

Scientific Advice and Administrative Traditions: The Role of Chief Scientists in Climate Change Adaptation

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Abstract

The role of the chief scientist (CS), a key administrative position in various Israeli ministries, is to fund policy-oriented research and support evidence-based decision-making. Has the CS's role promoted or constrained incorporation of scientific advice regarding climate change adaptation into governmental policy? Have administrative traditions affected the adaptation planning process in Israel? Analysis of documents and 26 in-depth interviews with key stakeholders sheds light on the ongoing climate change adaptation policy formulation process. Our study reveals that the CS of the Ministry of Environmental Protection functions as a bridge at different interfaces and can be characterized as a boundary worker between institutions. The inherent independence of this position facilitates the CS's ability to initiate, foster, and prioritize complex issues such as adaptation. Our findings further suggest that the perception that Israel has already adapted, or will easily adapt, has negatively affected the adaptation process.

KEY WORDS: climate change, adaptation, administrative traditions, chief scientist, science-policy interface, Israel

科学建议和行政传统：首席科学家在气候变化适应工作中的作用

首席科学家是以色列各部门的一个关键行政职务，其具体作用是为政策性研究提供资金，并支持循证决策。对于有关气候变化适应的科学建议，首席科学家的作用是促进还是限制了其被纳入到政府政策中？行政传统是否影响了以色列的气候适应规划进程？通过文件分析及与关键利益相关者的26次深入访谈，笔者揭示了正在进行的适应气候变化政策的制定过程。研究表明，环保部门的首席科学家在不同的层面上起着桥梁作用，在不同机构的分界线上工作以彼此连接。该职位的内在独立性能促进首席科学家在发起问题、培养和优先考虑包括适应气候等复杂问题的能力。研究进一步表明，以色列已经适应了或即将轻易适应某些观点，而这已经对气候适应过程产生了负面影响。

关键词：气候变化，适应，行政传统，首席科学家，科学政策接口，以色列

Asesoría científica y tradiciones administrativas: el papel que juegan los científicos principales en la adaptación al cambio climático

El papel que juegan los científicos principales, un puesto administrativo clave en varios ministerios israelíes, está específicamente designado para el financiamiento de investigación orientada hacia la política y el apoyo a decisiones basadas en evidencia. ¿El papel que juegan los científicos principales ha promovido o limitado la incorporación de asesoría científica en lo que concierne a la adaptación al cambio climático dentro de las políticas del gobierno? ¿Las tradiciones administrativas han afectado el proceso de planeación para la adaptación en Israel? El análisis de los documentos en 26 entrevistas exhaustivas con partes afectadas clave ilustra el proceso de formulación de las políticas de adaptación al

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cambio climático actual. Nuestro estudio revela que el Científico Principal del Ministerio de Protección Ambiental funciona como un puente para diferentes interfaces y puede ser caracterizado como un trabajador limítrofe entre las instituciones. La independencia inherente de esta posición facilita la habilidad del científico principal para iniciar, fomentar y darle prioridad a complejos problemas como la adaptación. Nuestros hallazgos sugieren que la percepción de Israel ya se ha adaptado, o se adaptará fácilmente, y ha afectado negativamente el proceso de adaptación.

PALABRAS CLAVE: cambio climático, adaptación, tradiciones administrativas, científico principal, interface ciencia-política, Israel

Introduction

Public administrators face many challenges when dealing with the complex issue of climate change adaptation (Termeer, Dewulf, & Breeman, 2013). Scholars have long documented how national political cultures, regulatory styles, or administrative traditions, broadly defined as sets of institutionalized norms and procedures, have influenced policy responses to complex global problems (Halfman, 2005; Howlett, 2014; Peters, 2018; Wellstead, Howlett, & Rayner, 2017). Administrative traditions vary among countries and over time. They partly explain political decisions and policy choices and, therefore, are also expected to influence climate change adaptation strategies (Biesbroek, Peters, & Tosun, 2018).

Scientific advice is an important element within the context of administrative traditions. Debates over how scientific advice enters the government or how science-policy boundaries are organized have received increased scholarly attention (Brugger, Meadow, & Horangic, 2016; Craft & Wilder, 2017). Advisory processes within the government often rely on scientists to provide guidance to decision-makers (Jasanoff, 1990). Administrative traditions affect the way public bureaucrats use their sources of advice and how policy makers assess knowledge that is often very unfamiliar to them. Since information is transferred to politicians by bureaucrats, the latter's processing of the information for use by others is important. Furthermore, in certain administrative traditions, scientists themselves hold a position in the administration and may also advocate for preferred outcomes (Craft & Howlett, 2013; Pielke, 2007).

In this article, we focus on the role of chief scientists (CSs) in the Israeli government and, in particular, in the Ministry of Environmental Protection (MoEP). In recent years, the CS of the MoEP has been leading an interministerial committee to draft a national climate change adaptation plan. We investigated if and how administrative traditions affect the adaptation planning process, focusing on the ability of the CS—as a boundary worker—to incorporate scientific advice about climate change adaptation into governmental policy. Previous studies assessing administrative traditions usually focused on established Western democracies in Europe and North America or post-Soviet or post-colonial states (Painter & Peters, 2010; Verheijen, 2007). Israel, other small or young countries, as well as African states (Vink & Schouten, 2018) are often overlooked. Research characterizing current adaptation strategies “remains in its infancy” (Ford et al., 2015, p. 801). Israel's experience in developing a national adaptation policy may contribute to a better understanding of other countries, especially non-Annex I states, that were not

required to meet international commitments under the United Nations Framework Convention on Climate Change (UNFCCC).

In Israel, the ideal policy maker is characterized by a capacity to improvise and an ability to make the most of limited and available means, rather than being guided by rationality and planned action (Sharkansky & Zalmanovitch, 2000). Interestingly, this distinctive administrative tradition also permeates the organizational bureaucracy in general. According to Menahem and Zehavi (2016, p. 175), Israel has inherited two opposing administrative traditions: on the one hand is the “civil servants’ tradition of political neutrality and professional norms, which was developed over the years by the British Colonial Office”; while on the other hand is the Jewish Zionist agency tradition which is characterized by improvisation and undisguised political activism (Menahem & Zehavi, 2016).

While administrations around the world have begun adopting policies regarding climate change, particularly in efforts to mitigate its effects (Nachmany et al., 2015; Tobin, Schmidt, Tosun, & Burns, 2018), and, increasingly also, have combined approaches of mitigation and adaptation (Fleig, Schmidt, & Tosun, 2017), most countries still have not yet comprehensively implemented these policies (Lesnikowski, Ford, Biesbroek, Berrang-Ford, & Heymann, 2016; Wellstead et al., 2017). The Paris Agreement, which Israel ratified in 2016, directs countries to respond to climate change nationally by taking both mitigation and adaptation measures. Thus far, Israeli policy makers have struggled to translate implications arising from climate change into domestic policies, let alone legislation (Michaels & Tal, 2015).

Israel’s relatively slow progress regarding mitigation and adaptation is puzzling, especially considering the many local technological innovations that support adaptation and that have been transferred worldwide. Due to the country’s lack of economic and natural resources, arid climate, and long-lasting water crisis, Israel has developed technological solutions for drylands adaptation, including seawater desalination, drip irrigation, and solar-thermal technologies (Erdan, 2009; Ministry of Economy, 2015; Teschner, Garb, & Paavola, 2013). Yet a comprehensive adaptation policy, which takes into account future impacts and cross-sector synergies, has not yet been adopted.

Our study attempts to shed light on the role of the CS in the ongoing climate change adaptation policy formulation process based on analysis of government documents and in-depth interviews we conducted with key stakeholders. In the first section, we examine how scientific knowledge enters bureaucracy and discuss key concepts pertinent to the science–policy interface and administrative traditions. We then describe the origins and tasks of Israeli CSs and present an overview of climate change adaptation measures in Israel. The subsequent section outlines our data sources and methodology. Finally, we present the results of the thematic analysis of 26 interviews, followed by a discussion of our main findings and conclusions.

