democratic (which can be shown with the notation X, ~Y where the ~sign indicates the negation). On the other hand, it also shows that Y is necessary for X because all cases representing X are fully included in the set of Y. Likewise, cases exhibiting ~X, Y do not contradict the statement of necessity but show that even though Y is necessary, it is not sufficient for X. In reference to the example above, this would mean that being democratic is necessary yet not sufficient to be a developed country.

4.3.1. Fuzzy-sets

In the real world, rarely does any social entity manifest as a perfect subset or superset of another entity. Rather, entities are more likely to hold a partial membership to a set such as democratic countries. This relation can be investigated with the use of fuzzy sets (Zadeh, 1965). Unlike crisp sets, *fuzzy sets* allow cases to have partial memberships as well instead of only dichotomous, full (non-) membership scores. The notion of fuzziness does not imply empirical information is imprecise. Instead, it represents the unique characteristic of a case that is a member of a set whose concepts have fuzzy boundaries. Therefore fuzzy-set values should not be treated as probabilities (Schneider and Wagemann, 2012). In an operation with fuzzy sets, data are calibrated so that cases have a value between 0 and 1, denoting the cases' degree of membership to a set (i.e. set-membership values). For instance, a country with a fuzzy-set democracy score of 0.7 belongs rather to the set

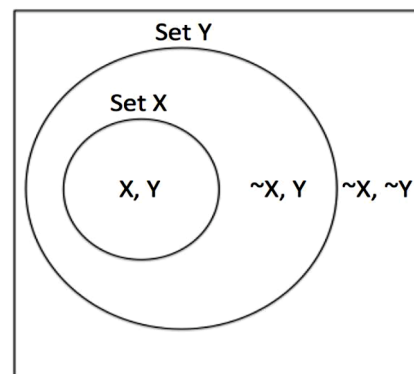


Fig. 1. Venn diagram showing the set relation between two entities X and Y. In the example, set X stands for developed countries and set Y for democratic countries. Set X as the subset of Y shows that X is a sufficient condition for Y, a claim that can only be disproved if there are cases of X, ~Y. It also shows that Y is necessary for X as all cases representing X are fully included in the set of Y. Adapted from Schneider & Wagemann, 2013

of democratic countries, while one with a score of 0.3 belongs more to the non-democratic set. A fuzzy-set score of 0.5 represents the maximum ambiguity, as it is indifferent with respect to being rather in or out of a set.

In this study, fuzzy-set QCA (fsQCA) was carried out, as it allows a more fine-grained understanding and a more conservative test of sufficiency than does crisp-set QCA (csQCA) (Schneider and Wagemann, 2012). For this reason, the raw data of both outcome and condition measurements needed to be calibrated to fuzzy-set scores that represent the set-membership values of the cases.

4.3.2. Calibration of data to set-membership values

Calibration was carried out by the direct calibration method, which allows the construction of interval-level fuzzy-set scores (Ragin, 2008). Direct calibration employs three qualitative anchors, full membership (0.95), point of indifference (0.5) and full non-membership (0.05), and then uses a logistic function to fit the raw data within these anchors. The analyst has to decide where the qualitative anchors fall in the raw data, ideally by drawing on substantive and theoretical knowledge. For instance, taking body-mass index (BMI) as a reference, one can assign a BMI value of 30 to full membership for the set of overweight people, which corresponds to the fuzzy set score of 0.95. Likewise, a BMI value of 18 can be designated as the full non-membership anchor for overweight set. Finally, BMI 25 can be set as the crossover between the overweight and non-overweight sets. On the basis of these anchors, a logistic function can then be fitted to transform the BMI values in a data set to fuzzy-set scores between 0 and 1. For cases where a theoretical benchmark does not exist and case knowledge does not apply, the distribution of the raw data provides an appealing alternative. For instance, a prominent gap in the data might hint at an inherent distinction between one group of cases and the rest. On the other hand, using mean or median values as qualitative anchors should be done only as a last resort because the resulting set-membership values might then be a pure artefact of the data characteristics at hand.⁸

In this study, a mix of the approaches listed above was used since no theoretical benchmark is significantly relevant to the outcome and conditions analysed in this work. The calibration procedure for the outcome and each of the conditions are explained in supplementary material. Furthermore, the information on the raw data, the crossover points used and the resulting fuzzy-set values of outcome and conditions can be found in Table SM3–9. Raw data matrix and fuzzy-set scores are also provided in Table SM 17 and 18, respectively. After the calibration step, the fuzzy-set values were fed into the software fs/QCA 2.5 (Ragin and Davey, 2014) to carry out the analysis of necessity and sufficiency.

