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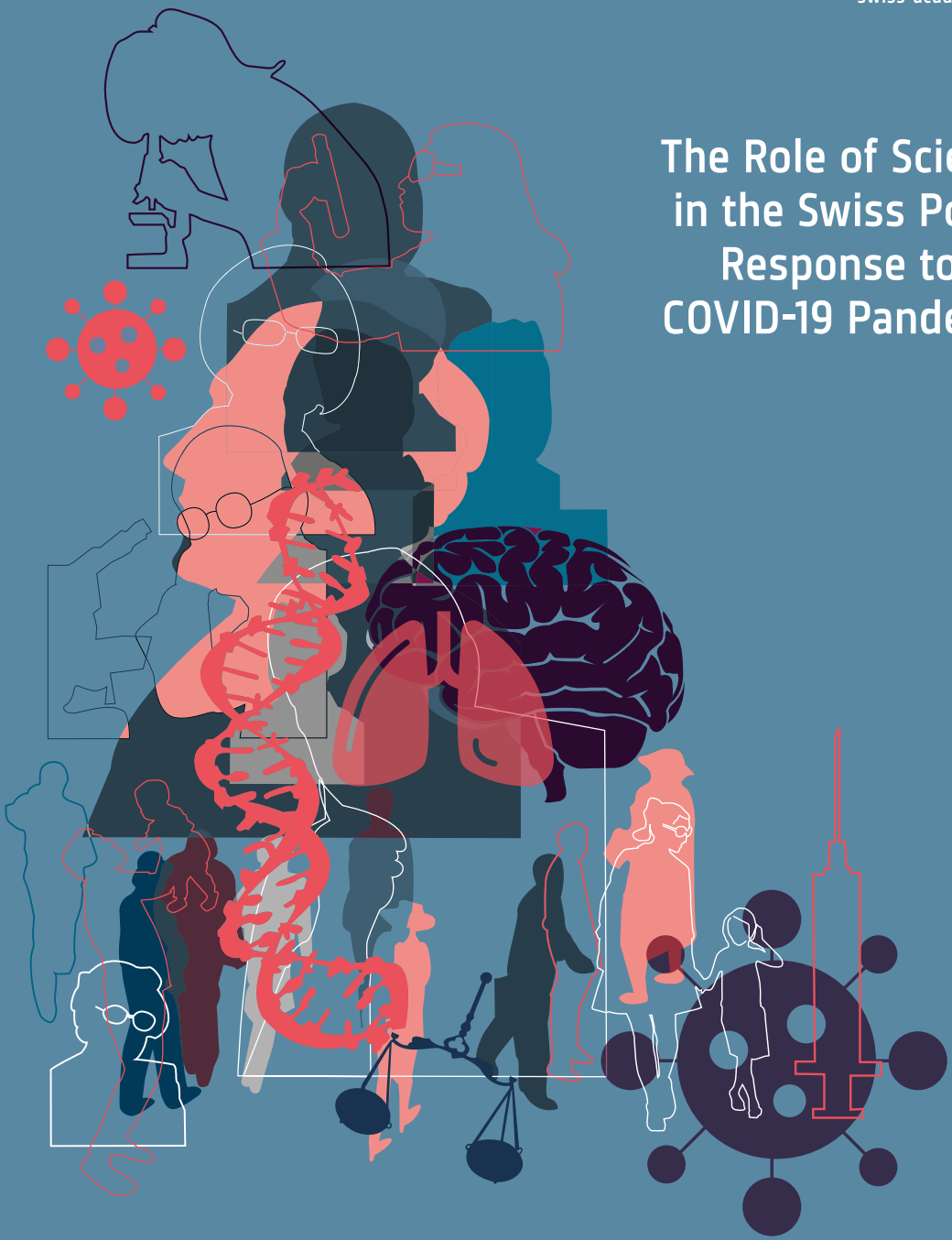
The Role of Science in the Swiss Policy Response to the COVID-19 Pandemic



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The Role of Science in the Swiss Policy Response to the COVID-19 Pandemic

Mandate

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The findings and conclusions in this report are solely those of the author.