How Knowledge Enters Bureaucracy

In this section, we investigate the interplay of national administrative traditions with climate change adaptation policy, paying particular attention to the significant

body of literature on the role of advisory systems and boundary workers in policy-making processes.

Use of Scientific Expertise in Climate Change Adaptation Policy Making

The practice of using scientific expertise in public administration is by no means a new one. Bureaucrats regularly rely on scientific knowledge to shape policy (Jasanoff & Wynne, 1998; Page, 2012). Much of the literature on scientific knowledge and government has, therefore, primarily involved debates on *how* to best integrate expertise into decision-making processes (Brugger et al., 2016; Himsworth, 1980; Sarewitz, 2004).

Due to their complexity, environmental issues are perhaps the most challenging science-informed decisions to tackle, often considered “wicked problems” and characterized by uncertainty, irreversibility, controversies, interdependency, and conflicting interests (Dryzek, 1987; Sandler, 1997; Termeer et al., 2013). Climate change adaptation is further confined by social perceptions of risks, values, ethics, and culture, as well as different levels of vulnerability (Adger, Lorenzoni, & O’Brien, 2009; Jordan, Huitema, van Asselt, Rayner, & Berkhout, 2010; Pelling, 2010), which, again, scientific postulates alone cannot solve.

As a result, policy makers’ heavy reliance on scientific models to identify, understand, or communicate potential solutions to climate change adaptation is sometimes viewed as an impediment to policy formulation and decision-making (Biesbroek, Klostermann, Termeer, & Kabat, 2013). Such challenges contribute to the fact that policies, especially in the field of adaptation, remain poorly developed in many countries (Araos, Ford, Berrang-Ford, Biesbroek, & Moser, 2017; Wellstead et al., 2017).

Bureaucrats and Administrative Traditions

The question of *who* brings scientific expertise into the government and under which constraints they operate is also important. Biesbroek and others (2018) discuss the link between knowledge gathering of civil servants and administrative traditions in the context of adaptation in great detail. Rahman and Tosun (2018) further show, for example, how national project directors play an important role in implementing and managing adaptation projects in the administration of Bangladesh.

Bureaucrats are very often faced with numerous constraints; exercising their mandate to advise politicians means navigating between what should be done and what can be done (Page, 2012). Scholarly evidence, however, indicates that the scientific expertise of bureaucrats does not automatically translate into the ability to influence policy processes. On the contrary, public administrators with policy experience are much more active in recommending and actually developing legislation (Page, 2010).

Translating is the key function of bureaucrats working in the science–policy interface (Hoppe, 2010). The challenge facing bureaucrats dealing with climate change is often how to translate their efforts into action (Hoppe, 2010). This is why scholars have raised a need for “climate science integrators” (Jacobs, Garfin, & Lenart,

2005) or “boundary workers” (Brugger et al., 2016). The idea is that boundary workers not only participate in the process of developing applicable science, but also have developed a favorable set of skills for putting policy into practice (Brugger et al., 2016).

For example, boundary workers need to communicate and sustain relationships with scientists from different fields, various decision-makers in government and industry, and also stay in touch with practitioners and the public (Jacobs et al., 2005; Lemos & Morehouse, 2005). In addition, civil servants rely on their traditional disciplinary training (Brugger et al., 2016) and previous professional experiences (Christensen & Lægheid, 2008).

However, difficulties can arise when different departments within government play by their own rules or have specific needs (Geerlings & Stead, 2003). Negev (2015) illustrates how personas and individual efforts of bureaucrats are crucial in enabling governmental interagency collaborations, especially in countries with relatively low policy integration, such as Israel. An administrative tradition that fosters cross-sector coordination is therefore all the more important (Persson et al., 2018).

Science and Policy in Israeli Administration: Chief Scientists

Special institutions for integrating science and political decision-making exist across various policy contexts and levels (Arimoto & Sato, 2012; Gallopin, Funtowicz, O'Connor & Ravetz, 2001; Guston, 1999; Jasanoff, 1990; Reinecke, 2015). In the United Kingdom, for example, advisory systems are embedded inside the government (Holmes & Clark, 2008) and the government chief scientific advisor directly advises the prime minister regarding risk and resilience, energy, and climate change (Government Office for Science, 2015). In the federal structure of Germany as well, every provincial state has its own governmental division and bureaucrats who deal with environmental and special technical aspects of climate change. In contrast, advisors for climate change issues in Finland are part of the Finnish Environment Institute which is an independent agency outside of the government. The following section situates the role of scientific advisors in the Israeli administration based on our analysis of relevant government documents and protocols.

In Israel, in 1966 the Kachalsky Committee for the Organization and Administration of Government Research recommended creating CS positions in relevant ministries to coordinate research and technology activities and to stimulate applied research. In its early years of existence, Israel relied heavily on foreign expertise (Leck, Lemarchand, & Tash, 2016), and the committee’s main conclusions were that there is a solid foundation for research at local universities, but no satisfactory mechanism to apply this academic-based knowledge in the industry or government (Keynan, 1988). The first scientific advisor in governmental ministries was in the Ministry of Defense (Keynan, 1998), but the first official CS was positioned in the Ministry of Economy in order to prioritize and fund civil research and development (R&D), mainly through research grants (Teubal, 1983).¹

Discussions over the extent and nature of the CS’s independence took place during the successive years. A Governmental Decision from 2001 (no. 2895/MT/16) stated that “a CS must be a senior scientist recognized and accepted by the scientific community, who is active as a researcher in the field relevant to the activities of his

office, and has authority and jurisdiction in his area of expertise. The CS will be able to bridge between academia and other factors involved in R&D” (Knesset Research and Information Center, 2016). A report from a public investigation committee a decade later found, however, that “in contrast to the original intention, in some of the ministries, several appointees for the CS positions were not academics or researchers” (Knesset Research and Information Center, 2016).

The committees also found that there was a lack of uniformity and clarity regarding the qualifications required for the CS position in the various ministries (Knesset Research and Information Center, 2016). CSs are usually external to the bureaucracy and are recruited from universities or the industry sector (e.g., the current CS at the Ministries of Environmental Protection and Transport), appointed to directly advise cabinet members of the respective ministries (Keynan, 1988), but it also happens that she or he are appointed from within the administrative structure of the ministry (e.g., a former CS at the MoEP).

CS positions have developed over the years in almost all executive ministries, such as the Ministries of Economy, Science and Technology, Agriculture, and Environmental Protection. In 2011, twelve CSs were employed by government ministries (15 ministries did not have one), but the number declined in 2016 to only nine (Knesset Research and Information Center, 2016). Depending on their responsibilities, CSs have varying sizes of staff and budgets in the office they head. For instance, the Office of the CS in the MoEP has five permanent and three temporary staff positions and a budget of nearly 1.7 million euros. In contrast, the CSs in the Ministry of Agriculture and the Ministry of Energy oversee a much higher budget, approximately 23 million and 11 million euros, and have eight and twelve staff positions, respectively (Knesset Research and Information Center, 2016).

The length of employment of a CS can vary as well, and sometimes ministries opt not to employ a CS for a certain period as was the case, for example, in the Ministry of Transportation from 1979 to 1994. Following a governmental decision on this topic, however, most CSs today are appointed for 4 years with the option of extending their contract for another 4 years.²

CSs play a critical role in the interface of science, policy, and politics in Israel. First, they are responsible for setting research priorities, publishing calls for proposals, evaluating them, and administering research funds. Second, they provide in-house scientific advice to the minister, the director general, and departments within the ministry, thereby supporting decision-making (NCRD, 2014). CSs also foster international scientific collaborations and each office may decide upon additional priorities.