4.3.3. Sensitivity analysis

In contrast to other conditions, both betweenness centrality measures (*network betweenness* and *discourse betweenness*) tend to generate a skewed data pattern. Hence, the selection of crossover points might have a larger effect on the fuzzy-set values of these two conditions than the rest. In order to investigate to what extent the results depend on the choice of crossover point, sensitivity analysis was run to compare the results when two different crossover points were selected for both of these conditions (Table SM10–11). In the base case, the analysis was performed with the crossover point that stemmed from the case knowledge. The other crossover points that were set to lessen the effect of the skewed data were used as a comparison to test the sensitivity of the results.

⁸ Context should also be considered because, for example, in a study that deals with EU member states, a country such as Hungary with a GDP of \$19,000 would hardly fall within the set of rich countries. However, it would be more in than out of the rich set if the research focus was global and the study included countries from all around the world (Schneider & Wagemann, 2012).

4.3.4. Tests for necessary and sufficient conditions

The tests to find the necessary and sufficient conditions were carried out using the software fs/QCA 2.5 (Ragin and Davey, 2014). The software provides consistency and coverage measures for both of the tests. *Consistency* measures indicate to what degree a perfect subset relation is observed. In other words, they express the extent of support from empirical cases for the postulated relationship between a given condition and the outcome (Fischer, 2014). By comparison, *Coverage* measure indicates to what degree a cause or a combination of causes account for occurrences of the outcome. Therefore, the coverage measure indicates the empirical relevance of a condition.

The sufficiency of a condition is tested by the truth table tool. The truth table (Table 4) comprises a list of all logically possible configurations of conditions included in an analysis and the empirical outcomes associated with them (Ragin 2008; Schneider and Wagemann, 2012). The logically possible number of configurations is equal to 2^k , with k being the number of conditions. Depending on the number of conditions and cases included in the analysis, some configurations might not be observed as empirical cases. This phenomenon is called *limited diversity* and rows without empirical cases are called *logical remainders*. The sufficiency of non-remainder rows is assessed by their consistency score. It is advised to consider rows as sufficient only when their thresholds are larger than at least 0.75. Before a row is declared to be sufficient, it should be ensured that none of the observed cases constitute a true logical contradiction. This occurs when the membership score to a given configuration (deemed to be sufficient) is in fact both larger than the membership score to the outcome (i.e. $X > Y$, which contradicts the relation of X being a sub-set of Y) and also on different sides of the qualitative anchor (e.g. $X > 0.5$ and $Y < 0.5$) (Schneider and Wagemann, 2012). The rows declared as sufficient in the truth table do actually exhibit sufficient conditions for the outcome. However, the expression of sufficiency can often be complex and include redundant terms. Therefore, a logical minimization is recommended to achieve non-redundant and more parsimonious solutions. The simplest way would be to look for configurations that vary by only one condition. If both configurations are sufficient for the outcome, then the only condition that varies can be considered logically redundant and thus omitted from the solution. Counterfactual cases can also be considered for logical minimization. For example, if the theoretical and substantive case knowledge suggests the presence of the following four conditions A, B, C and D as linked to outcome, yet, this configuration is not observed, then the solution term can still be simplified to $A^*B^*C \rightarrow Y$ if the configuration $A^*B^*C^* \sim D \rightarrow Y$ is observed.

As with the case of necessity, the coverage measure indicates the empirical relevance of a condition in terms of how much the outcome is covered by that respective condition. The software yields three coverage measures: raw, unique and solution. The *raw* coverage shows how much of the outcome is covered by a single path. A case can be a part of more than one sufficient path, and so it is likely to have overlaps among the raw coverage of different paths. The *unique* coverage measure indicates the exact coverage of a specific path, and unless the path is not logically redundant, the unique coverage is larger than zero. The *solution* coverage, on the other hand, shows the coverage of the entire solution term, which may consist of multiple sufficient paths (Schneider and Wagemann, 2012).

5. Results

5.1. Distribution of agency in swiss waste management

The results show that only a limited number of actors had strong agency in Swiss waste management. Fig. 2 below depicts the actors and the number of times their peers mentioned them as decisively influential on the policy output. Actor groups are shown by different symbols and with the respective numbers assigned to them for anonymization (Table SM1). As can be read from the graph, except for the NGO,