Science and Technology Studies (STS) is an interdisciplinary field of research and teaching that examines issues positioned at the intersection of science, technology, and society, with the ultimate goal of helping leaders in science, politics, public administration, business, and society to make informed decisions.

SDGs: The international sustainability goals of the UN

With this publication, the Swiss Academies of Arts and Sciences make a contribution to the SDG 3 "Ensure healthy lives and promote well-being for all at all ages", SDG 4 "Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all", SDG 16 "Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels" and SDG 17 "Strengthen the means of implementation and revitalize the global partnership for sustainable development".

› sustainabledevelopment.un.org

› eda.admin.ch/agenda2030/en/home/agenda-2030/die-17-ziele-fuer-eine-nachhaltige-entwicklung.html

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Preface

"Any historical narrative is a particular bundle of silences."
Michel-Rolph Trouillot, 1995

Since the advent of the SARS-CoV-2 virus, a spotlight has been shone on the role of science in public policy within liberal democracies. Despite the global nature of the COVID-19 pandemic, science advice was predominantly solicited at the national level and often guided by domestic crisis management regimes. Accordingly, countries worldwide are starting to consider lessons learned and to determine what steps they might take to revise their systems of science advice for policy.

The relationship between science and politics is inherently complex and problematic. Furthermore, as the pandemic has demonstrated, it is influenced by a range of other social forces such as media coverage and cultural traditions. As decision-makers contemplate viable options for action, it is important to examine current trends and discern patterns in the available record. In this vein, the present report offers a national case study on the role of science in pandemic policy response from the perspective of the field of Science & Technology Studies (STS).

This report was submitted to the Swiss Academies of Arts and Sciences (a+) in July 2021. It provided the impetus for the Academies' network for transdisciplinary research (td-net) to run an online workshop, "Science and COVID-19" on September 3, 2021. Project interviewees from politics, public administration, science, science journalism, and professional associations assembled to identify lessons learned to improve future collaboration between policy makers, scientists, and practitioners.

The author would like to express her gratitude to the dedicated persons who generously contributed their time despite the substantial workloads foisted upon them by an unrelenting global pandemic.

Memories fade and challenges shift in the aftermath of crises. In time, the topic of the relationship between science and politics will likely retreat to the background of policy agendas in favour of other issues. For this reason, it is important to seize this historic opportunity to capitalise upon the experiences gained and prepare this relationship to tackle the challenges that lie ahead.

Basel, October 2021

PD Dr. Alexandra Hofmänner

Zusammenfassung

Auf der ganzen Welt wurde die Wissenschaft als Beraterin von Entscheidungsträgerinnen und -trägern für Fragestellungen zum neuen SARS-CoV-2-Virus beigezogen. Die Rollen, die einzelne Staaten der Wissenschaft in ihren politischen Entscheidungsprozessen beimessen, unterscheiden sich jedoch deutlich. Nationale Fallstudien zur Rolle der Wissenschaft in der politischen Bewältigung der Pandemie sind noch nicht verfügbar. Entgegen der landläufigen Meinung umfasst wissenschaftliche Politikberatung mehr als nur einen geradlinigen Wissenstransfer sondern wird von politischen Systemen und Verfahren, gesetzlichen Vorgaben und Institutionen mitbestimmt. Die Komplexität dieser Umstände tritt in Krisensituationen noch deutlicher zutage.

Dieser Forschungsbericht dokumentiert die Rolle der Wissenschaft in der politischen Bewältigung der COVID-19-Pandemie in der Schweiz von Januar bis Dezember 2020 und untersucht sie anhand von analytischen Konzepten aus dem Fachbereich der Wissenschafts- und Technikforschung (STS). Die Ergebnisse beruhen auf einem empirischen Forschungsprojekt, das von Oktober 2020 bis Mai 2021 durchgeführt wurde und sich auf die Befragung von Entscheidungsträgerinnen und -trägern aus der Politik, Berufsverbänden, der öffentlichen Verwaltung, der Wissenschaft und den Medien abstützt.