The CS’s activities at the MoEP regarding climate change adaptation include preparing for and participating in the Conferences of the Parties under the UNFCCC, supporting the Israeli Climate Change Information Center (ICCIC) established in 2011, and raising awareness regarding environmental issues (Chief Scientist Office, 2015). Furthermore, the CS leads an interministerial Director Generals Committee created to prepare a national adaptation plan. This task was officially assigned to the CS of the MoEP by Government Decision 474 in 2009. It details which entities should take part in the process, including twelve ministries, among them the Ministry of Agriculture, Ministry of Health, and Ministry of

Energy, in addition to representatives of local authorities and NGOs. Other relevant organizations may also be invited to participate (Government of Israel, 2009b).

In summary, the R&D governance in Israel is decentralized and each ministry is responsible for R&D in its own sector. Working in a bureaucratic–political environment, rather than an academic one, poses numerous challenges for CSs who are mandated to translate scientific knowledge, advise, and support regulation in multiple fields (Knesset Research and Information Center, 2016). We further discuss these complexities below following a brief review of the effects of climate change on Israel.

Climate Change and Adaptation in Israel

Israel faces numerous ecological challenges. Most likely, Israel will become hotter and drier through increasing frequency and severity of extreme weather events resulting from climate change, specifically heat waves as well as continued decline in rainfall leading to droughts (Drobinski et al., 2016; Michaels & Alpert, 2013). Generally, the entire region (Israel, Palestinian Authority, and Jordan) is extremely vulnerable and predicted to experience an increase in the average temperature of 1°C, which lies above the global warming rate (Givati, 2016).

Water is an extremely scarce resource in the country, with 75% of the available freshwater reserved for domestic, agricultural, and industrial use. Israel has addressed water shortages through the development of desalinated water (80% of drinking and industrial demand in 2017) and agriculture-related technologies (Israeli Water Authority, 2017; Ministry of Economy, 2015). Yet some argue that any change in Israel's rainfall pattern will have major implications for the country that might also be trans-boundary in nature in a geopolitically volatile region (Feitelson, Tamimi, & Rosenthal, 2012; Teschner et al., 2013).

Climate change will also impact Israel through a second channel: Israel will likely be affected by floods and a rise in the sea level, albeit to a lesser extent (ICCIC, 2011). A study, for example, found that Tel-Aviv is one of the top 15 coastal cities most likely to be affected by climate change worldwide (Hallegatte, Green, Nicholls, & Corfee-Morlot, 2013). This is particularly worrisome as the country has a population density of 387.2 persons per km², with the majority of residents living in cities along the coast. The population growth rate was 2% in 2016 (World Bank, 2017), a very high rate compared with the EU's annual average of 0.13% (OECD, 2017).

As part of the long process of drafting recommendations for the official adaptation plan, the ICCIC was established in 2011 and mandated to produce research and policy recommendations in seven main fields: climatic changes, public health, water, biodiversity, urban planning and building, economy, and geostrategic implications (ICCIC, 2014). The center consisted of scientists from Israeli universities and was budgeted for the years 2011–13. Since then it did not receive additional funding.

During this period, three reports were produced. The first report gathers existing knowledge regarding the implications of climate change on the State of Israel

(ICCIC, 2011). The second report focuses on the proposed national adaptation policy in relevant areas and details possibilities of international marketing for the ICCIC (Shechter et al., 2012). The third and final report specifically addresses the local level of government and adaptation to climate change in the local authorities (Ayalon et al., 2013).

These reports identified research and knowledge gaps in the abovementioned sectors so they could lay the foundations for the national adaptation plan. Thus far, the Israeli government has not enacted an official adaptation policy; currently, a full draft of recommendations for the national plan, as well as a resolution to adapt, has been written and is circulating among ministries. The resolution acknowledges that Israel needs to adapt, and the national adaptation plan envisions that each ministry will submit an annual progress report on its preparation for climate change (INT 6, 2017).

Methodology

To investigate the role of CSs and examine their influence on climate change adaptation policy in the Israeli administrative system, in addition to a document analysis of government protocols and policy papers, we conducted elite interviews (Aberbach & Rockman, 2002) with relevant stakeholders. Scholars agree that gathering data from those directly involved in the daily process (Gläser & Laudel, 2010) is useful because expert judgments can identify key actors. Hence, in seeking to understand the inner workings of Israeli CSs with regards to the national climate change adaptation plan, semistructured interviews helped to reconstruct the process (Anfara, Brown, & Mangione, 2002).

In total, we conducted 26 interviews, the majority of them face-to-face, between 2016 and 2017 (for a detailed list of the interviewees' affiliations see the Appendix). The sample consists of current and past CSs, senior staff members of CS offices, as well as Israeli academics and NGO representatives—all of whom have had long-term experience with aspects of climate change and many of whom participated in the national drafting process. They were able to offer insights regarding the role of a CS and the use of scientific advice in policy making in general, and in adaptation policy in particular. The diversity of the interviewees helped to control for subjective influences of individuals, adding validity to our primary data set (Flick, von Kardoff, Steinke, & Jenner, 2004). With the consent of all interviewees, notes were taken during the interviews and the recorded audio files were transcribed subsequently with the transcription software f5.

The transcriptions were compared and interpreted qualitatively using MAXQDA software, which enables structuring and organization of large quantities of data as well as the construction of coding schemes. We employed the qualitative thematic analysis approach to identify and analyze emerging themes from detailed and complex data (Braun & Clarke, 2006). In seeking to identify these themes, we coded the interviews in an inductive manner using the grounded theory approach (Glaser & Strauss, 1967). In the first reading of the interview material, codes were created and then redefined at subsequent stages of the coding development.

In determining patterns, thematic analysis enables identification of commonalities and determination of repetitive themes across interviews. The fact that codes change throughout the process is common (MacQueen, McLellan, Kay, & Milstein, 1998). At later stages, the analysis consisted of fine-tuning our coding until novel aspects no longer surfaced (Guest, Bunce, & Johnson, 2006). Coding of the data ended when we reached saturation—that is, once further analysis did not result in new codes or in the additional fine-tuning of existing codes. At this stage, codes were clustered into themes.

Results

In this section, we present a detailed overview of the four prominent themes that emerged from the interviews. To better understand the contribution and constraints of boundary workers, such as CSs, we will concentrate on the role of the CS in the MoEP and its relationship with other actors involved in the national adaptation plan in Israel. The results also help address our question as to how administrative traditions have affected the adaptation process in the country.

In Israel, CSs are characterized by their interactions inside and outside of their ministry. The constant interaction between various interfaces makes the role of the CS at the MoEP collaborative and participatory in nature. The CS bridges between (1) science and policy through support of and collaboration with academic research conducted at universities; (2) government and the public sphere, for example, engagement with NGOs; (3) governmental sectors (various ministries); and (4) governmental levels (local–national). In the following, we detail the four abovementioned interfaces and the boundary-spanning activities undertaken by the CS at the MoEP (see also Figure 1 below).

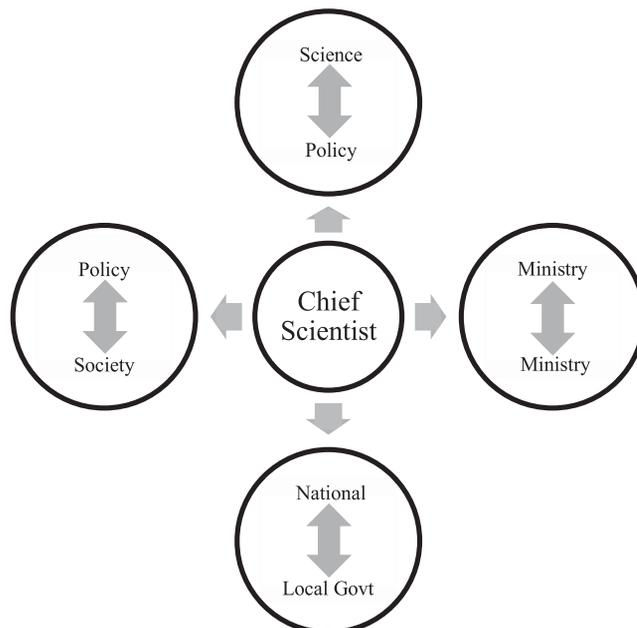


Figure 1. The CS of the MoEP as a Bridge Between Institutions

Science–Policy Interface

A recurring theme was the science–policy interface and the CS’s function as a bridge between the science and policy arenas. Several interviewees, including current and former CSs, perceived that the CS’s role mediated scientific advice about current issues to other policy actors. Interviewees noted in particular that collaborations between the CS and scientists from higher education institutions in Israel take place frequently and through several different projects and channels.

