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Investigating Science-Policy Interfaces in Japanese Politics through Climate Change Discourse Coalitions of an Environmental Policy Actor Network

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How is science advice integrated in environmental policymaking? This is an increasingly pertinent question that is being raised since the nuclear catastrophe of Fukushima, Japan, in 2011. Global re-evaluation of energy policies and climate mitigation measures include discussions on how to better integrate science advice in policymaking, and at the same time keeping science independent from political influence. This paper addressed the policy discourse of setting up a national CO2 reduction target in Japanese policymaking between 2009 and 2012. The target proposed by the former DPJ government was turned down, and Japan lacked a clear strategy for long-term climate mitigation. The analysis provides explanations from a quantitative actor-network perspective. Centrality measures from social network analysis for policy actors in an environmental policy network of Japan were calculated to identify those actors that control the discourse. Data used for analysis comes from the Global Environmental Policy Actor Network 2 (GEPON 2) survey conducted in Japan (2012-13). Science advice in Japan was kept independent from political influence and was mostly excluded from policymaking. One of the two largest discourse coalitions in the environmental policy network promoted a higher CO2 reduction target for international negotiations but favored lowering the target after a new international agreement would have been set. This may explain why Japan struggled to commit to long-term mitigation strategies. Applying social network analysis to quantitatively calculate discourse coalitions was a feasible methodology for investigating "discursive power." But limited in discussing the "practice" (e.g. meetings, telephone, or email conversations) among the actors in discourse coalitions.

Keywords: science-policy interface, environmental policy networks, discourse coalitions, CO2 reduction, Japan

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Introduction

The purpose of this paper is to provide basic understanding of what science advice to government is, what kind of issues relate to it, and argues for the means of analyzing discourse coalitions within science-policy interfaces. In short, giving science advice is a communicative act ("speech-act"), and its language, timing, and audience are key features for its impact in policymaking. The field of environmental policymaking relies particularly on science advice because climate change is a contested issue accompanied by many uncertainties. Diverse interests of stakeholders ranging from environmental NGOs to business corporations challenge policy planners to negotiate long-term climate mitigation goals. Hence, scientific evidence is a crucial tool for state and non-state policy actors to formulate reliable policy proposals because environmental science constitutes a powerful and legitimate form of discourse in environmental policymaking (Hajer, 2006).

Negotiating long-term CO2 reduction targets between multiple stakeholders in environmental policymaking takes time. While most European governments have consensus about their long-term goals, other countries like Japan have ongoing political debates without a clear long-term strategy (Wuppertal Institut & Institute of Energy Economics, 2018). The science-policy interface in Japanese environmental policymaking may explain this. For example, even though the Science Council of Japan defined Codes of Conduct for government science advice, and the Council for Science, Technology and Innovation provided guidelines for policy planners how to integrate scientific evidence into policy formulation, the regulatory system received much criticism for being dysfunctional after the 2011 Fukushima nuclear disaster. This raised the question of the role science advice played between the years 2009 and 2012. Operationalizing this question was the goal of this paper.

As governmental decisions are not solely based on scientific evidence, science advisers are one group of many actors within the policy community. Ideally, policy planners and decisionmakers include expert advice in the formulation of policy proposals and take many interests into account. Because of its discursive nature, discourse analysis in policy studies are one way to approach the question on how scientific advice is used in political decisionmaking. However, the limitation of discourse analysis for understanding the interaction of policy actors in negotiating policies required another layer of analysis to operationalize the proposed research question. Therefore, the practical layer of communicative interaction between actors was analyzed through discourse coalitions.

2011 was a crucial year for global environmental and energy policies, and Japan among other countries had to re-evaluate its basic energy policy strategies. Analyzing discourse coalitions in Japanese environmental policymaking through a science-policy interface provided insights into the policy negotiation process for climate mitigation measures. The analysis of the role of science advise offered an argument to the above described observation that Japan seemed to be undecided on a clear climate mitigation strategy.

Data for analysis comes from the second round of the Global Environmental Policy Actor Network (GEPON 2) survey conducted in Japan between 2012 and 2013. The purpose of the survey among

policy actors was to identify the information sharing, and support and cooperation network of environmental and energy policy actors after Fukushima. The analysis focused on the political debate about the CO2 reduction target which the government of Japan proposed in 2011 after Fukushima. This identified discourse coalitions based on the attitude towards this issue among policy actors, and highlighted the location of science advisers in the policymaking network in the overall debate.

The paper starts with discussing basic characteristics about advisory policymaking and science-policy interfaces, and illustrates the theoretical framework of discourse coalitions. It continues with investigating science-policy interfaces in Japanese environmental policymaking, describing methods and data to empirically investigate the integration of scientific advice in a policy network through the constructivist lens of discourse coalitions on contested issues in environmental policymaking: decarbonization of energy systems and long-term national CO2 reduction targets. Lastly, it confers results and final conclusions for the implications of this research for the overall research question on how science advice was integrated the policy discourse for CO2 reduction targets.

Science Advice to Governments

Defining Science Advice and its Regulatory Process.

Science advisers are one group among many stakeholders in policymaking processes amongst policy planners, law makers, industry, NGOs/NPOs, and other vested interest groups (UNDESA, 2015). Scientific advice to governments is timely political advice giving through advisory systems provided by scientists and experts based on trustworthy evidence and research; it is the integration of scientific knowledge in policymaking processes (Horton & Brown, 2018). Furthermore, its impact depends on "how it is formulated and communicated as well as how it is perceived by its target policy audience and by other interested parties" (OECD, 2015, p. 5).

Nowadays, science is asked to take a more active role in politics. Ideally, the advisor takes no sides, or even offer an opinion (Arimoto, Sato, Matsuo, & Yoshikawa, 2016). However, while other stakeholders may be inherently political in nature, a better integration of science in policymaking should not lead to a "politicization of science." The best interest of the public is that science advice is to be kept independent from ideological influence or pressure from authorities (Arimoto et al., 2016).

Policymaking consists of multi-layered networks of multiple and diverse stakeholders that interact with each other (Marsh & Smith, 2002; Sabatier & Jenkins-Smith, 1993). With the increased number of stakeholders and interest groups in policymaking as well as the growing complexity of climate crises existing advisory systems to governments which are in process of change, actors have to improve their communication skills to successfully integrate their expertise in policymaking. Thus, science advisers are advocates for science. Cairney and Kwiatkowski (2017) called this "evidence advocacy."