Ein Blick auf die Einrichtungen der wissenschaftlichen Politikberatung der Länder Österreich, Frankreich, Deutschland, Italien und Vereinigtes Königreich während der Pandemie weist auf eine Vielfalt von gesetzlichen Bestimmungen, Mandaten, Strukturen sowie fachlicher Zusammensetzungen hin. Im internationalen Vergleich lässt sich bisher kein bevorzugtes Modell der wissenschaftlichen Politikberatung für die Bewältigung der Pandemie erkennen und es ragt auch kein bestimmtes Modell als Vorbild heraus (Capano et al., 2020; Allen et al., 2020; Jasanoff et al., 2021b).

In der Schweiz entwickelte sich die Rolle der Wissenschaft in der politischen Bewältigung der Pandemie entlang von Phasen, die von den Veränderungen in der politischen Zuständigkeit zwischen Kantonsregierungen und Bund und der entsprechenden Krisenorganisationen geprägt wurden. Anders als in vielen anderen europäischen Ländern wurde die Rolle der Wissenschaft nicht durch rechtliche Vorgaben wie das Epidemiengesetz, den Influenza-Pandemieplan oder das COVID-19-Gesetz geregelt. Aus diesem Grund kamen allgemeine gesetzliche Bestimmungen für die wissenschaftliche Politikberatung in der Schweiz zum Tragen, die den Ämtern, Direktionen und Departementen der Bundesverwaltung eine zentrale Rolle zuweisen.

In der Schweiz wurde am 1. April 2020 eine Swiss National COVID-19 Science Task Force (NCS-TF) eingerichtet, die historisch einzigartig ist und mehrere Besonderheiten aufweist. Für die NCS-TF lässt sich in mehreren Bereichen, die in Gremien der wissenschaftlichen Politikberatungsgremien in anderen Ländern im Jahr 2020 für Aufruhr gesorgt haben, eine vergleichsweise positive Bilanz ziehen. Beispiele sind die fachliche Zusammensetzung, die Einsatzstruktur, die inter- und transdisziplinären Verfahrensweisen und die Qualität der wissenschaftlichen Beratungsleistungen der NCS-TF. Die eingesetzten wissenschaftlichen Politikberatungsgremien wurden überall,

auch in der Schweiz, in Bezug auf ihre Legitimität, Transparenz und Kommunikation von Politik, Medien und Gesellschaft kritisiert. Diese Kritikpunkte betreffen jedoch grundlegende Probleme der wissenschaftlichen Politikberatung, die für gewöhnlich auftreten, weil wissenschaftliche Politikberatung sowohl über formelle als auch informelle Kommunikationskanäle stattfindet. Politische Tätigkeiten, die in liberalen demokratischen Gesellschaften über informelle Kanäle laufen, rufen naturgemäss Kritik hervor.

Die NCS-TF weist im Vergleich zu den Einrichtungen der wissenschaftlichen Politikberatung der Nachbarländer einige Schweizer Besonderheiten auf. Diese umfassen unter anderem die Entstehung und Mitbegründer der NCS-TF; ihren Stellenwert als Taskforce anstelle eines Beirats oder einer Kommission; ihre Tätigkeit ausserhalb der Notstandsgesetzgebung und die Änderung ihrer Anbindung an die Krisenorganisation des Bundes von der strategisch-politischen Ebene hin zur organisatorischen Ebene inmitten der Pandemie. Die Ursachen für diese Schweizer Besonderheiten sind auf die bestehenden allgemeinen politischen, rechtlichen, strukturellen, organisatorischen und verfahrenstechnischen Voraussetzungen für die wissenschaftliche Politikberatung zurückzuführen.