The majority of CSs are scientists themselves, which means that they not only have scientific credibility to handle complex issues, but also value the fair and objective advice given to them by active academics (INT 22, 2016; INT 23, 2016). Other scientists shared a more critical view, arguing that even though CSs usually hold PhDs, their administrative position imposes various limitations since it is part of a larger administrative system (INT 20, 2016). As one university professor noted: “As an academic, I perceive them as being part of the bureaucracy.” Another university professor said that overall, the science–policy interface is not managed well in Israel and that the interconnectedness between the two systems is fragile:

My feeling is that compared to other countries, the position of experts within the government is rather weak and the connection between academia and the ministries is weak. Academia is very independent, very research-oriented—not policy oriented. (INT 25, 2016)

Furthermore, comments regarding the occupancy of the position repeatedly surfaced throughout the interview sessions. For instance, in the Ministry of Science CSs usually come and go from/to academia, thereby staying connected to both worlds. Coming from academia prepares them to identify important questions in their respective fields. It also presents a unique opportunity for scientists to showcase their accumulated knowledge, “test” it in the policy sphere, and influence decision-making. The following quote by a CS in the current administration captures these aspects:

And this is why I believe that this job should be done in rotation and that people who come will serve a few years in this position and go back to academia [. . .]. Because, otherwise we lose contacts in the community, we lose contact to what’s going on; what’s on the agenda. So it’s very important in my view that it is a position which is fulfilled by a high-rank academic, recognised by his colleagues. (INT 23, 2016)

Moreover, relationships with other scientists that were formed during CSs’ scientific careers form a large network of experts that can be contacted and consulted later. This especially helped with regards to setting the agenda on adaptation, as the CS of the MoEP tried to bring together relevant stakeholders. Furthermore, the CS of the MoEP and scientists who were part of the ICCIC argued about the need for evidence-based decision-making in relation to adaptation.

Despite the scientific credibility of a CS and the close working relationships with other scientists, one university professor claimed that when it comes to policy formulation, the one great limitation of a CS is the lack of decision-making authority. In the case of adaptation, one NGO worker mentioned that the CS of the MoEP can draft a resolution but does not have the opportunity to enact it into policy (INT 8, 2016). This exemplifies the clear boundaries between collecting expertise for politicians and actual decision-making authority. The CS certainly

has independence in prioritizing research on adaptation and advancing adaptation policy, but as a bureaucrat, the CS does not have the power to design and implement governmental policy.

The situation in Israel is particularly aggravating because the policy-making style is “reactive” and the application of scientific evidence is less prevalent in policy formation (INT 15, 2016). Another deputy CS confirmed that once the government has identified a problem, it usually wants an immediate solution (INT 17, 2016). Such an attitude makes it difficult to garner support among politicians for issues such as adaptation. To make matters worse, frequent rotation of politicians conflicts with the long-term scientific perspective of the issue. As one university professor noted:

[Bureaucrats/politicians say to themselves] climate change will not happen. If it happens it will not be during my term of office. We have other issues to be troubled with or to be concerned about. They know that the likelihood that things will happen is unknown. (INT 12, 2016)

In relation to the frequent turnover of political appointments, another factor mentioned by several interviewees was the perception that politicians seem to believe that Israel will be able to meet the challenge of adaptation by improvisation. A CS attributed inconsistent work on policies in several fields to this attitude and also stressed the nonexistent long-term planning approach of policy actors:

Maybe, at the political level there is such an understanding that we will be able to improvise. But we are not rehabilitating at a rate that is appropriate. There is a gap between what the professionals know and what the political level is dealing with. [...] There is no systematic planning mentality. You see a lot of ad-hoc decisions. (INT 6, 2017)

That CS attributed the lack of long-term planning to the frequent changes of ministers and director generals in Israel, each politician and bureaucrat promoting their own agenda and shifting policy processes. This poses a challenge to CSs in their efforts to bridge science and policy, and supporting long-term, scientifically sound policy making.

Policy-Society Interface

The CS's position as a bridge and potential mediator between the policy and the public spheres, and in particular NGOs, was another important aspect of the adaptation policy-making process. A civil servant in an office of a CS viewed the access of NGOs to government positively. Likewise, NGOs feel that channels of communication with key bureaucrats and politicians are generally open (INT 9, 2016). In contrast to the position of minister or director general of a ministry, the position of the CS has more leeway and a CS is able to participate and engage with civil society in various contexts.

If a CS has a good working relationship with an NGO member, collaboration can be effective (INT 9, 2016). Under such circumstances, the CS functions as a trigger to raise awareness of a certain issue on a higher level, which, as a former advisor to a CS described, indeed happened with the topic of climate change

adaptation where both the CS and an NGO worked well together and promoted adaptation (INT 2, 2016).

Yet, while many viewed the CS's position positively and stressed his or her efforts to "build a bridge," there were some critical views pointing toward a lack of cooperation, particularly in contrast to the aforementioned science-policy interface. For example, there were more mixed opinions and assessments of the CS's cooperation with NGOs. One CS pointed out the active science-policy engagement but discredited the public-policy sphere, contending that they do not collaborate at all:

We [the CSs] work with all the academia in Israel. That's our main field of operation. We work a lot also with other governmental offices. You don't work a lot with NGOs. (INT 22, 2016)

It seems that the successful functioning of a CS in the policy-public sphere depends on the individual in the position, the ministry, the relevant NGO, and the issue at stake.

Horizontal Policy Interface between Ministries

Interviewees noted that CSs serve as a bridge between their ministry and other relevant ministries during the adaptation formulation process. For instance, all CSs meet regularly in the so-called Chief Scientists Forum headed by the Ministry of Science. In specific cases, they also have long-term collaborations with other relevant ministries to coordinate horizontal issues. These frameworks are important and respected venues for exchange and make collaboration across different sectors possible.

In the case of climate change adaptation, the main venue for exchange between entities was the interministerial committee on adaptation established by the Government Decision 474 in 2009. CSs had an active role and the CS of the MoEP assigned each ministry the task of writing a chapter in the adaptation plan detailing their specific needs in order to close existing knowledge gaps in each sector. The CS at the MoEP led the process, and had the power to bring on board the relevant ministries, and the capacity to provide scientific advice and coordinate a comprehensive adaptation plan, which is in the final stages of preparation. However, this boundary work proved to be challenging. In fact, providing scientific advice horizontally and convincing other ministries that there is a need for adaptation in Israel was not an easy task, as a CS noted:

There was a huge gap in understanding [of climate-related science]. When I approached people [in ministries] five years ago they looked at me like: What the hell are you talking about? Now they come to me and ask: Can you help us convince our director general? Can I share this document with another department? But it took time to convince people that there is an issue. (INT 6, 2017)

The former and current CSs in the MoEP deliberately reached out to other ministries to approach climate change adaptation from a horizontal perspective. Here, a former CS reasoned that climate change adaptation is not relevant exclusively to the MoEP but to a whole range of other sectors as well (INT 10, 2016). Coordination efforts of the CS proved challenging because some ministries were reluctant to

cooperate. Some interviewees revealed that the CS of the MoEP had to manage the unwillingness of certain ministries since some sectors were not even aware that they should concern themselves with climate change (INT 14, 2016). For example, the Ministry of Interior did not contribute to the national adaptation plan because according to them, adaptation does not concern them. Surprisingly, questions related to migration in the context of climate change were raised by the Ministry of Public Security (INT 6, 2017).