Influence of Actors

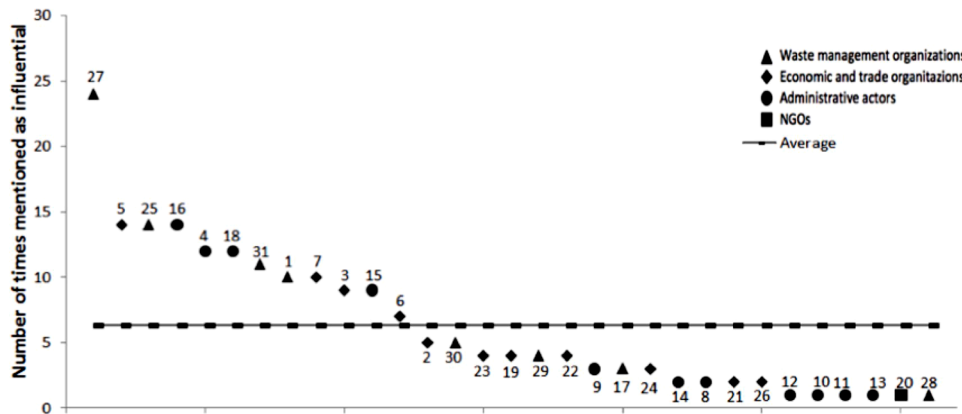


Fig. 2. Distribution of agency among the key actors in Swiss waste management (reputational approach, online survey, $N = 31$). For anonymization, the actors are shown with their unique case numbers. The actors are classified into four actor groups: waste management organizations, economic and trade organizations, administrative actors and NGOs. The Y-axis denotes the agency of actors measured by the number of times they were mentioned as influential by their peers, excluding their self-nomination. The average score is indicated by the horizontal line. The figure shows that only a limited number of actors have scores higher than the average, while the majority is below the average.

representatives from all three other actor groups (i.e. waste management organizations, economy and trade organizations and administrative actors) are found among the set of influential actors. However, it is important to highlight that, except for one German-speaking canton, all other cantons appear to have had relatively weak influence. This finding is not very surprising, as the revision of the ordinance was dealt on a federal level. Still, it is striking to see that agency is concentrated in the hands of only a small number of actors while the majority turned out to have relatively weak impact.

5.2. Necessary conditions

The results of the necessity tests are displayed in Table 3. Throughout the paper, QCA results are shown in Boolean notation in which the symbol * denotes the “AND” combination, + stands for “OR” and conditions and outcome written in capital letters indicate their presence while lower case letters indicate their absence (negation). Considering a threshold of 0.9 for consistency and 0.50 for relevance of necessity (RoN), non-material resources (*RES_NONMAT*), as well as the “or” conjunction of having either material or non-material resources (*RES_MAT + RES_NONMAT*), were found to be necessary for strong agency. An inspection of the XY plots (SM Fig. 1 and 2) also show that there are only a few cases where the value of outcome is larger than the condition (above the diagonal line) and only one case (nr.3) where the outcome is present when the condition is not. Overall, the results point out that having resources, especially non-material resources, is highly likely to be necessary for having strong agency. As can be seen from the results in Table SM 12, there is no noticeable change with the use of different crossover points for the two betweenness centrality measures.

Table 3
Analysis of necessity for the occurrence of the outcome.

	Consistency	Coverage	Relevance of Necessity
RES_MAT	0.78	0.65	0.77
RES_NONMAT	0.91	0.59	0.63
NETW_OUTDEG	0.49	0.52	0.92
NETW_BETW	0.45	0.73	0.92
DISC_CONCEPT	0.54	0.53	0.77
DISC_BETW	0.50	0.55	0.80
RES_MAT + RES_NONMAT	0.96	0.59	0.58
RES_MAT * RES_NONMAT	0.73	0.67	0.81
NETW_OUTDEG + NETW_BETW	0.58	0.64	0.75
DISC_CONCEPT + DISC_BETW	0.53	0.50	0.68

5.3. Sufficient conditions

The truth table for the analyses of sufficient conditions is shown below in Table 4. The table displays the consistency of each row (i.e. the logically possible configuration) and the number of empirical cases observed.⁹ The last column shows the cases anonymized with their unique case numbers. The cases with a higher membership score in the influential set are highlighted in bold. Out of the 64 logically possible configurations, 17 were empirically observed with at least one case. Among these 17 rows, only 5 of them have a consistency score larger than the threshold of 0.8. Moreover, despite having a consistency score of 0.86, row 16 was omitted from the ensuing analysis, as the only empirically observed case for this configuration (case nr. 19) is in fact a true logical contradictory case. The remaining four rows given below constitute a solution with four different paths, each being sufficient for strong agency.