Diese Voraussetzungen haben eine Situation geschaffen, in der wissenschaftliche Politikberatung in erster Linie über die Ämter, Direktionen und Departemente der Bundesverwaltung abgewickelt wird. Diese Konzentration auf die Bundesverwaltung hat sich während der Pandemie für das Bundesamt für Gesundheit (BAG) und die NCS-TF als Belastung herausgestellt. Historisch betrachtet haben diese Bedingungen der wissenschaftlichen Politikberatung in der Schweiz die Entwicklung von vielfältigen Instrumenten und -mechanismen eingeschränkt, wie es sie etwa in Deutschland oder im Vereinigten Königreich gibt. Insofern findet im Vergleich zu anderen Ländern in der Schweiz die direkte wissenschaftliche Politikberatung für Entscheidungsträgerinnen und Entscheidungsträger der horizontalen und vertikalen Politikfelder nur begrenzt statt.

Ein wichtiges Kriterium zur Einschätzung der Beschaffenheit von nationalen wissenschaftlichen Politikberatungssystemen ist die Trennung zwischen zwei unterschiedlichen Funktionen wissenschaftlicher Politikberatung: «science for policy» beschreibt die Nutzung der Wissenschaft bei der politischen Entscheidungsfindung, und «policy for science» betrifft Entscheidungen zur Finanzierung und Struktur der Wissenschaft (Brooks, 1964). Um Interessenskonflikte zu vermeiden, müssen diese beiden Rollen getrennt werden, denn Politikberatung zu Fragen der Wissenschaftspolitik kann Auswirkungen auf die institutionelle Herkunft und Forschungsperspektiven der wissenschaftlichen Beraterin oder des wissenschaftlichen Beraters haben. Aus diesem Grund haben einige Länder während der COVID-19-Pandemie zwei voneinander getrennte Instrumente für die wissenschaftliche Politikberatung eingerichtet oder aktiviert.

Das schweizerische Modell der wissenschaftlichen Politikberatung während der COVID-19-Pandemie hat keine getrennten wissenschaftlichen Politikberatungsinstrumente vorgesehen, um diese beiden Rollen abzudecken. Die NCS-TF wurde ausschliesslich dazu beauftragt, wissenschaftliche Politikberatung im Sinne der «science for policy» durchzuführen. Darüber hinaus verfügt die Schweiz im Gegensatz zu vielen anderen liberalen Demokratien über kein ständiges nationales wissenschaftspolitisches Gremium mit ausdrücklichem gesetzlichen Auftrag, die Regierung in Belangen der «policy for science» zu beraten, das sich während der Pandemie

hätte einbringen und diese wichtige Rolle übernehmen können. Infolgedessen wurden wichtige nationale Entscheidungen in der Bewältigung der Pandemie ohne umfassende Konsultationen getroffen, wie zum Beispiel Entscheidungen zu besonderen Förderinstrumenten und -investitionen für die Forschung, etwa im Bereich «Impfstoffe» oder «klinische Studien». Die wichtigste Schlussfolgerung des Forschungsprojekts ist, dass das Schweizer Modell der wissenschaftlichen Politikberatung während der Pandemie vom Rat eines unabhängigen nationalen Beirats für kurzfristige wissenschaftspolitische Fragen, Ziele, Strategien und Aktionspläne hätte profitieren können. Ein solches Beratungsgremium hätte auch das BAG und die NCS-TF in ihren Beratungsfunktionen entlasten und Diskussionen um ihre jeweiligen Aufgaben und Verantwortlichkeiten vorbeugen können.

Die Beschaffenheit eines nationalen wissenschaftlichen Politikberatungssystems lässt sich anhand des Zusammenspiels zwischen Angebot und Nachfrage untersuchen. Die Untersuchung zeigt, dass wichtige Entscheidungsinstanzen in der Krise nicht hinreichend über die Kanäle der wissenschaftlichen Politikberatung erreicht werden konnten. Erstens verfügen das Schweizer Parlament und der Bundesrat, im Vergleich zu Ländern wie Neuseeland, Deutschland oder dem Vereinigten Königreich, nur beschränkt über direkte und kontinuierliche Instrumente der wissenschaftlichen Politikberatung. Zweitens gilt dies auch für die kantonalen Behörden und Organisationen, die im föderalen System der Schweiz über umfassende politische Entscheidungsmacht verfügen. Drittens sind Berufsverbände und Gewerkschaften in hohem Masse von den Ämtern, Direktionen und Departementen der Bundesverwaltung abhängig, da sie über keinen direkten Zugang zu anderen Quellen wissenschaftlicher Beratung verfügen. Trotz konzertierter und professioneller Anstrengungen des BAG und der NCS-TF konnte die gestiegene Nachfrage nach wissenschaftlicher Politikberatung während der COVID-19 Pandemie nicht hinreichend abgedeckt werden. Die Analyse zeigt, dass dieses Ungleichgewicht zwischen Angebot und Nachfrage nach wissenschaftlicher Politikberatung jedoch in der grundlegenden Beschaffenheit des nationalen wissenschaftlichen Politikberatungssystems und nicht in den spezifischen Instrumenten und Massnahmen der Pandemiebewältigung begründet liegt.