Accessibility to national advisory systems depend on established socio-political institutions. Access to the network which means having access to the resources of the network, is easier for non-state actors in some countries than in others (Schreurs, 2002). The form of collaboration is subject to balancing interests "which can affect the framing of questions, the selection of experts or the provision of funding" (OECD, 2015, pp. 11-12). Traditional non-linear understandings of policymaking in which a small elite group is in control of policymaking does not apply anymore (Cairney & Kwiatkowski, 2017), because policymaking and its advisory processes have grown more complex. (The concept of the non-linearity is revisited in the next section describing the model of a science-policy interface.) In response to these changes, the OECD provided guidelines for actors on how to provide effective advice (Box 1.1):

Box 1 *OECD Guidelines for effective and trustworthy science advisory processes*

1. Have a clear remit, with defined roles and responsibilities for its various actors. This includes having:
   a. A clear definition and, insofar as is possible, a clear demarcation of advisory versus decision-making functions and roles
   b. Defined roles and responsibilities and the necessary expertise for communication
   c. An ex ante definition of the legal role and potential liability for all individuals and institutions that are involved
   d. The necessary institutional, logistical and personnel support relative to its remit.
2. Involve the relevant actors – scientists, policy-makers and other stakeholders, as necessary. This includes:
   e. Using a transparent process for participation and following strict procedures for declaring, verifying and dealing with conflicts of interest
   f. Engaging all the necessary scientific expertise across disciplines to address the issue at hand
   g. Giving explicit consideration to whether and how to engage non-scientific experts and/or civil society stakeholders in framing and/or generating the advice
   h. Having, as necessary, effective procedures for timely exchange of information and co-ordination with different national and international counterparts.

3. Produce advice that is sound, unbiased and legitimate. Such advice should:
   i. Be based on the best available scientific evidence
   j. Explicitly assess and communicate scientific uncertainties
   k. Be preserved from political (and other vested-interest group) interference
   l. Be generated and used in a transparent and accountable manner.

(OECD, 2015: 8)

A regulatory system usually contains established protocols of advisory processes and for the integration of evidence in policymaking. Broadly speaking, such systems contain four types of

actors or institutions: 1) science policy advisory committees or councils, 2) permanent or ad hoc scientific/technical advisory structures, 3) academies, professional societies and research organizations, and 4) individual scientific advisers and counsellors (OECD, 2015, pp. 13-16). Each advisory institution contains a sub-set of policy actors that form coalitions based on interests, belief-systems, and goals (Sabatier & Jenkins-Smith, 1993; Tsebelis, 2002).

Establishing roles of science advisers and decisionmakers differs between political fields (Arimoto et al., 2016). Depending on the issue science is either used as a tool to justify strategic proposals or policies, or scientists themselves are part of the process (Montpetit, 2003). Put simply, science is either outside of the process and non-participatory or participating and actively influencing the policy discourse (Montpetit, 2003).

Communicating science comes with fallacies and poses a challenge for scientific advisers to establish an influential and effective role in policymaking networks that other stakeholders or interest groups are not concerned about, since science advice is supposed to be un-opinionated and neutral when providing evidence about complex issues. Are those who give science advice to be held responsible and liable for their advice? In case of the L'Aquila earthquake of 2009 in Italy, the prosecution of a group of scientists answered this question with yes. It was argued that the escalation of the 2011 nuclear catastrophe in Fukushima, was caused by failed communication between experts and decisionmakers (Omoto, 2013; Thatcher, Vasconcelos, & Ellis, 2015). Eventually, "Codes of Conducts" for political science advisers were revised shortly after the Fukushima disaster (Science Council of Japan, 2013) as well as guidelines on the integration of science advice in politics for the political audience were formulated (Cabinet Office of Japan, 2016).

Science-Policy Interface.

As explained above, a science-policy interface is the process of integrating scientific investigation into political debate (Horton & Brown, 2018). For example, the Intergovernmental Panel on Climate Change (IPCC) is the "scientific body" to the United Nations Framework Convention on Climate Change (UNFCCC). Its main function is to "provide the world with a clear scientific view on the current state of knowledge about climate change and its potential environmental and socio-economic impacts" (IPCC, 2018). In this role, the body is a knowledge broker for policy options, therefore it is a political institution. For instance, it was argued that the ineffectiveness of the Kyoto Protocol was a result of its original formulation by political leaders (Helm, 2012). That is, it was a political decision that ignored scientific evidence on the required degree of climate mitigation, the technical potential and was not effectively implemented. Hence, a disregard of climate science may decrease the likelihood of effective mitigation policies (Brueckner & Horwitz, 2005).

The selection of evidence and integration of advisers is guided by interests, goals, and core belief-systems of stakeholders that rely on scientific input to formulate their strategic papers or policy proposals. That is the framing of questions or problems that define the narrative of the advice and discourse in the issue-oriented policy community. In a traditional regulatory model (Figure 1) science reacts to social, political, or economic demands while creating scientific evidence from an

independent, and neutral standpoint without being influenced by values or beliefs that are attached to policy needs for the policy community as a whole.

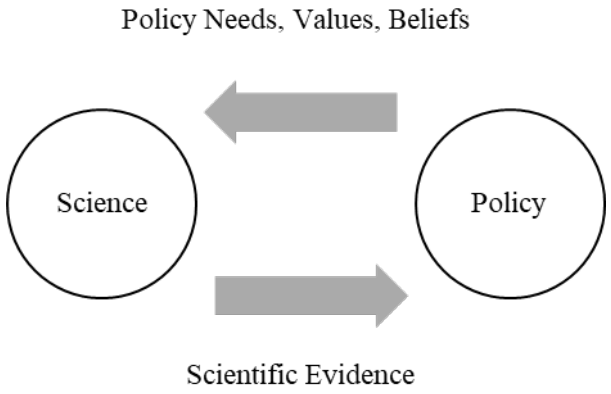


Figure 1. Bi-modal Linear Science-Policy Interface.

A Science-policy interface takes on different shapes and sizes. In an integrative model, science is not only asked to be more proactive with their own values and belief-system (Figure 2), but it creates diverse and multi-layer coalitions between sub-sets of actors who share the same values and beliefs within the policy community on contested issues. Such an integrative model describes a "circular" relationship between science and policy (UNDESA, 2015). Through the reciprocal interaction between various stakeholders, scientific expertise is not only used by decisionmakers, but scientific experts become influential actors in policymaking themselves.