- 1) RES_MAT * RES_NONMAT * NETW_OUTDEG * NETW_BETW * DISC_CONCEPT * DISC_BETW
- 2) RES_MAT * RES_NONMAT * NETW_OUTDEG * NETW_BETW * disc_concept * disc_betw
- 3) RES_MAT * RES_NONMAT * netw_outdeg * NETW_BETW * DISC_CONCEPT * disc_betw
- 4) RES_MAT * RES_NONMAT * netw_betw * netw_outdeg * DISC_CONCEPT * disc_betw

As can be clearly seen from paths 1) and 2), the entire solution contains redundant terms and should thus be subject to logical minimization. Furthermore, given that path 2) was found to be sufficient, the counterfactual at row 18 was also assumed to be sufficient as the additional term, *DISC_CONCEPT*, was expected to only strengthen the occurrence of the outcome. The same argument can also apply to the counterfactual at row 19. The last two counterfactuals at rows 21 and 22 were also fed to the analysis as sufficient configurations due to the presence of consistent rows 5 and 11, respectively.

Using the Quine–McCluskey algorithm (Ragin and Davey, 2014) and the counterfactuals defined as sufficient in the previous step, the program yielded the three paths shown in Table 5 as sufficient for the outcome.

The solution comprising these three paths explains the outcome with a consistency and coverage of 0.81 and 0.56, respectively. All three

⁹ The assignment of cases to rows is done by screening their membership score because each case can have a membership score larger than 0.5 for only one row (i.e. only for one configuration).

Table 4
Truth table for the analysis of sufficient conditions.

Row	RES_MAT	RES_NONMAT	NETW_OUTDEG	NETW_BETW	DISC_CONCEPT	DISC_BETW	OUTCOME	nr. of cases	Cons.	Case nr.
1	0	1	0	0	0	0	0	7	0.61	1, 3, 4, 10, 11, 14, 21
2	1	1	0	0	1	1	0	3	0.71	7, 13, 22
3	0	0	0	0	0	0	0	3	0.49	12, 23, 28
4	1	1	1	1	1	1	1	2	0.89	25, 31
5	1	1	0	0	1	0	1	2	0.81	6, 15
6	0	0	1	0	1	0	0	2	0.55	20, 24
7	0	0	1	0	0	0	0	2	0.57	17, 30
8	1	1	1	1	0	1	1	1	0.89	16
9	1	1	1	0	0	1	0	1	0.65	26
10	1	1	1	0	0	0	0	1	0.74	9
11	1	1	0	1	1	0	1	1	0.99	5
12	1	1	0	0	0	1	0	1	0.75	27
13	0	1	1	1	0	0	0	1	0.71	8
14	0	1	1	0	0	0	0	1	0.7	18
15	0	1	0	0	1	0	0	1	0.66	2
16	0	0	0	1	0	0	0	1	0.87	19
17	0	0	0	0	1	1	0	1	0.57	29
18	1	1	1	1	1	0	1	0	—	—
19	1	1	1	1	0	1	1	0	—	—
21	1	1	1	0	1	0	1	0	—	—
22	1	1	0	1	1	1	1	0	—	—

Table 5
Sufficient paths for decisive influence on policy output.

Sufficient paths	Raw Coverage	Unique coverage	Consistency
1) RES_MAT * RES_NONMAT * NETW_OUTDEG * NETW_BETW Cases covered: 16, 25, 31	0.35	0.11	0.86
2) RES_MAT * RES_NONMAT * NETW_BETW * DISC_CONCEPT Cases covered: 5, 25, 31	0.30	0.004	0.88
3) RES_MAT * RES_NONMAT * DISC_CONCEPT * disc_betw Cases covered: 5, 6, 15 Solution coverage: 0.56 Solution consistency: 0.81	0.38	0.15	0.81

paths contain a combination of several conditions, for instance the presence of both material and non-material resources. However, the mere presence of both resources appears to be insufficient for a decisive influence on policy output. According to the first path, high material and non-material resources should be supplemented with a high degree of activity in collaboration network. Or with high betweenness centrality in a collaboration network and a discourse rich in a variety of concepts. Although this second path has relatively lower coverage, its theoretical importance is noteworthy as it suggests that an actor’s position in a social network (i.e. the collaboration network in this study) is more important than the number of ties it has, or it sends out to others, to be more precise. On the other hand, articulating arguments and visions with a variety of concepts seems to be more prominent than having moderate policy beliefs and thereby linking different discourse coalitions. This finding may not be so surprising, as linking actors that are not otherwise linked in a collaboration network is likely to have a larger impact on the functioning of a system than bridging discourse coalitions; the latter merely indicates the potential or at most the credibility of an actor as a moderator or a broker. The third path, on the other hand, indicates that a rich discourse together with the presence of resources and the absence of the condition *DISC_BETW* (i.e. *disc_betw*) also suffices, which is contrary to expectations. Like all the other conditions, we expected the presence of the betweenness centrality in discourse networks and not its absence to be linked with high influence. However, the solution path cannot be reduced further because the configuration *RES_MAT * RES_NONMAT * DISC_CONCEPT* has a lower consistency (0.72), which makes it difficult to acknowledge as sufficient. In addition,

amongst the entire solution, the third path in fact has the lowest consistency score, barely over the consistency threshold of 0.80 used in this study.