In den letzten Jahren haben mehrere Länder (z. B. Neuseeland, Japan und das Vereinigte Königreich) ihre nationalen wissenschaftlichen Politikberatungssysteme überprüft, ausgebaut und professionalisiert, oft motiviert durch ihre Erfahrungen mit Infektionskrankheiten. Die Schweiz gehört nicht zu diesen Ländern; vielmehr ist eine gegenläufige Tendenz zu beobachten. Im vergangenen Jahrzehnt wurde die Verantwortung für wissenschaftliche Politikberatung zunehmend der öffentlichen Verwaltung übertragen. Dies lässt sich teilweise durch das neue Bundesgesetz über die Förderung der Forschung und der Innovation (FIFG) aus dem Jahr 2012 erklären, in dem der Begriff «Ressortforschung» als eigene rechtliche Forschungskategorie eingeführt wurde. Diese Kategorie übertrug der öffentlichen Verwaltung zwar indirekt, aber auf einen Schlag die Verantwortung für viele Aspekte der wissenschaftlichen Politikberatung auf nationaler Ebene. Diese Verantwortlichkeiten sind zahlreich, weitreichend und umfassen unter anderem Entscheidungen zu wissenschaftspolitischen Richtungen, Zielen, strategischer Planung, sowie zu Koordinations- und Steuerungsgefässen. Die Pandemie hat ein Schlaglicht auf diese Konzentration von Aufgaben und Verantwortlichkeiten geworfen und aufgezeigt, dass sie nicht allein durch die öffentliche Verwaltung getragen werden sollten.

Ausserdem werden durch das aktuelle System der wissenschaftlichen Politikberatung kurzfristige Beratungsprojekte und das Beratungsformat der Evaluation bevorzugt. Das führt dazu, dass der Grossteil der wissenschaftlichen Politikberatung von privaten Beratungsfirmen durchgeführt wird. Diese Grundausrichtung wirft Fragen bezüglich der Transparenz, Qualität und Unabhängigkeit der im politischen Prozess eingeholten wissenschaftlichen Expertise auf. Darüber hinaus geht die Vorherrschaft der Evaluationen zulasten der wissenschaftlichen Politikberatung für die Entscheidungsfindung an anderen Stellen im politischen Prozess («policy cycle»), zum Beispiel der Festlegung der politischen Agenda, der Politikformulierung, der politischen Strategiebildung und der Politikumsetzung. Ausserdem bleibt die potenziell wertvolle wissenschaftliche Expertise der Hochschul- und Forschungseinrichtungen durch diesen Fokus unausgeschöpft.

Gleichzeitig bestehen auch für Wissenschaftlerinnen und Wissenschaftler von Hochschulen und Forschungseinrichtungen kaum Anreize, sich aktiv an der wissenschaftlichen Politikberatung zu beteiligen. Diese Art wissenschaftlicher Tätigkeit wird weder finanziell noch durch akademische Anerkennung entschädigt und zahlt sich für Hochschulen und Forschungsinstitutionen kaum aus, da wissenschaftliche Beratungsleistung kein Kriterium für die Akkreditierung von wissenschaftlichen Einrichtungen ist. Insgesamt ist die wissenschaftliche Politikberatung traditionell nicht Teil der Wissenschaftskultur der Schweiz. Die NCS-TF hat mit Nachdruck unter Beweis gestellt, dass die Forschungsgemeinschaft in der Schweiz motiviert und willens ist, sich in der wissenschaftlichen Politikberatung zu engagieren. Jedoch konnte sie in der Bewältigung der hohen Nachfrage während der COVID-19-Pandemie, entgegen anderen Ländern, nicht von schon bestehenden Fachgesellschaften, Plattformen, Kommunikationsgefässen, Vorgaben und Leitlinien für wissenschaftliche Politikberatung unterstützt werden.