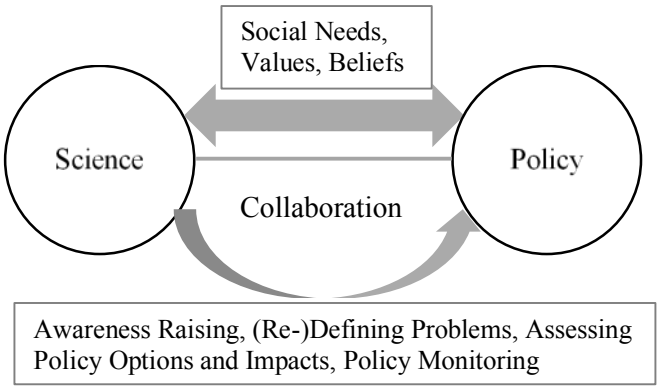


Figure 2. Integrative Science-Policy Interface.

Skilled communicators in the framing and problem setting phase in advisory processes set the tone for successful advice giving. Format of the advice, its language, and timing are keys to focus attention on the issue and its desired outcome by the policy community (UNDESA, 2015). The diversity of groups within science-policy interfaces such as the IPCC makes full penetration across all different standpoints in policy negotiations unlikely, and in most cases, evidence produced is specific to a discourse group within the policy community.

Cognitive filters are set in place for selecting and interpreting scientific evidence within a framed issue. Caverni and Peris (1990) called this information filtering process a form of "anchoring-adjustment" that is a strategy used by experts in complex decisionmaking processes in an information rich context. To reach a conclusion upon an issue, experts start from an "initial value that is adjusted to yield the final answer" (Caverni & Peris, 1990, p. 35). They create a cognitive anchor that helps to understand the problem and evidence provided to find a solution. The anchor may be defined by values, and beliefs, but the framing of the problem is just as important for the decisionmaking process, and influences the outcome (Caverni & Peris, 1990).

The framing of an issue and advice for solutions is a collective discursive action of a group that operates within a shared set of interests. Strategic use of evidence by a discourse coalition influences the impact in policy outcomes. However, assessing the impact of science advice is difficult and, in many cases, not possible (OECD, 2015). The analysis in this paper is a contribution to this underdeveloped field in policy research on how to assess the role of science in policymaking, more specifically, in environmental policymaking in Japan.

Theoretical Concept of Discourse Coalitions in Environmental Policymaking and Framing of Governmental Science Advice

As explained above, advice giving is a speech-act in policy negotiations between stakeholders. The identity of influential advisers determines which discourses are dominant. Because formulation of policy proposals is a group activity, the framing, and understanding of problems is dependent on the members of a discourse group, Lejano, Ingram and Ingram (2013) argued that understanding the narrative of a network means to understand the network itself.

Impact of scientific advice is difficult to measure (OECD, 2015). It depends on language, timing, and whether the advice was given to an influential coalition within the bigger policy community of a problem (Cairney & Kwiatkowski, 2017). Actors' interests, values, and goals determine how they perceive, interpret, or how they use scientific findings and evidence in decisionmaking. For this, narrating climate change science is important.

A discourse coalition is an informal, temporary set of actors who share "the usage of a particular set of story lines over a particular period of time" (Hajer, 2006, p. 70). Here, discourse is understood as "an ensemble of ideas, concepts, and categories through which meaning is given to phenomena, and which is produced and reproduced through an identifiable set of practices" (Hajer, 2006, p. 70). Examples are found in the annual COP negotiations under the IPCC where temporary "negotiating groups," or "climate clubs" establish based on shared interests and goals in order to

envoke more influence by combining intellectual and material resources (Gampfer, 2016). Hajer (2006) proposed that in policy studies analyzing discourse coalitions enables us to identify the influence of the discourse, hence, the influence of the group that produces that discourse.

The influence of a discourse coalition can be identified through "discourse structuration," that is the phase in which a discourse begins to dominate, and "discourse institutionalization," that is the solidification of that discourse in an institutional arrangement (Hajer, 2006). But before a discourse starts to dominate a "discursive struggle" has to occur (Humphreys, 2009) in which discourse coalitions compete for "discursive hegemony" in which actors try to secure support for their definitions of reality (Hajer, 1995). The structuration of a discourse depends on the credibility and accountability of trust invested in the storyline as well as the discourse coalition (Humphreys, 2009). Whether an informal discourse coalition transforms into formal networks, that is the institutionalization phase such as seen in advocacy networks, may depend on the discursive power of actors in the coalition (Keck & Sikkink, 1998).

Scientific evidence is a significant source of power and discourse defining in environmental policymaking because it facilitates the clarification of interests (Litfin, 1994). Coalition formation studies argue that knowledge exchange is an independent variable in explaining dominant policy discourses (Hajer, 1995, Humphreys, 2009). The underlying assumption is that those policy actors who have more connections to science experts than others are controllers of dominant policy discourses.

Science-Policy Interfaces in Japan: Long-term Policy Planning versus Crisis Situation

Long-term Policy Planning.

Even though governments are expected to transfer international agreements under the IPCC into domestic policies, such agreements are not legally binding for their ratifying countries. For instance, the government of Japan implemented the Global Warming Countermeasures Promotion Act under which governmental institutions are instructed to develop their own GHG emission reduction plan: "In 2012, Japan implemented the Low-Carbon City Promotion Act aimed at cross-sectoral emissions reductions through the development of low-carbon, resource-efficient urban infrastructures. The City Act provides tax breaks and subsidies to certified energy-efficient buildings, appliances and systems, helping to reduce energy consumption and prepare low-carbon city development plans." Keidanren, Japan's major business federation, established a Commitment to a Low Carbon Society. Despite such measures, Japan remains a major greenhouse gas emitting country (OECD), and its main energy sources are fossil fuels (Figure 3) which the country is importing on a rate of almost 90% (Table 1).