In light of these findings, it is important to carry out a sensitivity analysis to test how sensitive and robust the paths are to the decisions made in the calibration step. The sensitivity analysis in this study was carried out primarily for the betweenness centrality scores of both social networks and discourse coalitions. As explained in Section 4.3.3., given that the distribution of betweenness centrality in a network is often highly skewed, the influence of the crossover point selection for these two conditions can be particularly significant for the results. Therefore, the analysis was repeated with a smaller crossover point for both conditions (*NETW_BETW* and *DISC_BETW*) to lessen the impact of a skewed distribution. The truth table for this analysis is shown in Table SM13. The results show that when a smaller crossover point is selected, the third path can hardly be considered any longer as sufficient. While the second path still appears to be sufficient, the first path shows a slight change with the additional term of *disc_betw* (Table SM14). Therefore, it can be argued that the third path, including the discourse, is sensitive to calibration with different crossover points, whereas the others, especially the second path with the conditions *NETW_BETW* and *DISC_CONCEPT*, appear to be more robust. This result can also be seen from the consistency scores for paths that are sufficient (Table 5). The third path, which was found to be not highly robust, has actually the lowest consistency score, just above the threshold set at 0.8.

6. Discussion

The findings suggest that agency in Swiss waste management is concentrated on a few state and private actors that include waste management organizations and economy and trade organizations. However, among this influential set, some of the powerful economic actors turned out to be less prominent compared to their presence and impact on policy matters in other sectors, such as energy. Furthermore, apart from one prominent industrial association, there is no other economic organization among the cluster of most influential actors (e.g. top five). Therefore, it can be argued that a handful of infrastructure-rich waste management organizations, such as treatment plant operators and recyclers, as well as administrative agencies at the federal level are the key players in Swiss waste management. While economic actors, such as unions and retailers, seem to be less prominent in this equation, the agency of NGOs and thus civil society, seems to be weak.

The study revealed that actors with strong agency in Swiss waste

management are indeed the incumbents. While this may not be so surprising, what remains unexplored so far is what makes them more influential than others. Which type or set of endowments are crucial for their agency? To tackle these questions, we look closer into the necessary and sufficient conditions and their implications for power relations and transitions in Swiss waste management. The results signify that possessing resources (material and non-material) is crucial for influencing formal institutions, but they are not sufficient. Actors also need to be superior, at least with respect to certain aspects of social networks or discourses. Nevertheless, it is interesting to observe that not all type of endowments have to be present. As long as an actor has large material and non-material resources, being active (e.g. high out-degree centrality) and well embedded in networks (high betweenness centrality) might suffice to have an impact on regulative institutions without being strong on discursive aspects. Likewise, if an actor is strong in framing its arguments with the abundant use of different concepts, it may suffice to hold key positions in social networks and link to actor clusters without establishing a large number of ties.

One unexpected finding is the association of *disc_betw* with the outcome. The sign implies that it is not holding moderate beliefs, but its negation is in fact linked with large influence. While it would require further analysis to explain why this is so, some preliminary arguments can already be made. First, moderate beliefs that share elements of several different positions might have been perceived as incoherent or inconsistent. Second, potential brokerage induced by actors with moderate beliefs may be more valuable when there is a strong conflict between equally opposed and powerful advocacy coalitions threatening a gridlock. In consensus-seeking political systems, including Swiss waste management where even actors with opposing policy beliefs (i.e. incinerators, recyclers, cement industry, cantons) gather regularly in meetings such as forums or roundtables, brokerage by outsiders might not be required or even favoured.

In fact, *disc_betw* was also found to be associated with negation of the outcome. While it is not a necessary condition for weak agency (Table SM 19), it is part of the two sufficient solution paths (Table SM 20). Likewise, just as the presence of large resources is part of all sufficient paths for strong agency, their negation (i.e. small resources) also appear in almost all solution paths for weak agency. One exception is the first pathway that consists of high activity and low embeddedness in collaboration networks and low discursive activity. Considering the first sufficient path for strong agency (Table 5), it can be concluded that a high activity in collaboration networks (*NETW_OUTDEG*) does not seem to be conducive for the formation of influence unless coupled with large resources and a rich discourse (*DISC_CONCEPT*). This varying effect of *NETW_OUTDEG* (i.e. its association with both the occurrence and non-occurrence of the outcome) depending on the presence of other conditions is an interesting example of causal heterogeneity (Section 4). The results also indicate that both the presence (*NETW_BETW*) and absence (*netw_betw*) of embeddedness in collaboration networks are prominent factors for strong and weak agency, respectively. This can be interpreted as although initiating collaborative ties can be relevant for creating influence, embeddedness in social networks, that is, being in a strategic position of binding actors that are otherwise not linked, is much more important. Overall, the findings of both analyses for strong and weak agency suggest that resources, embeddedness in collaboration networks and a high discursive activity are decisive factors for the strength of an actor's agency.