NGO employees and university professors further attested to these difficulties and even spoke of “rivalries,” “fights,” and “clashes” between ministries (INT 13, 2016; INT 14, 2016; INT 15, 2016; INT 20, 2016). As the CS depends on other ministries’ input and consent, one university professor described the process as follows:

We had to confine ourselves to those areas or sectors in the system where the other ministries felt that it would be ok. (INT 13, 2016)

Lastly, and with regards to the ministerial landscape in Israel, many participants from different sectors mentioned that in order for a policy to succeed, the involvement of the Ministry of Treasury is essential (INT 8, 2016; INT 15, 2016; INT 25, 2016). In Israel, this ministry is responsible for all fiscal planning of the government, which is why it is considered one of the most powerful ministries. As one university professor noted:

The bottleneck is always the Ministry of Treasury. And if it leads the process, [there is] a greater likelihood that the rest will join along. (INT 20, 2016)

The MoEP is a relatively small ministry with a modest staff and budget. Therefore, it depends on the other ministries’ willingness to engage in its agenda, especially in the case of horizontal issues such as adaptation. One NGO representative referred to this problem by emphasizing “the marginality of this office” and pointed out the need for stronger cooperation between ministries in order to advance national adaptation policy (INT 7, 2016).

Vertical Policy Interface

In Israel the CS has also assumed a connecting role between the national and the local levels of government. Some interviewees mentioned the efforts undertaken by the CS, predominantly in relation to the MoEP, to actively involve representatives from the local level. NGO representatives stressed the efforts undertaken by the CS to actively involve municipalities; representatives from city councils; and the Forum 15, which is comprised of Israel’s largest and most financially independent cities (INT 7, 2016; INT 8, 2016). This is important since concrete adaptation measures and implementation responsibilities often lie at the local level (INT 13, 2017). Others claimed that the local level is not as involved as it could be in knowledge gathering for the adaptation plan. Mayors attended meetings for informative reasons but did not participate beyond that.

Engagement at the municipal level is vitally important in the context of adaptation. Barber (2013) argues that cities and the mayors that govern them exhibit a leadership quality to deal with global problems such as climate change. Certainly,

local administrative bodies are equipped with the specific knowledge about its residents, including vulnerable populations, and critical infrastructure—in essence, the community’s needs—and they are also responsible for supplying local climate resilient measures such as flood and cyclone shelters (Araos et al., 2017). Studies have examined the state of preparedness at the local level (Heidrich, Dawson, Reckien, & Walsh, 2013), but often fail to also highlight how important coordination between different levels is (Henstra, 2017; Nalau, Preston, & Maloney, 2015). Often, the local level lacks the necessary financial resources or capacity to adequately deal with the impacts of climate change (Measham et al., 2011) and is reliant on the leadership and financial support of the central government.

The significance of the local level was also highlighted in the third and final report of the ICCIC, entitled “Adaptation to Climate Change in the Local Authorities” (Ayalon et al., 2013). The realization was that different accountabilities and obligations reside at various levels, but that the local level is essential when it comes to implementing adaptation policies. Rather than preparing simple guidelines, the CS emphasized the importance of developing several models for big and medium-sized towns in Israel as well as rural areas on how to prepare for climate change (INT 6, 2017).

Discussion

In this section, we discuss the role of CSs in Israel and focus specifically on the advantages and constraints affecting the provision of scientific advice for the adaptation strategy. We discuss our findings in the context of the literature on scientific knowledge and how it enters bureaucracy, the role of boundary workers, and the framework of administrative traditions.

The Role of the Chief Scientist and Its Ability to Bring Scientific Advice Related to Climate Change Adaptation into Governmental Policy

The CS is a unique position *inside* the bureaucratic system of Israel and an integral part of most Israeli ministries. Its purpose is twofold: to advise ministers in order to ensure evidence-based decision-making and to advance applied research relevant to specific ministries’ needs. However, responsibilities differ among ministries and some CSs are more active in advising their minister and director general than others.

Often considered “short-term bureaucrats” who come from and go back to academia (or the private sector), a CS may lack the political know-how to advance their innovative scientific agendas (Peled, 2000, p. 222). However, CSs can hold this position for 4 years and longer, thereby ensuring consistency and continuity which, in the case of the MoEP, helped in keeping the topic of adaptation on the ministry’s agenda. In addition, the former CS at the MoEP was a civil servant of the ministry prior to the appointment. This meant familiarity with the bureaucracy of ministerial and governmental procedures.

Evidently, recruiting and duration of Israeli CSs is more heterogeneous in practice than envisioned in the governmental decision. For example, some CSs do not

necessarily come from academia (Knesset Research and Information Center, 2016) or hold the position for less than 4 years (INT, 12; INT, 18). Sometimes, ministries do not employ a CS at all; among other reasons for lack of suitable candidates. Future research could investigate this matter in-depth across a larger number of Israeli CSs over time. However, with regard to our interview sample and the CS at the MoEP in particular, one distinct feature is prominent regardless the origins of the CS: it equips its holder with considerable leeway to prioritize long-term progressive tasks such as adaptation. An example for this would be engaging in international research collaborations, but also issuing calls for proposals on adaptation and organizing events to engage the public or leading the inter-ministerial committee on climate change adaptation.

Craft and Wilder (2017) argue that those “inside” a government advisory system enjoy a limited level of autonomy. Yet, many interviewees mentioned that the position of the Israeli CS, despite his or her location within the government, enjoys a great deal of independence. Furthermore, many recounted that the CS is highly respected thanks to his or her scientific credentials and that this status reinforces the position’s independence. Having the freedom to initiate, foster, and prioritize issues such as adaptation before they have been prioritized by the government can be considered a clear advantage.

On the downside, interviewees revealed numerous constraints that the CS faces despite his or her independence, for example, low budget, inadequate manpower to shoulder the task, and limited political power, as well as the CS’s lack of policy-making authority. These findings are in line with observations by Page (2010, 2012) who noted that experts—whether part of the ministerial landscape or outside of it—are simply consultants to policy makers and are not the ones who enact policy decisions.

Adaptation is an intersector task, and by bridging adaptation across various scientific disciplines and sectors, the CS is certainly a boundary worker (Brugger et al., 2016) who actively integrates climate change adaptation science among relevant actors. The fact that the MoEP is a ministry that deals with other environmental cross-cutting issues may have been beneficial to the work on the adaptation plan as well. At times, however, bureaucrats can feel “underprepared to deal with boundary work situations, without a compass, or guidelines on how to productively engage in it” (Hoppe, 2010, p. 115). According to our interviewees, recent CSs at the MoEP have faced this challenge with a scientific approach by first focusing their efforts on closing existing knowledge gaps in the context of adaptation.

Being part of the bureaucracy helps to build and sustain relationships with various other departments and other CSs. The interviewees’ responses attested that the CS of the MoEP tried to include as many relevant actors as possible in the developing phases of the adaptation strategy. This is exemplified by the circumstance that more ministries than initially required by the government decision, such as the Ministry of Public Security, were part of the process.

The translating function raised by Hoppe (2010) and others was critically important in the CS’s work. Seeing the interlinkages across ministries and vertical levels of governance; explaining what adaptation means; and most importantly, translating to relevant actors that adaptation is a cross-cutting issue that concerns them, was one of the biggest challenges of this cross-sector collaboration. This is especially

significant because horizontal collaborations are generally hard to establish in Israel due to an administrative structure that often hampers interministerial collaborations (Negev, 2015). This became evident when some ministries avoided collaboration during the adaptation formulation process.

Another barrier to successful dissemination of scientific advice is that academia and administration speak different languages and have different goals. For example, one interviewee mentioned the tension between the technical language of the guidelines of the CS at the MoEP and an academic writing style. This illustrates the gap between scientific and bureaucratic work. We can relate this to Sarewitz's (2004) finding that administrators often politicize—or in this case bureaucratize—scientific resources. While this can be characterized as a typical struggle within a bureaucracy, it might also attest to the fact that scientists consider applied work in the governmental arena troublesome.