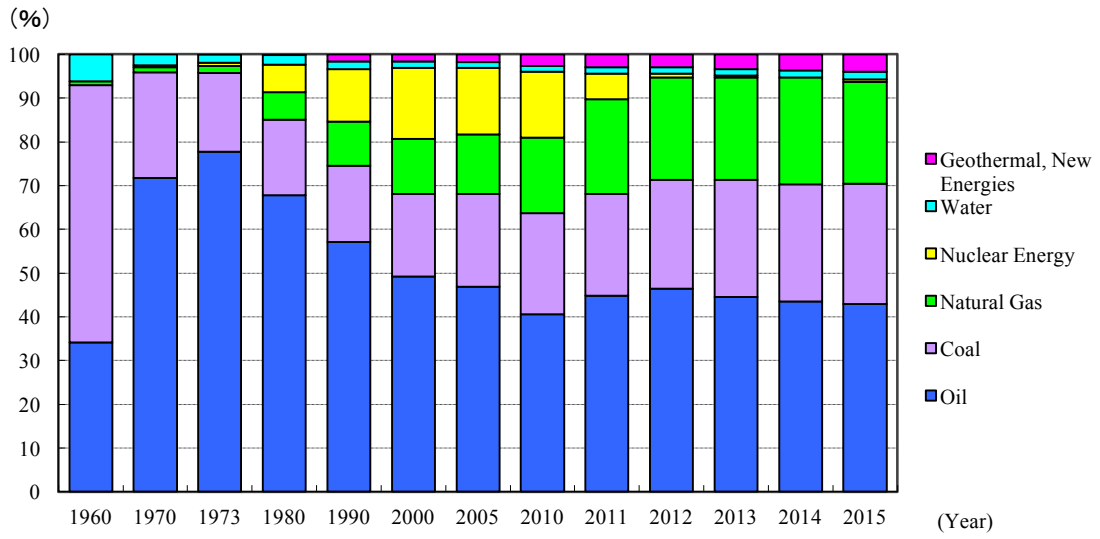


Figure 3. Japan's Primary Energy Supply (%) (METI, 2016).

Table 1.

Japan's Energy Self-Sufficiency Rate (%)

Year	**1960**	**1970**	**1973**	**1980**	**1990**	**2000**	**2005**
Energy Self-Sufficiency Rate(%)	58.1	15.3	9.2	12.6	17.0	20.2	19.1
	2005	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
	19.1	19.9	11.1	6.2	6.1	6.0	7.0

Source: METI (2016)

Japan leads in the development and export of low-carbon energy efficient technologies that the country has developed since the 1960s, combatting its post-war economic growth environmental pollution problem which is known as the Growth-Environment dilemma (GE) (Broadbent, 1998). Japan also invests in projects with cooperating international partners to implement new technology systems in regions with less technical know-how, fewer resources and government funding. Based on the Cancun Agreement of COP16 (2010) where UNFCCC member states agreed to develop new market mechanisms in preparation for COP17 in 2011, the government drafted the Bilateral Offset Credit Mechanism (BCOM) in cooperation with the Ministry for Economy Trade and Industry (METI) and the Ministry for Environment (MOE). The government appointed the New Energy and Industrial Technology Development Organization (NEDO), a national research institute, to conduct feasibility studies in cooperating countries for example Indonesia, India, Vietnam, Thailand, Malaysia, South Africa, Poland, Russia, and Turkey to strengthen the value of this proposition. The studies established "methodologies for assessing business prospects for dissemination and transfer of low carbon technologies, evaluation techniques of emission reduction effects" (NEDO, 2012).

The government of Japan promotes such cooperation between ministries. However, METI and MOE are in constant competition over resources and dominance over domestic environmental policy strategies. Issues on energy dominate environmental policies, and METI determines energy policy decisions. Even though the LDP government was placed in the opposition between 2009 and 2012, its strong ties to METI, industries, and government bureaucracy remained, and the former DPJ government during this time could not enforce more ambitious CO2 reduction targets than what the party tried in 2011. Upon the Fukushima nuclear catastrophe with large-scale global impact on the re-assessment of nuclear energy and energy policy instruments, climate mitigation target propositions and mechanisms in preparation for COP17 were re-evaluated as well.

For long-term policy planning, advisory systems to policymaking in Japan are vertically structured (Figure 4). Each sub-set of governmental bodies have their own advisory process of "framing the issue," "selecting advisers," "producing advice," and "communicating advice" (OECD, 2015). The dynamic between national research institutes and policy planners or decisionmakers created an advisory structure of "regulatory science" (Arimoto et al. 2016). Central governmental scientific advisory organizations in Japan such as the Science Council of Japan and the Council for Science, Technology and Innovation have the formal function of the main regulatory government science advisory boards. However, research for this paper showed that they were limited in their functionality and effectiveness.

For daily policymaking, national research institutes are under the jurisdiction of their main funding ministry. In case of NEDO, the institute is part of the main advisory boards for METI. The main advisory organization for MOE is the National Institute for Environmental Studies (NIES).

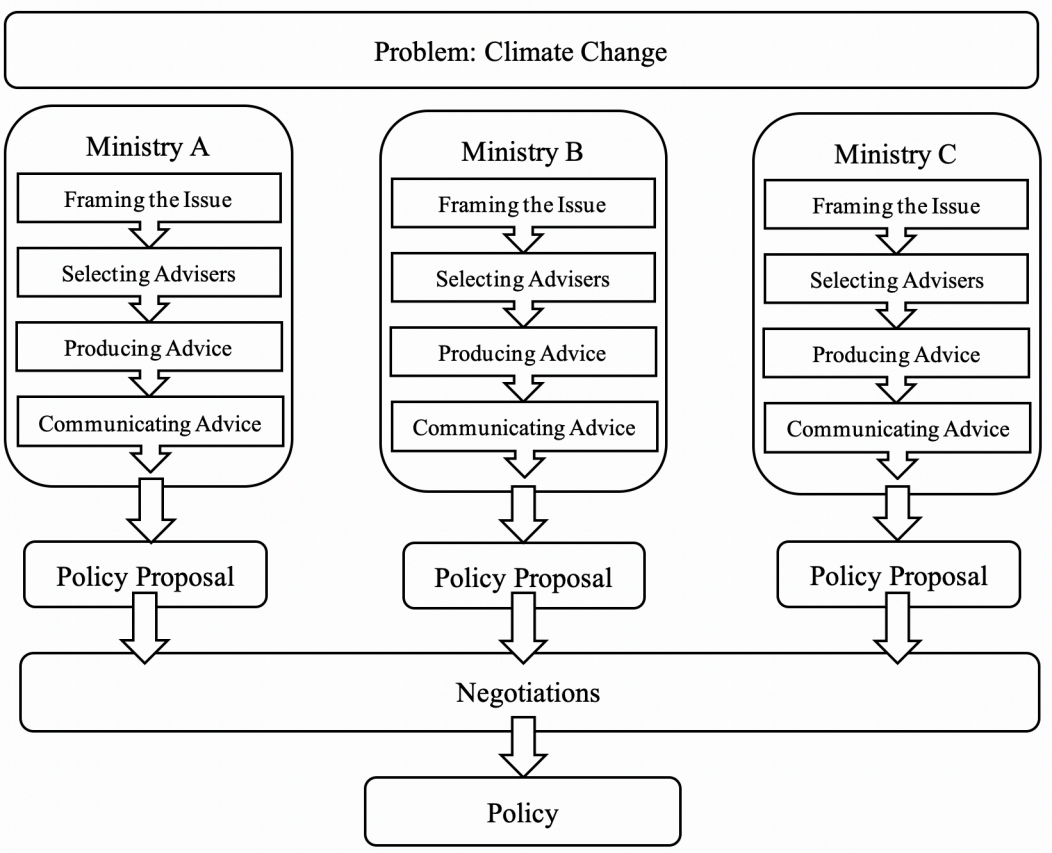


Figure 4. Multi-layered Science Advisory Processes to Governments.