Bis auf diese systemischen Hindernisse lässt sich für die Arbeitsleistung der nationalen wissenschaftlichen Politikberatung in der Bewältigung der COVID-19-Pandemie in der Schweiz eine positive Bilanz ziehen, was vor allem auf den ausserordentlichen Einsatz und die vereinten Bemühungen von Vertretern und Vertreterinnen der Wissenschaft, der öffentlichen Verwaltung, der Politik, der Berufsverbände, der Medien und anderer Bereiche zurückzuführen ist. Viele der Probleme, die während der Pandemie an der Schnittstelle von Wissenschaft und Politik aufgetreten sind, betreffen grundlegende Schwierigkeiten der wissenschaftlichen Politikberatung. Gleichzeitig lässt sich aufgrund der Untersuchung auch Verbesserungspotenzial erkennen. Systemische Probleme im Umfeld der wissenschaftlichen Politikberatung in der Schweiz sind zum Vorschein getreten, die nicht in die Kompetenz des BAG oder der NCS-TF fallen. Es gibt keinerlei Hinweise dafür, dass die Einrichtung von einzelnen temporären Gefässen der wissenschaftlichen Politikberatung den massiven kurzfristigen nationalen Bedarf während einer globalen Krise decken könnte. Es deutet jedoch einiges darauf hin, dass die allgemeinen Rahmenbedingungen, das Reaktionsvermögen und die Resilienz nationaler wissenschaftlicher Beratungssysteme wichtige Voraussetzungen für die Erfüllung dieser Nachfrage sind. Aus diesem Grund empfiehlt diese Studie, dass die Schweiz Schritte unternimmt, um die öffentliche Verwaltung zu entlasten und die nationalen Einrichtungen, Instrumente und Mechanismen der wissenschaftlichen Politikberatung zu revidieren und zu diversifizieren.

Um diesen Reformprozess anzustossen, werden sechs Handlungsoptionen aufgezeigt:

1. Einrichtung eines unabhängigen, ständigen nationalen *Beirats zur Wissenschaftspolitik (BWP)*, der dafür verantwortlich ist, kurz- und mittelfristige Ziele, Strategien und Aktionspläne für wissenschaftspolitische Fragen von nationaler Bedeutung zur Empfehlung zu erarbeiten;

2. Einrichtung einer *Sonderkommission zur wissenschaftlichen Politikberatung* unter der Federführung des Beirats zur Wissenschaftspolitik (BWP), die aus Entscheidungsträgerinnen und -trägern aus Politik, Wissenschaft, Berufsverbänden und Wissenschaftsjournalismus besteht. Um zukunftsgerichtete Lehren aus der Pandemie ziehen zu können, sollte die Sonderkommission
   - eine strategische Beurteilung des nationalen wissenschaftlichen Politikberatungssystems vornehmen, und Massnahmen und Instrumente zur Stärkung seiner Widerstandsfähigkeit, Qualität und Professionalität vorschlagen,
   - die Nachfrage nach wissenschaftlicher Politikberatung von Entscheidungsträgerinnen und -trägern in Parlament, Kantonsbehörden und Berufsverbänden auswerten und wissenschaftliche Beratungsinstrumente erarbeiten, um diesen Bedarf bestmöglich zu decken und die Verfügbarkeit dieser Instrumente in Krisenzeiten sicherzustellen,
   - nationale Instrumente und Massnahmen der Forschungsförderung entwickeln, die in Krisenzeiten bedarfsgerecht schnell ein- und umgesetzt werden können, und die unter anderem Forschungsarten von strategischer nationaler Bedeutung fördern (z.B. Nord-Süd-Forschungspartnerschaften, transdisziplinäre Forschung mit Interessensgruppen),
   - nationale Instrumente und Massnahmen der Forschungsförderung entwickeln, um unabhängige Forschung für die wissenschaftliche Politikberatung zu fördern, insbesondere im Bereich «policy for science»,
   - Leitlinien, Regelungen und Prinzipien für die wissenschaftliche Politikberatung in der Schweiz formulieren, um deren Qualität zu erhöhen;