6.1. Strategies for the governance of transitions

The availability of not one but various paths for strong agency suggests that actors can tailor their strategies according to their capacities and priorities. However, all of the paths require the presence of resources and, therefore, variations in strategies may rather be on the utilization of discourses or social networks. This finding seems to vindicate the recent attention given to the role of resources in power

relations in transitions (Avelino and Rotmans, 2011). Nevertheless, for those actors seeking to strengthen their agency, acquiring both material and non-material resources may be a daunting task. Therefore, it is more realistic to expect actors to build coalitions or strategic alliances to complement one another's weaknesses. In fact, four of the top five most active actors initiating collaboration ties are the ones with weak influence. Likewise, the environmental NGO included in our analysis is already an alliance of several other NGOs. Yet, this appears to be inadequate and one can expect NGOs to seek further alliances with cantons or private organizations that possess larger resources. The cantons that are active in networks can also build partnership with private actors with larger resources. However, it is usually the incumbent actors possessing large resources and are reluctant to initiate radical change due to their vested interests on the existing arrangements. This case is also valid for Swiss waste management. A closer look into the twelve actors that belong to the influential set suggests that Swiss waste management is run by an iron triangle consisting of incumbents from bureaucracy, industry and interest groups. Among the former group are powerful inter-cantonal organizations (case nr. 4, 18, 16) that stand out with large non-material resources and the strategic positions (i.e. high betweenness centrality) they hold in collaboration networks (actors 16, 18). As industry members, waste management organizations such as waste treatment plant operators (27) and recycling organizations (25 and 31) possess large resources. These actors are also in charge of day-to-day operations of vital infrastructures such as incineration and recycling plants and some waste collection points. As a result, they are likely to have a high bargaining power due to their vital role. Finally, important economic actors such as retailers (7), umbrella associations from the construction and cement industries (5) and the Swiss corporate union (6) hosting up to a hundred thousand companies with about 2 million employees in total can be accounted for the influential interest groups. In addition to large resources, they (5, 6) have also produced a well-articulated discourse rich in different concepts. Although these incumbents hold different policy preferences and thus do not constitute a homogenous unity (Duygan et al., 2018), it is still quite difficult for others, such as niche actors who are typically not rich in resources, to have any influence on the institutional design and thus transitions. This might be different if there were some incumbents who favour disruptive change, yet there is no strong indication of that happening in Swiss waste management (Duygan et al., 2018).

One way of empowering niche actors in federal level decision-making is to alter the selection pressure. The consultation process organized by FOEN is a typical example of how regulatory changes are carried out in various other sectors in Switzerland. It can be argued that by making the evaluation of position papers and the entire process more systematic, and transparent, the relative importance of discursive elements can be increased. This may result in favour of some actors like NGOs (nr.20) which indeed have a well-articulated discourse rich in a variety of concepts (Table SM 8). Although it is consensus based, the revision process resembled corporatist-style decision-making with very few central actors (FOEN being the most centrally positioned), inadequate involvement of civil society and insufficient transparency. It is likely that in this type of setting actors with large amount of resources have advantage and activities such as networking or, more profoundly, lobbying pays off more than a well-articulated and grounded discourse that provides empirical fit or resonates well with macro-cultural resonance (Geels and Verhees, 2011). In fact, this may be a prime example of how some actors are disadvantaged by institutions that have been designed, reinforced and maintained by certain actors that benefit from those institutions. Therefore, changing the mode of governance and policy-making in Swiss waste management towards less central and more transparent processes could be one of the strategies for increasing plurality, establishing a level playing field and empowering actors such as frontrunners over resource-rich incumbents. As a matter of fact, due to a recent change in the law concerning the consultation processes that came into effect after this revision, agencies such as FOEN are now

mandated to disclose the position papers of the actors. This eventually introduces more transparency given that a wider range of stakeholders or public can have access to actors' policy preferences and their arguments. Yet, there is still some ambiguity about how FOEN evaluates these position papers and make decisions when formulating new ordinances.