Administrative Traditions and Their Impact on the Adaptation Policy-Making Process in Israel

Preparation of a comprehensive climate change adaptation strategy for the Israeli government officially started in 2009. Taking into account that the former CS at the MoEP began engaging in this subject as early as 2007 (through participation in research supported by a European grant), this process has lasted longer than a decade up to now. While it certainly has been time intensive, the process has focused on providing a knowledge base for future policy actions.

To some extent, international pressures, for example, the process of joining the OECD and the Paris Agreement, have had some effect on raising awareness of politicians and the public in Israel regarding climate change issues. In general, however, this has led to measures being taken in relation to mitigation (Government of Israel, 2016; Michaels & Tal, 2015). In contrast, adaptation is a topic that has received very little public and political attention in Israel thus far, partly because of the country's persistent security concerns (Michaels & Alpert, 2013). The question then arises, to what can we attribute the low awareness and long process regarding the issue at hand?

Adaptation is not only confined by different levels of vulnerability but also by risk perceptions (Adger et al., 2009; Jordan et al., 2010; Pelling, 2010). Interviewees attested that politicians and bureaucrats seem to be guided by a perception that Israel is *de facto* adapted. As a civil servant working for a CS accounted: "We don't call it adaptation, but we are adapting" (INT 4, 2016). On the one hand, one could argue that there is a persistent belief that Israel is adapted. The country has developed many innovative technological solutions to deal with the arid climatic conditions, most importantly, advanced seawater desalination but also drip irrigation and solar-thermal technologies (Erda, 2009; Ministry of Economy, 2015; Teschner et al., 2013).

On the other hand, adaptation efforts do not translate sufficiently to other spheres, especially the political, the municipal level, and the public arena. Here, a big barrier is the quick rotation and frequent changes of the Israeli political cycle, which constrains long-term, strategic policy approaches and is rather characterized by a "reactive" policy-making style (INT 15, 2016).

Since Israel is an arid country, innovative technologies for the hot and dry climate were developed early to overcome water shortages. Most of these actions regarding water or energy efficiency were not strategically planned as adaptation but were driven by severe climatic conditions which needed “to be addressed regardless of climate change” (Feitelson et al., 2012, p. 253). Several interviewees hinted at this observation by naming past adaptive technological advancements, such as desalination or other technologies developed in Israel (e.g., water tanks heated by thermal energy). However, one could argue that these past advancements in technology will not be enough in the face of future challenges and constitute an assumed sense of preparedness.

In sum, the long climate change adaptation policy process can be attributed in part to an Israeli administrative tradition that values short-term planning and improvisation. While not all interviewees shared this view, some noted that improvising has been effective in the past in light of Israel’s scarce resources. The assumption is that innovation is embedded in the DNA of the Israeli administrative tradition and thus, ways of coping with other emerging issues such as adaptation will develop. Simultaneously, a tradition valuing short-term solutions over systematic knowledge-based policies has constrained the ability of the CS to push forward the national adaptation plan in particular.

Conclusions

We typified four different interfaces in which the CS of the MoEP actively connected with various entities in the adaptation planning process, that is, between science and policy, between science and the general public, and at the horizontal and vertical government levels. Hence, the role of the CS can be characterized as boundary work. It functions—to varying extents—as a bridge between different institutions resulting in important implications for climate change adaptation policy. The administrative tradition of Israel, and the position of scientific advice in the country, may explain some of the advantages and barriers to efforts of the CS of the MoEP in advancing adaptation policy, and might also explain why Israel, like many other countries (Wellstead et al., 2017), does not have a well-developed adaptation policy in place.

Climate change is a cross-cutting issue and will continue to demand boundary work. Despite our conclusions regarding limitations of the role of Israeli CSs, we recommend that further research be conducted to reveal additional variables which influence the process of integrating scientific advice in the national adaptation policy-making process, such as politicians’ attitudes to climate change in general, and adaptation in particular.

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Notes

- 1 Its primary goal, which was defined by law in 1984, is to foster innovation in industry and to advance the long-term economic future of Israel (Knesset Research and Information Center, 2016). Funding innovative, state-of-the-art technologies and products at various stages in development has contributed to Israel's reputation as a "start-up nation" (Trajtenberg, 2000). In January 2016, the Office of the CS at the Ministry of Economy was replaced by a National Authority for Technological Innovation (Leck et al., 2016).
- 2 The CS in the Ministry of Health can be appointed for up to 6 years, with the possible extension of another 4 years. Also excluded from this rule is the CS at the Ministry of Economy, who is appointed for 6 years according to Government Decision 4470 (Government of Israel, 2009a).

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References

- Aberbach, J. D., & Rockman, B. A. (2002). Conducting and coding elite interviews. *Political Science and Politics*, 35(4), 673–676.
- Adger, W. N., Lorenzoni, I., & O'Brien, K. L. (2009). *Adapting to climate change: Thresholds, values, governance*. Cambridge, UK: Cambridge University Press.
- Anfara, V. A., Jr., Brown, K. M., & Mangione, T. L. (2002). Qualitative analysis on stage: Making the research process more public. *Educational Researcher*, 31(7), 28–38.
- Araos, M., Ford, J., Berrang-Ford, L., Biesbroek, R., & Moser, S. (2017). Climate change adaptation planning for global south megacities: The case of Dhaka. *Journal of Environmental Policy & Planning*, 19(6), 682–696.
- Arimoto, T., & Sato, Y. (2012). Rebuilding public trust in science for policy-making. *Science*, 337(6099), 1176–1177.
- Ayalon, O., Kutiel, H., Kliot, N., Green, M., Sterenberg, M., Trop, T., Eshet, T., & Liebes, I. (2013). *Adaptation to climate change in the local authorities*. Haifa Israel: Samuel Neaman Institute. Retrieved from <https://www.neaman.org.il/EN/Adaptation-climate-change-the-local-authorities>