Crisis Situation.

The nuclear catastrophe in Fukushima in March 2011 turned attention to significant weaknesses of the role of expert advice in decisionmaking processes. From a "policy for science" perspective, the Science and Technology Policy Basic Plan shifted, and more weight was put on demand-driven, solution-oriented topics (Arimoto et al., 2012). From a "science for policy" perspective a disregard of scientific evidence for disaster management preparedness of government officials showed poor judgment in decisionmaking on how to handle the situation in the nuclear powerplant (Omoto, 2013). Therefore, a weak linkage in the science-policy interface in a crisis situation was identified as a cause for the escalation of the nuclear crisis in Fukushima (Omoto, 2013; Takao, 2016; Thatcher, Vasconcelos, & Ellis, 2015). This instigated global re-evaluation of science advice to governments, and mechanisms of science-policy interfaces.

Surprisingly, scientific advice in policy processes was not a major theme in Japan until the Fukushima disasters (Sato & Arimoto, 2016). Moreover, the lack of information sharing in a crisis situation and the selected sharing of information based on personal relationships lead to a critical

view towards scientific experts and questioned the reliability of scientific knowledge (Arimoto et al., 2016).

To operationalize the question about how science advice is integrated in policymaking, this paper investigates a specific case by looking at an environmental policymaking network of Japanese policy actors by analyzing survey data from an elite interview survey (J-GEPON2) conducted in Japan 2012/13. In more detail, the paper operationalized the following question to contribute to research about science advice in policymaking, and why Japan struggles to set long-term climate mitigation strategies: How are science experts integrated in the environmental policy attitude and discourse coalitions of the 2011 policy proposal for COP17 to define a 25% CO2-reduction target of the 1990 base level?

Methodology

Discourse Coalitions as Social Networks & Science Adviser Types.

Investigation of discourse coalitions in a Japanese environmental policy actor network used analytical tools from social network analysis. Similar to Okura et al. (2016) centrality-measures for environmental policy actors were calculated. Centrality-measures allowed to identify influential actors in the environmental policymaking network who hold discursive power. The two centrality-measures were "degree centrality" and "betweenness centrality." Degree centrality measured how important an actor is based on the average number of connections. Betweenness centrality measured how important an actor is based on a brokerage-function. This means that the actors with high betweenness centrality often control information in the network (Morgan, 2017). The calculations were done in RStudio using the R script template as used in Okura et al. (2016) provided by Kobashi.

The purpose of centrality-measures is to calculate the influential power of policy actors, and social network analysis offers different kinds of such centrality-measures. Degree centrality and betweenness centrality are two of these varying centrality-measures. In general, both measured influential power, however, they varied in terms of what kind of influence is measured and how they were measured. Therefore, the values that are discussed in the results section also differ.

Degree centrality (degree average) measured actors' influence in the network by the accumulated number of relationships an actor had. The analytical package iGraph used in RStudio scaled the number of relationships from 0 to 1. This means, that the actor with the highest degree centrality had a degree centrality of 1, and every other actor's centrality was the fraction of its degree compared with the actor with the highest degree centrality (Golbeck, 2015).

Considering the role of science advisers to bridge the science community with policymaking as explained above, betweenness centrality was calculated because it measured the importance of an actor based on its role to allow information to pass through it into the network; that is a brokerage-function (Golbeck, 2015; Morgan, 2017). The value of betweenness centrality differed from that

of degree centrality as it was calculated differently because, in iGraph, the value of betweenness centrality is a numeric value with the score for each actor that is calculated through the sum of the fraction of all pairs of nodes by the shortest path that goes through the specific actor for which the betweenness centrality is calculated (Csardi, 2015).

Data Source: GEPON 2 Japan Survey.

This paper analyzed data from the second round of the Global Environmental Policy Network (J-GEPON 2) survey data to answer the question about the role of science advice in environmental policymaking networks. More precisely, it looked into where science experts were located in discourse coalitions about the 2011 policy debate about the proposed 25% national CO2 reduction target in Japan in preparation for COP17 negotiations.

The survey was undertaken in Japan between December 2012 and June 2013. Table 2 shows the proportion of the organization category (target population) and their response rates. From a total of 172 organizations 107 responded, which makes a response rate of 62.2%. From these 107, 77 were valid responses for plotting discourse coalitions. Not all 107 respondents replied sufficiently to the information exchange network questions in the survey. Therefore, list-wise deletion was performed reducing the number of cases for the discourse coalition analysis.

The determination of the target population of "organizations that influence policies regarding global warming" for the J-GEPON 2 surveys underwent a series of steps in the research process (Okura et al., 2016). In other terms, it was not random sampling, but an established procedure to identify relevant actors. The following indicators were selected to verify the selection: a) government agencies participating in national and international policy formation, b) actors involved in implementing national policies for the reduction of industrial greenhouse gas emissions, and c) actors, NGOs and mass media participating indirectly in policies aimed at reducing greenhouse gas emissions.

Table 2

GEPON 2 Japan Target Organization Category and Response Rates

Organization Category	**J-GEPON 2 Target Population (N)**	**J-GEPON 2 Responses (N)**	**J-GEPON 2 Response Rate (%)**
Governmental Body	23	17	73.9
Incorporated Administrative Agency	9	8	88.9
Political Party	7	6	85.7
Business Organizations	19	15	78.9
Economic Corporations	41	21	51.2
NGOs	19	12	63.2
Foundations	30	15	50
Mass Media	13	6	46.2
Other	11	7	63.6
Total	**172**	**107**	**62.2**

GEPON 2 Japan.

Adviser Type-Adjustment.