However, introducing further changes along this line may require a preceding institutional change concerning normative structures (Fuenfschilling and Truffer, 2016; Lawrence and Suddaby, 2006; Scott, 1995). This implies challenging the moral basis and dominant perceptions about what a fair and transparent decision making is. To initiate this, actors can engage with certain forms of institutional work such as *changing normative associations* and *dissociating moral foundations* (Lawrence and Suddaby, 2006) that are pertinent for targeting normative institutions. The discursive elements found to be secondary for impacting regulative institutions might actually be crucial when it comes to altering normative institutions. In this regard, a closer examination of the interactions, alignments and discrepancies among regulative, normative and cultural-cognitive institutions could be a promising research avenue for transition studies. Whether and how an impact on one type of institution reverberates on others may be worth examining. Additionally, does a transition that depends only on regulative institutions risk facing backlashes more than the one that is also supported by changes in normative and cultural-cognitive institutions? If it's the case, how can a change in regulative, normative and cultural-cognitive institutions be coordinated and the likely temporal discrepancies (i.e. while regulative change might take place within several years, change in other institutions might take more time) be handled?

6.2. Critical reflections and recommendations for further research

This section elaborates on the limitations of this study and how they can be addressed by further research. One shortcoming arises from the measurement and calibration of data. The measurement of the resources relied on experts' insights. In our case, expert judgements were gathered individually. Further studies could consider undertaking a more intensive approach, such as organizing deliberation rounds where experts first fill out a questionnaire and then elaborate on their judgments in plenary sessions and revise them if necessary. Furthermore, we used reputational measure, which elicits the perceived influence of actors by others who were involved in the same policy making process. While it is subjective, reputational measure has been shown to be robust to biases except for the overestimation of influence of those that the respondent had collaborated with (Fischer, 2014). To assess actors' influence, more objective measures taking into account the degree of overlap between an actor's preference and policy output can be implemented. However, such measures are also not without limitations, as an overlap does not necessarily mean that it is caused by the actor in question but maybe by others who have the same or similar preferences. Therefore, as also revealed by Political Science studies on interest groups the measurement of "actual influence" remains to be a highly complicated task (Bernhagen et al., 2014). Perhaps a more accurate assessment of actors' influence could be achieved in future studies by using reputational and some "objective measures" in combination. A further challenge is the calibration of the raw data. As mentioned in Section 4.3.2., the existence of a benchmark value or theories that can guide the setting of qualitative anchors is important. Without any external reference, the calibration runs the risk of being purely data driven and arbitrary. For network and discourse measures, no external reference of that sort exists. Therefore, a group discussion with case experts could be beneficial to reach a common understanding of what constitutes high betweenness centrality or a rich discourse.

Another source of ambiguity arises with respect to actors. Most private actors in our sample are associations, unions or umbrella organizations. The difficulty arises with the assessment of their agency. How

should these particular organizations be conceptualized? Is it meaningful or possible to delineate the agency and for that matter the resources of such organizations from that of their members? Even though this may be analytically possible in many circumstances, how can it be empirically distinguished and analysed? It is well possible for two different umbrella organizations to hold a considerable extent of assets, yet the mobilization of these resources can be strongly dependant on their members' commitment. Especially in very large organizations such as the Swiss corporate union, it would not be realistic to envisage every member as sharing the same views and interests. Furthermore, for some members, a given issue might not be at the top of their agenda and therefore they would not show the same commitment as other members. This might, for instance, explain the relatively low score of the Swiss corporate union, which is known to have a much larger impact on other sectors, such as energy. Further studies should be more attentive to such organizations and the dynamics within to understand their agency better.

A further limitation that may be encountered frequently in QCA is the limited diversity: the presence of rows in a truth table with no empirical cases. These logical remainders cannot be avoided and are partly an artefact of the social world in which we live (Schneider and Wagemann, 2012). Not all the possible configurations we can think of in relation to a phenomenon are observed in reality. However, the abundance of logical remainders can limit the explanatory power of an analysis. In this study, material resources appear in all of the solution paths even though they cannot be acknowledged as a definite necessary condition due to the low consistency score of 0.78 (Table 3). This could be partly resulted from the limited number of cases analysed. For example, if there were a case with all conditions present except material resources, it would be easier to reach a conclusion about whether a sufficient path can exist without material resources. However, no matter how large the sample size is, it might still be that no actor exhibits this particular configuration.