- Barber, B. (2013). *If mayors ruled the world: Dysfunctional nations, rising cities*. New Haven, CT: Yale University Press.
- Biesbroek, R., Klostermann, J. E. M., Termeer, C., & Kabat, P. (2013). On the nature of barriers to climate change adaptation. *Regional Environmental Change*, 13(5), 1119–1129.
- Biesbroek, R., Peters, B. G., & Tosun, J. (2018). Public bureaucracy and climate change adaptation. *Review of Policy Research*, 35(6), 776–791.
- Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77–101.
- Brugger, J., Meadow, A., & Horangic, A. (2016). Lessons from first-generation climate science integrators. *Bulletin of the American Meteorological Society*, 97(3), 355–365.
- Chief Scientist Office. (2015). *Summary of activities for 2015: The Office of Chief Scientist, Ministry of Environmental Protection*. Jerusalem: Ministry of Environmental Protection [in Hebrew].
- Christensen, T., & Lægreid, P. (2008). *Administrative reforms and competence in central government organizations* (Working Paper No. 7). Bergen, Norway: Stein Rokkan Centre for Social Studies.
- Craft, J., & Howlett, M. (2013). The dual dynamics of policy advisory systems: The impact of externalization and politicization on policy advice. *Policy and Society*, 32(3), 187–197.
- Craft, J., & Wilder, M. (2017). Catching a second wave: Context and compatibility in advisory system dynamics. *Policy Studies Journal*, 45(1), 215–239.
- Drobinski, P., Da Silva, N., Panthou, G., Bastin, S., Muller, C., Ahrens, B., ... Güttler, I. (2016). Scaling precipitation extremes with temperature in the Mediterranean: Past climate assessment and projection in anthropogenic scenarios. *Climate Dynamics*. <https://doi.org/10.1007/s00382-016-3083-x>
- Dryzek, J. S. (1987). Complexity and rationality in public life. *Political Studies*, 35(3), 424–442.
- Erdan, G. (2009). *Statement at the UN Special Summit on Climate Change*. New York: Ministry of Environmental Protection.
- Feitelson, E., Tamimi, A., & Rosenthal, G. (2012). Climate change and security in the Israeli–Palestinian context. *Journal of Peace Research*, 49(1), 241–257.
- Fleig, A., Schmidt, N. M., & Tosun, J. (2017). Legislative dynamics of mitigation and adaptation framework policies in the EU. *European Policy Analysis*, 3(1), 101–124.
- Flick, U., von Kardoff, E., Steinke, I., & Jenner, B. (2004). *A companion to qualitative research*. Thousand Oaks, CA: SAGE.
- Ford, J. D., Berrang-Ford, L., Bunce, A., McKay, C., Irwin, M., & Pearce, T. (2015). The status of climate change adaptation in Africa and Asia. *Regional Environmental Change*, 15(5), 801–814.
- Gallopin, G., Funtowicz, S., O'Connor, M., & Ravetz, J. (2001). Science for the twenty-first century: From social contract to the scientific core. *International Social Science Journal*, 53(168), 219–229.
- Geerlings, H., & Stead, D. (2003). The integration of land use planning, transport and environment in European policy and research. *Transport Policy*, 10(3), 187–196.
- Givati, A. (2016). Observed and predicted climate change in the eastern Mediterranean and their impact on the water sector. *Water and Irrigation*. Retrieved from <http://iwwaportal.co.il/index.php/המים-משק-על-השפעתם-התיכון-הים-במזרח-הודוים-נצפים-אקלים-שינוי-115/מקצועיות-כהמות> [in Hebrew].
- Glaser, B. G., & Strauss, A. L. (1967). *The discovery of grounded theory: Strategies for qualitative research*. New York: de Gruyter.
- Gläser, J., & Laudel, G. (2010). *Experteninterviews und Qualitative Inhaltsanalyse*. Wiesbaden, Germany: Springer.
- Government of Israel. (2009a). *The list of senior positions in the civil service for which there is a determination of the term of office* (Government Decision 4470). Jerusalem: Cabinet of Israel. [in Hebrew].
- Government of Israel. (2009b). *Preparedness for climate change in Israel: Adaptation to climate change in Israel and mitigation of GHG emissions* (Government Decision 474). Jerusalem: Cabinet of Israel. [in Hebrew].
- Government of Israel. (2016). *National plan for implementation of the greenhouse gas emissions reduction targets and for energy efficiency* (Government Decision 1403). Jerusalem: Cabinet of Israel. [in Hebrew].
- Government Office for Science. (2015). *Chief Scientific Advisers and their officials: An introduction*. Retrieved from https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/426307/15-2-chief-scientific-advisers-and-officials-introduction.pdf
- Guest, G., Bunce, A., & Johnson, L. (2006). How many interviews are enough? *Field Methods*, 18(1), 59–82.
- Guston, D. H. (1999). Stabilizing the boundary between US politics and science. *Social Studies of Science*, 29(1), 87–111.
- Halfman, W. (2005). Science-policy boundaries: National styles? *Science and Public Policy*, 32(6), 457–467.
- Hallegratte, S., Green, C., Nicholls, R. J., & Corfee-Morlot, J. (2013). Future flood losses in major coastal cities. *Nature Climate Change*, 3(9), 802–806.
- Heidrich, O., Dawson, R., Reckien, D., & Walsh, C. (2013). Assessment of the climate preparedness of 30 urban areas in the UK. *Climatic Change*, 120(4), 771–784.

- Henstra, D. (2017). Climate adaptation in Canada: Governing a complex policy regime. *Review of Policy Research*, 34(3), 378–399.
- Himsworth, H. P. (1980). On the integration of expert knowledge into the machinery of government. *British Medical Journal*, 281(6249), 1197–1199.
- Holmes, J., & Clark, R. (2008). Enhancing the use of science in environmental policy-making and regulation. *Environmental Science and Policy*, 11(8), 702–711.
- Hoppe, R. (2010). Lost in translation? Boundary work in making climate change governable. In P. Driessen, P. Leroy, & W. van Vierssen (Eds.), *From climate change to social change: Perspectives on science-policy interactions* (pp. 109–130). Utrecht, the Netherlands: International Books.
- Howlett, M. (2014). Why are policy innovations rare and so often negative? Blame avoidance and problem denial in climate change policy-making. *Global Environmental Change*, 29, 395–403.
- Israeli Climate Change Information Center (ICCIC). (2011). *Executive summary—1st interim report*. Retrieved from <http://nrerc.haifa.ac.il/images/iccic/eng%20executive%20summary.pdf>
- Israeli Climate Change Information Center (ICCIC). (2014). *Adaptation to climate change in Israel: Recommendations and knowledge gaps*. Retrieved from <http://www.sviva.gov.il/infoservices/reservoirinfo/doclib2/publications/p0701-p0800/p0739.pdf>
- Israeli Water Authority. (2017). *Water desalination*. Retrieved from <http://www.water.gov.il/Hebrew/WaterResources/Desalination/Pages/default.aspx> [in Hebrew].
- Jacobs, K., Garfin, G., & Lenart, M. (2005). More than just talk: Connecting science and decisionmaking. *Environment: Science and Policy for Sustainable Development*, 47(9), 6–21.
- Jasanoff, S. (1990). *The fifth branch: Scientific advisors as policymakers*. Cambridge, MA: Harvard University Press.
- Jasanoff, S., & Wynne, B. (1998). Science and decision-making. In S. Rayner & E. L. Malone (Eds.), *Human choice and climate change* (pp. 1–87). Columbus, OH: Battelle Press.
- Jordan, A., Huitema, D., van Asselt, H., Rayner, T., & Berkhout, F. (2010). *Climate change policy in the European Union: Confronting the dilemmas of mitigation and adaptation?* Cambridge, UK: Cambridge University Press.
- Keynan, A. (1988). *Science and Israel's future: A blueprint for revitalizing basic research and strengthening science-based industry*. Jerusalem: Israel Academy of Sciences and Humanities.
- Keynan, A. (1998). The original perception of the chief scientists. Chief scientists in Israeli governmental ministries: Proceedings of Conference held on June 10, 1998, Jerusalem: Israel Academy of Sciences and Humanities [in Hebrew].
- Knesset Research and Information Center. (2016). *Chief scientists and R&D institutes in government ministries*. Jerusalem: Knesset Research and Information Center [in Hebrew].
- Leck, E., Lemarchand, G., & Tash, A. (Eds.). (2016). *Mapping research and innovation in the State of Israel. GO-SPIN country profiles in science, technology and innovation policy*. Paris: UNESCO.
- Lemos, M. C., & Morehouse, B. J. (2005). The co-production of science and policy in integrated climate assessments. *Global Environmental Change*, 15(1), 57–68.
- Lesnikowski, A., Ford, J., Biesbroek, R., Berrang-Ford, L., & Heymann, S. J. (2016). National-level progress on adaptation. *Nature Climate Change*, 6(3), 261–264.
- MacQueen, K. M., McLellan, E., Kay, K., & Milstein, B. (1998). Codebook development for team-based qualitative analysis. *CAM Journal*, 10(2), 31–36.
- Measham, T., Preston, B., Smith, T., Brooke, C., Gorrdard, R., Withycombe, G., & Morrison, C. (2011). Adapting to climate change through local municipal planning: Barriers and challenges. *Mitigation and Adaptation Strategies for Global Change*, 16(8), 889–909.
- Menahem, G., & Zehavi, A. (2016). *Policy analysis in Israel*. Bristol, UK: Policy Press.
- Michaels, L., & Alpert, P. (2013). Anthropogenic climate change in Israel: An overview of scientific research and policy responses. In A. Tal, D. Orenstein & C. Miller (Eds.), *Between ruin and restoration: An environmental history of Israel* (pp. 309–333). Pittsburgh: University of Pittsburgh Press.
- Michaels, L., & Tal, A. (2015). Convergence and conflict with the ‘national interest’: Why Israel abandoned its climate policy. *Energy Policy*, 87, 480–485.
- Ministry of Economy. (2015). *Israeli know-how and adaptation technologies for climate change*. Retrieved from <http://www.economy.gov.il/publications/publications/doclib/adaptationtechforclimatechange.pdf>
- Nachmany, M., Fankhauser, S., Davidová, J., Kingsmill, N., Landesman, T., Roppongi, H., ... Townshend, T. (2015). The 2015 global climate legislation study—A review of climate change legislation in 99 countries. Summary for policy-makers. Retrieved from http://www.lse.ac.uk/GranthamInstitute/wp-content/uploads/2015/05/Global_climate_legislation_study_20151.pdf
- Nalau, J., Preston, B. L., & Maloney, M. C. (2015). Is adaptation a local responsibility? *Environmental Science & Policy*, 48, 89–98.
- NCRD. (2014). *Government R&D activities report 2012–2013*. Jerusalem: National Council for R&D (NCRD). [in Hebrew]