The J-GEPON2 target population did not distinguish science adviser categories in the actor classification listed in the table above. Therefore, based on the type-adjustment procedure of actor classifications developed for this research, the sample population (N=77) for analyzing discourse coalitions included eleven national research institutes for climate change, energy and the environment, and three innovation centers that provide research and evidence services on a broad scale on environmental, social, and economic issues in the sampled network.

In the landscape of Japan's science-policy interfaces, three distinct types of science advisers were identified: universities, national research institutes, and innovation centers (NISTEP, 2019). The legal status of national research institutes in Japan are forms of independent administrative corporations, incorporated administrative agencies or special corporations under civil law. Innovation centers are typically organizations from the private sector. For example, R&D, private research institutes, or corporations. The adjusted actor types for the J-GEPON2 population developed through the studies by the National Institute of Science and Technology Policy

(NISTEP) is broad, for it includes many kinds of organizations that differ in legal status, size, budget, or objective. In the study by NISTEP, universities and national research institutes were grouped together. Building on this, the analysis in this paper focuses on the two types national research institute and innovation center. Further research is proposed to distinguish these types more concisely in order to draw out the complexity of the environmental policy actor landscape in the context of the integration of science advice in policymaking.

Survey Questions used for Analysis.

In light of negotiations among member states to UNFCCC at COP17 (Durban), December 2011, the Japanese government proposed a CO2 reduction target of 25% by 2020 of the 1990 base year, that eventually was turned down. Taking the communication network of the sampled environmental policy network as a whole as basis, the following questions from the survey were used to extrapolate and analyze discourse coalitions on the COP17 related policy discourse among Japanese environmental policy actors.

To calculate centrality measures, questions 7 and 8 in the survey, that asked about information sharing and communication relationships among the actors, were analyzed. From the responses incoming relations of the sample of environmental policy actors was used to identify important actors in the network.

For identifying the narrative, actors' political attitudes toward national CO2 reduction was used. Interviewees were asked in question 37 to choose between the following statements about the proposed reduction target: 1) regardless of the establishment of the new climate change framework, Japan should follow its reduction target, 2) only when the new climate change framework has been established should Japan follow its reduction target, 3) Japan should lower its target after the new climate change framework has been established, 4) regardless of the new climate change framework, there should be no reduction target, 5) no interest.

Analytical Steps.

The first step was to calculate centrality measures of the communication network to identify actors who could potentially influence the policy discourse (communication network). The second step was to identify the political attitude of environmental policy actors in the J-GEPON2 population regarding the CO2 reduction target proposal by the Japanese government in relation to their discursive power followed by grouping the actors according to their attitude towards a national CO2 reduction target in relation to a new international agreement.

Results

Centrality Measures: Discursive Influence in Environmental Politics.

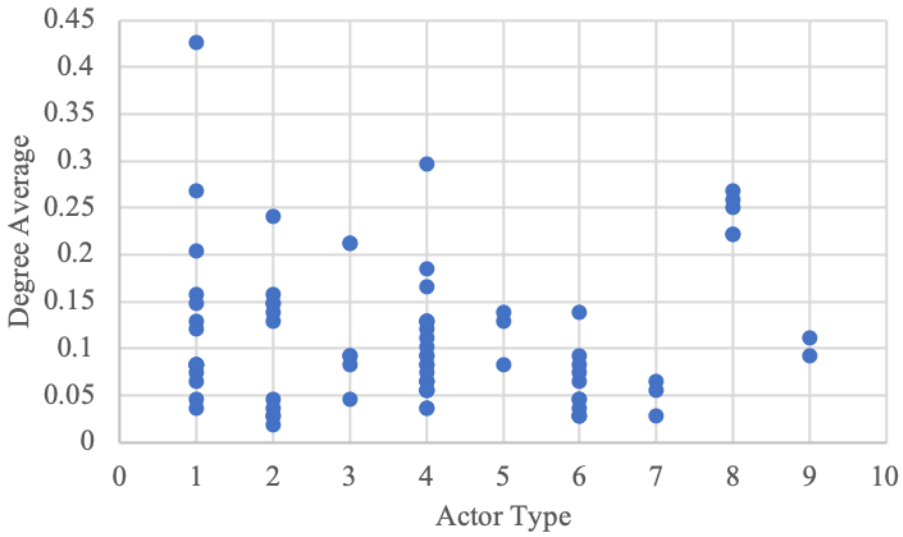
Given the environmental policy network as unit of analysis, MOE Global Environmental Bureau had the highest degree average (0.42593) and betweenness centrality (1,068.98). This in turn

means that MOE was the information hub and controlled the overall policy discourse among environmental policy actors. The second most important governmental body was the Industrial Science and Technology Policy and Environment Bureau of METI. Its degree average (0.26852) and betweenness centrality (583.01) showed the ministry was roughly half as influential as MOE. The degree average of policy actors' integration in the discourse coalition is summarized in Figure 5.

NIES, the national research institute under MOE, was the most influential science adviser. But its betweenness centrality showed that the institute's brokerage, or advisory, function in terms of disseminating information into the network was less than half of METI's. The degree average of NIES was 0.24074, but its betweenness centrality was only 223.83. NEDO, the national research institute under METI, had a surprisingly weak position in the network with a degree average of 0.14815, and a betweenness centrality of 4.71. The remaining nine national research institutes of a total of eleven had a degree average lower than 0.12, or even 0.02. The position of the innovation center Mitsubishi UFJ Research and Consulting (degree average of 0.12963, and betweenness centrality of 0.36), or Mitsubishi Research Institute (degree average of 0.13889, and betweenness centrality of 0) in the network were negligible.

The former DPJ (in government during data collection) and the LDP were identified as being equally influential with a 0.21296 average degree centrality in the network. Surprisingly, while the DPJ did have an important brokerage position with a betweenness centrality of 210.4, the LDP did not have any measurable betweenness centrality.

The distribution of discursive power in the environmental policy network between governmental bodies showed that few were significantly more powerful (>0.2). National research institutes were mainly divided between two groups, and the differences between their influence in the policy network was rather large. NGOs/NPOs and foundations were relatively weak in the discourse coalitions. Details about the distribution of the discourse coalitions is explained in the next section.



1: Govern-mental Body	2: National Research Institute	3: Political Party	4: Business/ Industry	5: Innova-tion Center	6: NGO/ NPO	7: Founda-tion	8: Mass Media	9: Voluntary Associ-ation

Figure 5. Degree Average by Actor Type of the Japanese Environmental Policy Actor Network

Political Attitude of Actors in Environmental Policy Discourse Coalitions.