Some of these questions can be answered to some degree by repeating an analysis in different contexts. The systematic conduct of case studies could help transfer such crucial insights across different contexts and contribute to theory development. Since the revision process, and the consultation procedure analysed in this study, is common in Switzerland, some of the findings might apply to other sectors, too. However, a more attentive and sound conduct of the analysis in other settings may not only help assess the generalizability of the findings but also unravel some additional unknown positive paths that may not have been observed in this study for the aforementioned reasons. Further analysis can also shed light on some of the unexpected findings. It would be interesting to investigate whether the condition *disc_betw* shows up in other contexts or whether it is likely to be an artefact of this particular study or flaws in its conceptualization or measurement. Aside from the policy processes in other settings, our approach can also be applied to contestations on normative and cultural-cognitive institutions. An interesting enquiry would be to compare how results vary and whether, for instance, discursive elements play a more prominent role than resources in the change of normative or cultural-cognitive institutions.

Finally, there are also contradictory cases that may be worth investigating in detail in a follow-up study. As can be seen from the first two rows of the truth table (see Table 4), there are cases with the same configuration yet with different outcomes. Due to this inconsistency, some of the cases that are member of the outcome are not explained by the solution path. Among these, cases nr.1 and 3 are relatively small organizations that specialize on certain waste streams such as construction waste or bio-waste. Further studies can address how these organizations manage to be influential despite their lack of larger material resources and thus uncover further potentially relevant factors for strong agency. While some of these inconsistencies (leading to unexplained cases) may result from the definition of conditions, data collection and their calibration, we also recommend that further studies use complementary methods to address this issue. For example,

Emmenegger (2010; 2011) conducted in-depth case studies with causal process tracing (Blatter and Haverland, 2012) to explain why Denmark did not adopt a high level of job security regulation like other Scandinavian countries, despite the fact that Denmark displayed all the conditions found to be relevant for this outcome. By applying causal process tracing, the important differences in the temporal occurrence of conditions in Denmark and Sweden that eventually led to the different outcomes were unravelled.

7. Conclusion

In order to have a deeper understanding of transition dynamics, we need to address the contestations around the institutions that underpin socio-technical systems and uncover the agency involved in the preservation, disruption or creation of these institutions. While agency has been getting a higher recognition in transition literature, a systematic analysis on why some actors exhibit stronger agency is missing. Recent studies looking into the institutional work practices within the context of transitions propose a promising line of research to tackle this problem. Yet, plenty of aspects need to be uncovered such as why actors conduct certain practices, how effective these practices are in different contexts and what enables actors to engage and perform these practices successfully. In this study, we make an initial step in addressing the latter point. Defining agency as the capability of actors to influence institutions, we conceptualize actors to impact institutions through institutional work practices (Lawrence and Suddaby, 2006) which requires mobilization of a variety of endowments. Hence, actors' endowments can be critical for their influence on institutional structures. In an earlier study (Duygan et al., 2019), we deduced three categories of endowments: resources, social networks and discourses. In the current study, to uncover the relative importance of these categories, we operationalized two endowments from each category and determined the configurations associated with actors' influence on formal institutions in Swiss waste management.

The results show that several configurations of endowments are pertinent for a major influence and some types of endowments are more prominent than others. We found resources, especially non-material ones to be necessary yet not sufficient, as they either have to be supplemented by a strong activity and embeddedness in social networks or a high embeddedness in networks along with a discourse that utilizes a variety of concepts to strengthen the arguments made therein. The findings suggest that resources have primary importance for strong agency followed by networks and discourses. More precisely, the results suggest that having strategic positions in collaboration networks (such as bridging actors that are otherwise not linked) may be more effective than the number of ties an actor has initiated. As to discourses, the abundant use of different concepts was found to be much more prominent than holding moderate policy beliefs, which are displayed as high betweenness centrality in discourse networks. Those insights about the ingredients of strong agency can also be instrumental for the strategy development and empowerment of niche actors.

As we elaborate in the paper, we argue that the solution paths we uncovered may well be conditioned by the particularities of the empirical setting. The way consultation process was run might have favoured certain forms of institutional work (i.e. covert forms such as lobbying) and thus make the set of endowments required for these practices more prominent. To test these claims and the effect of contextual factors, further studies can be conducted in different sectoral, political or organizational settings. Also, in-depth case studies can be run to uncover the link between different practices, the endowments required and how they are obtained by actors. We believe the analytical approach we present can facilitate conducting systematic analyses that can reveal generalizable insights valuable for building or revising theories on agency and its determinants.

Author statement

Mert Duygan: Conceptualization, Methodology, Formal Analysis, Investigation, Writing – Original Draft, Writing – Review & Editing, Visualization

Michael Stauffacher: Resources, Writing – Review & Editing, Supervision, Project Administration, Funding Acquisition

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Declaration of Competing Interest

The authors have no conflict of interests to declare.

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Supplementary materials

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