- Negev, M. (2015). Interagency aspects of environmental policy: The case of environmental health. *Environmental Policy and Governance*, 26(3), 205–219.
- OECD. (2017). *Population growth (indicator)*. Retrieved from <https://data.oecd.org/israel.htm>
- Page, E. (2010). Bureaucrats and expertise: Elucidating a problematic relationship in three tableaux and six jurisdictions. *Sociologie Du Travail*, 52(2), 255–273.
- Page, E. (2012). *Policy without politicians: Bureaucratic influence in comparative perspective*. Oxford: Oxford University Press.
- Painter, M., & Peters, G. (2010). *Tradition and public administration*. Berlin, Germany: Springer.
- Peled, A. (2000). The politics of outsourcing: Bureaucrats, vendors, and public information technology (IT) projects. *Information Infrastructure and Policy*, 6(4), 209–225.
- Pelling, M. (2010). *Adaptation to climate change: From resilience to transformation*. Abingdon, UK: Routledge.
- Persson, Å., Runhaar, H., Kalsson-Vinkhuyzen, S., Mullally, G., Russel, D., & Widmer, A. (2018). Environmental policy integration: Taking stock of policy practice in different contexts. *Environmental Science & Policy*, 81(Special issue).
- Peters, G. (2018). *Administrative traditions and administrative reform*. Oxford: Oxford University Press.
- Pielke, R. A. (2007). *The honest broker: Making sense of science in policy and politics*. Cambridge, UK: Cambridge University Press.
- Rahman, M. S., & Tosun, J. (2018). State bureaucracy and the management of climate change adaptation in Bangladesh. *Review of Policy Research*, 35(6), 835–858.
- Reinecke, S. (2015). Knowledge brokerage designs and practices in four European climate services: A role model for biodiversity policies? *Environmental Science & Policy*, 54, 513–521.
- Sandler, T. (1997). *Global challenges: An approach to environmental, political, and economic problems*. Cambridge, UK: Cambridge University Press.
- Sarewitz, D. (2004). How science makes environmental controversies worse. *Environmental Science and Policy*, 7(5), 385–403.
- Sharkansky, I., & Zalmanovitch, Y. (2000). Improvisation in public administration and policy making in Israel. *Public Administration Review*, 60(4), 321–329.
- Shechter, M., Sofer, A., Palatnik, R., Kutiel, H., Kliot, N., Green, M., . . . Ayalon, O. (2012). *Report #2—Israel Adaptation to Climate Change Policy Recommendations—Executive Summary*. Haifa Israel: Samuel Neaman Institute. Retrieved from <https://www.neaman.org.il/EN/Report2-Adaptation-Climate-Change-Policy-Recommendations-Summary>
- Termeer, C., Dewulf, A., & Breeman, G. (2013). Governance of wicked climate adaptation problems. In J. Knieling & W. Leal Filho (Eds.), *Climate change governance* (pp. 27–39). Berlin, Germany: Springer.
- Teschner, N., Garb, Y., & Paavola, J. (2013). The role of technology in policy dynamics: The case of desalination in Israel. *Environmental Policy and Governance*, 23(2), 91–103.
- Teubal, M. (1983). Neutrality in science policy: The promotion of sophisticated industrial technology in Israel. *Minerva*, 21(2), 172–197.
- Tobin, P., Schmidt, N., Tosun, J., & Burns, C. (2018). Mapping states' Paris climate pledges: Analyzing targets and groups at COP 21. *Global Environmental Change*, 48, 11–21.
- Trajtenberg, M. (2000). *R&D policy in Israel: An overview and reassessment* (NBER Working Paper No. 7930). Cambridge, MA: National Bureau of Economic Research.
- Verheijen, T. (2007). Public administration in post-communist states. In B. G. Peters & J. Pierre (Eds.), *Handbook of public administration* (pp. 311–319). Thousand Oaks, CA: SAGE.
- Vink, M., & Schouten, G. (2018). Foreign-funded adaptation to climate change in Africa: mirroring administrative traditions or traditions of administrative blueprinting? *Review of Policy Research*, 35(6), 792–834.
- Wellstead, A., Howlett, M., & Rayner, J. (2017). Structural-functionalism redux: Adaptation to climate change and the challenge of a science-driven policy agenda. *Critical Policy Studies*, 11(4), 391–410.
- World Bank. (2017). *Population growth 2016 (annual %)*. Israel: Central Bureau of Statistics. Retrieved from <https://data.worldbank.org/indicator/SP.POP.GROW?locations=IL>

Appendix—Overview of Interviews

Number	Date	Position/Institution
Telephone Interviews		
INT 1	March 10, 2016	Former scientific advisor to the chief scientist (Ministry of Environmental Protection)

Appendix (Continued)

Number	Date	Position/Institution
INT 2	March 21, 2016	Former scientific advisor to the chief scientist (Ministry of Environmental Protection)
INT 3	March 22, 2016	Former scientific advisor to the chief scientist (Ministry of Environmental Protection)
INT 4	April 4, 2016	Scientific advisor to the chief scientist (Ministry of Energy)
INT 5	May 9, 2016	Former chief scientist (Ministry of Transportation)
INT 6	July 27, 2017	Chief scientist (Ministry of Environmental Protection)
Face-to-Face Interviews		
INT 7	March 21, 2016	Scientific advisor to the chief scientist (Ministry of Economy)
INT 8	March 28, 2016	Environmental NGO employee
INT 9	March 30, 2016	Executive director, a leading environmental NGO
INT 10	April 10, 2016	Office of the chief scientist (Ministry of Environmental Protection) employee
INT 11	May 1, 2016	Former chief scientist (Ministry of Environmental Protection)
INT 12	May 2, 2016	Former chief scientist (Ministry of Science)
INT 13	May 4, 2016	Leading scientist in the Israeli Climate Change Information Center
INT 14	May 4, 2016	Professor (University of Haifa) ICCIC member
INT 15	May 4, 2016	Professor (University of Haifa) ICCIC member
INT 16	May 8, 2016	Professor (Hebrew University)
INT 17	May 10, 2016	Post-Doc (Hebrew University)
INT 18	May 11, 2016	Deputy chief scientist (Ministry of Science)
INT 19	May 11, 2016	Scientific advisor to the chief scientist (Ministry of Economy)
INT 20	May 13, 2016	Former chief scientist (Ministry of Environmental Protection)
INT 21	May 15, 2016	Professor (Hebrew University)
INT 22	May 15, 2016	Former scientific advisor to the chief scientist (Ministry of Science)
INT 23	May 16, 2016	Chief scientist (Ministry of Transportation)
INT 24	May 17, 2016	Chief scientist (Ministry of Health)
INT 25	May 18, 2016	Scientific advisor to the chief scientist (Ministry of Energy)
INT 26	May 23, 2016	Professor (Hebrew University)