The two largest discourse coalitions were DC (1) with 26 actors, and DC (3) with 25 actors.

DC (1) was the group of actors who favored a more stringent CO2 reduction target and clear long-term strategy as proposed by the DPJ, and for Japan to be more proactive in following climate mitigation targets without waiting for a new international agreement under the UNFCCC. In terms of actor types, the most organizations present in DC (1) were NGOs/NPOs. Generally, the actor landscape of DC (1) was diverse. However, innovation center were not part of the group.

The actor landscape of the second largest group, that is DC (3) who do not want higher CO2 reduction targets, and even promote to lower the target after a new international agreement had been set, also consisted of a diverse set of actors. While DC (1) was dominated by NGOs/NPOs, DC (3) was dominated by business corporations. And while innovation centers were not part of DC (1), they were evenly distributed between DC (3) and DC (2). The innovation centers also revealed that they had a more passive stance towards climate mitigation targets as well. National research institutes were distributed between DC (1), DC (2), and DC (3). Interestingly, a group of national research institutes did not reveal a political opinion, which is reflected in DC (5).

In summary, the actor landscape for each discourse coalition was as follows:

- **Discourse coalition (1):** Regardless of the establishment of the new climate change framework, Japan should follow its reduction target (26)
- **Discourse coalition (2):** Only when the new climate change framework has been established should Japan follow its reduction target (11)
- **Discourse coalition (3):** Japan should lower its target after the new climate change framework has been established (25)
- **Discourse coalition (4):** Regardless of the new climate change framework, there should be no reduction target (5)
- **Discourse coalition (5):** No interest (12)

Table 3 below shows the actor landscape per discourse coalition by organizational category in more detail.

Table 3

Number and Type of Actors per Discourse Coalition

Actor Type	DC (1)	DC (2)	DC (3)	DC (4)	DC (5)
Business Association	0	0	3	0	0
Business Corporation	1	1	7	2	0
Foundation	3	2	3	0	1
Governmental Body	3	1	1	0	3
Industry Association	1	1	3	3	0
Innovation Center	0	2	2	0	0
Mass Media	2	0	1	0	2
National Research Institute	3	2	3	0	4
NGO	8	0	1	0	2
Political Party	3	2	1	0	0
Voluntary Association	2	0	0	0	0
Total	26	11	25	5	12

Figure 6 summarizes the discursive power of the discourse coalitions showing that the power distribution over the environmental policy discourse in 2011 was distributed between varying discourse coalitions.

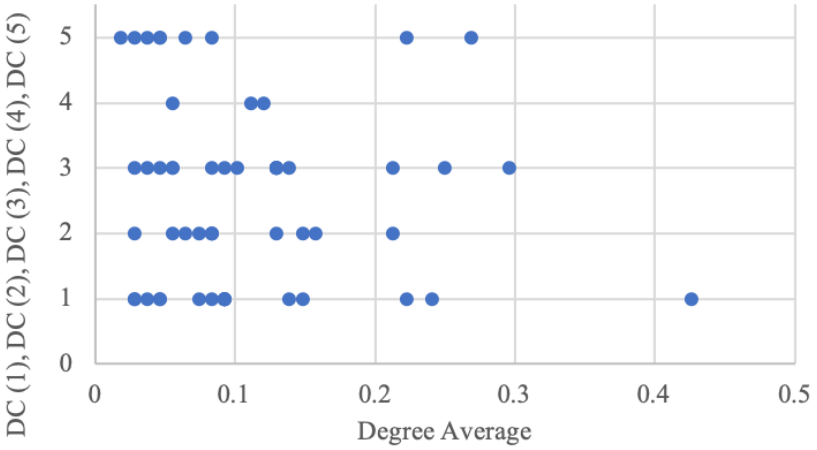


Figure 6. Discursive Power Distribution between Discourse Coalitions

Discussion.

The centrality-measures showed that environmental policy institutions including governmental bodies and research institutes controlled the overall policy debate about the proposed CO2 reduction target in light of COP17. Economic institutions had less control over the discourse in Japan than expected. Even though, they were in a central position and did have power to influence the discourse among policy actors, they did not control it.

Results of centrality measures for the LDP were surprising. According to these results, the party did not occupy a position in the network in which it would be a bridge between actors. The weakness of international agreements, as they were not binding for national governments, may explain the large group of DC (3). This group agreed to promote a higher target proposition for international negotiations but then to lower the target after a new international agreement would have been set. This may explain why Japan continues to struggle to commit to long-term mitigation strategies as it demonstrated a divide between the government's international standpoint and domestic policies.

In the example of Japan, discourse institutionalization of long-term climate mitigation measures seemed to not have happened yet because long-term CO2 reduction targets remain unclear (Wuppertal Institut & Institute of Energy Economics, 2018). This may be due to vertical boundaries between ministries and their respective advisory processes as illustrated with Figure 4. The distribution of national research institutes in the network reflected the vertical advisory process that was described.

The results cannot clearly argue for a formal communication on a horizontal plane between the actors. The CO2 reduction target proposed by the DPJ government in 2011 was a political decision. Data about the "practice" in the discourse coalitions such as meetings, telephone or email conversations were ambiguous. This may be due to a weakness in the form of survey data collection.

The results imply that science advisers are excluded from policymaking, which is true to some extent, but reasons for its exclusion cannot be discussed with this current set of data. And even though science advisers are not part of the daily political work among policy actors, this does not mean advice itself is not considered to formulate their strategies and policy proposals. As explained above, the impact of science advice is difficult to investigate. The pure quantitative approach proposed in this paper is limited in its explanatory capability, and further research of an in-depth qualitative inquiry is needed to integrate into the quantitative network analyses if we want to understand the nature of the integration of science advice in environmental policymaking in depth.

Conclusions

While governmental bodies dominated the discourse in the overall policy community on climate change, science advice in Japan was kept independent from political influence and mostly excluded from policymaking. As previous literature argued, even by the year 2018, the government of Japan struggles with setting long-term climate mitigation targets, and more ambitious goals as proposed by the former DPJ in 2011 in preparation for COP17 did not formalize. No consensus was reached among environmental policy actors, because the political attitude on defining national CO2 reduction targets and how to achieve them are divided.

Applying social network analyses to quantitatively calculated discourse coalitions was a feasible methodology for investigating "discursive power." But it is limited in discussing the "practice" (e.g. meetings, telephone, or email conversations) among the actors in the discourse coalitions. A qualitative approach needs to be integrated into the calculation of discourse coalitions and the discursive power of actors in order to understand the narrative and its influence in policy outcomes.

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Appendix A: Centrality Measures

Organization Name	Organization Type	Degree Average	Betweenness Centrality
Japan Association of Corporate Executives (Keizai Doyukai)	Business association	0.09259	21.42861
Japan Business Federation (Keidanren)	Business association	0.2963	0
Japan Chamber of Commerce and Industry (JCCI)	Business association	0.10185	0
Itochu	Business corporation	0.05556	16.22368
Marubeni	Business corporation	0.06481	0
Mitsubishi UFJ Research and Consulting	Business corporation	0.12963	0.3588235
Mitsubishi Heavy Industries, Ltd.	Business corporation	0.06481	1
Mitsubishi Research Institute, Inc.	Business corporation	0.13889	0
Sumitomo	Business corporation	0.0556	0.4444444
Kobe Steel	Business corporation	0.07407	1.580952
Tokyo Electric Power Company (TEPCO)	Business corporation	0.16667	0
Fujitsu Research Institute	Business corporation	0.08333	5.970858
Japan Transport and Tourism Research Institute (JTTRI)	Foundation	0.02778	1.790115
International Center for Environmental Technology Transfer (ICETT)	Foundation	0.01852	0
World Conference of Religions and Peace Japan (WCRP)	Foundation	0.02778	0
Global Environmental Forum (GEF)	Foundation	0.06481	6.60636
Global Environment Centre Foundation (GEC)	Foundation	0.05556	5.774574
Institute for Global Environmental Strategies (IGES)	Foundation	0.14815	76.28684

Organization Name	Organization Type	Degree Average	Betweenness Centrality
Global Industrial and Social Progress Research Institute (GISPRI)	Foundation	0.0463	0
Central Research Institute of Electric Power Industry (DENKEN)	Foundation	0.13889	0
The Japan Economic Research Institute (JERI)	Foundation	0.02778	7.754278
Japan Ship Technology Research Association (JSTRA)	Foundation	0.03704	1.732576
MOFA International Cooperation Bureau	Governmental body	0.15741	484.7061
MOFA Foreign Policy Bureau	Governmental body	0.0463	0
MOFA Ambassador for Global Environmental Issues	Governmental body	0.12963	9.693651
MOE Global Environmental Bureau	Governmental body	0.42593	1068.982
METI Industrial Science and Technology Policy and Environmental Bureau	Governmental body	0.26852	583.014
METI Manufacturing Industries Bureau	Governmental body	0.12037	6.959668
MLIT Maritime Bureau	Governmental body	0.06481	102.4821
MLIT Meteorological, Global Environment and Maritime Department	Governmental body	0.07407	2.885256
MLIT Policy Planning Bureau	Governmental body	0.14815	112.8905
MOF International Affairs Bureau	Governmental body	0.08333	0
MOF National Tax Agency and Taxation Department	Governmental body	0.03704	0
MAFF Minister's Secretariat and Environmental Policy Division	Governmental body	0.08333	0
MAFF Forestry Agency and Private Forest Department	Governmental body	0.08333	11.1051
MEXT Research and Development Bureau	Governmental body	0.08333	67.06053

Organization Name	Organization Type	Degree Average	Betweenness Centrality
Japan International Cooperation Agency (JICA)	Incorporated administrative agency	0.15741	141.1173
National Institute for Environmental Science (NIES)	Incorporated administrative agency	0.24074	223.8277
National Institute of Advanced Industrial Science and Technology (AIST)	Incorporated administrative agency	0.12963	152.947
New Energy and Industrial Technology Development Organization (NEDO)	Incorporated administrative agency	0.14815	4.714386
Japan Petrochemical Industry Association (JPCA)	Industry association	0.08333	0
Petroleum Association of Japan (PAJ)	Industry association	0.12037	7.682331
Japan Federation of Hire-Taxi Association	Industry association	0.03704	6.710014
Federation of Electric Power Companies (FEPC)	Industry association	0.18519	13.72207
Japan Aluminum Association (JAA)	Industry association	0.05556	11.15525
Japan Fluorocarbon Manufacturers Association (JFMA)	Industry association	0.09259	6.483385
Japan Chemical Industry Association (JCIA)	Industry association	0.12963	25.07526
Japan Federation of Construction Contractors (NIKKENREN)	Industry association	0.08333	2.263492
Japan Automobile Manufacturers Association, Inc. (JAMA)	Industry association	0.12963	126.5091
Japan Paper Association (JPA)	Industry association	0.11111	14.20855
Japan Iron and Steel Recycling Institute (JISRI)	Industry association	0.06481	0
Japan Iron and Steel Federation (JISF)	Industry association	0.12963	90.36418
Japan Department Stores Associations	Industry association	0.03704	0
NHK	Mass Media	0.26852	0
Kyodo Newspaper	Mass Media	0.22222	173.8619

Organization Name	Organization Type	Degree Average	Betweenness Centrality
Jiji Newspaper	Mass Media	0.22222	2.25
Asahi Newspaper	Mass Media	0.25926	0
Mainichi Newspaper	Mass Media	0.25	0
Citizen's Alliance for Saving the Atmosphere and the Earth	NGO	0.09259	49.01398
KIKO Network	NGO	0.13889	0.9940476
ICLEI Japan	NGO	0.03704	0
Japan Refrigerants and Environment Conservation Organization (JRECO)	NGO	0.0463	11.78063
Greenpeace	NGO	0.08333	0
Conservation International Japan	NGO	0.0463	11.04825
Earth Day Tokyo	NGO	0.06481	0
Research Institute for Culture and Environment	NGO	0.02778	0
Old Paper Network	NGO	0.02778	0
Japan Environmental Council (JEC)	NGO	0.07407	3.665079
DPJ	Political party	0.21296	210.4118
LDP	Political party	0.21296	0
People's Life First Party	Political party	0.0463	0
JCP	Political party	0.09259	109.0651
SDP	Political party	0.09259	0
Parliamentarians for Global Action (GLOBE Japan)	Political party	0.08333	108.6554
NPO Regional Exchange Center	Voluntary association	0.02778	0.6699134
Japanese Consumer Cooperation (co-op)	Voluntary association	0.09259	46.02948
Japanese Trade Union Confederation (RENGO)	Voluntary association	0.11111	0