3. Präzisierung der Rollen der fünf wichtigsten wissenschaftlichen Einrichtungen an der Schnittstelle zwischen Wissenschaft und Politik im Bereich der wissenschaftlichen Politikberatung (Schweizerischer Nationalfonds, ETH-Bereich, swissuniversities, Akademien der Wissenschaften Schweiz, Schweizerischer Wissenschaftsrat) vor dem Hintergrund der COVID-19-Ereignisse;

4. Aktive Teilnahme an internationalen Initiativen zur Verbesserung der wissenschaftlichen Politikberatung bei globalen Problemen, wie zum Beispiel am International Network for Government Science Advice (INGSA);

5. Gezielter Aufbau von Kompetenzen und Strukturen für die wissenschaftliche Politikberatung, welche das Zusammenspiel der Akteure an der Schnittstelle von Wissenschaft und Politik stärken (Wissenschaftsjournalismus, Hochschulen, Politik, berufliche Vereinigungen), z. B. durch neue Aus-, und Weiterbildungskurse, Forschungszentren, Plattformen, und transdisziplinäre Pilotprojekte;

6. Anerkennung der wissenschaftlichen Politikberatung als wesentlichen Bestandteil einer zukünftigen Wissenschaftskultur an universitären Hochschulen und Forschungseinrichtungen der Schweiz; Prüfung von entsprechenden Anpassungen in der Begutachtung von wissenschaftlichen Leistungen.

Executive Summary

All over the world, decision-makers consulted scientists for advice on policy issues relating to the new SARS-CoV-2 virus. The roles that individual nations assign to science in their policy response, however, differ considerably. National case studies on the role of science in national policy responses to the pandemic are not yet available. Contrary to popular opinion, science advice for policy involves much more than a simple transfer of knowledge to decision-makers and depends on political systems and procedures, legal provisions, and institutions. These complicated conditions are compounded in emergency situations.

This research report documents the role of science in the Swiss policy response to the COVID-19 pandemic from January to December 2020 and analyses this role using analytical tools from the field of Science & Technology Studies (STS). Its findings are based on an empirical research project conducted between October 2020 and May 2021, which involved interviews with decision-makers from public policy, professional associations, public administration, science, and the media.

A brief glance across national borders at the science advisory arrangements for policy of Austria, France, Germany, Italy, and the UK during the pandemic confirms a wide variety of legal provisions, mandates, structures, and disciplinary compositions. No preferred model of science advice for pandemic policy response can be identified internationally, and no best-practice model stands out (Capano et al., 2020; Allen et al., 2020; Jasanoff et al., 2021b).

In Switzerland, the role of science in pandemic policy response developed in phases, which were influenced by the country's changing distribution of power between federal and cantonal governments and their respective modes of crisis organisation. In contrast to many European countries, the role of science in the health emergency situation in Switzerland was not regulated by statutory provisions such as the Swiss Epidemics Act, the Influenza Pandemic Plan, or the COVID-19 Act. By default, the standard regulations for science advice in Switzerland applied, which assign a central role to offices and departments of federal public administration.

The Swiss case involved the establishment of the Swiss National COVID-19 Science Task Force (NCS-TF) on April 1, 2020, which is unique in Swiss history and has several special characteristics. For one, the record of the NCS-TF is a testament to its excellent performance on several issues that caused turmoil in other countries in 2020. These include its disciplinary composition, efficient operational structure, and inter- and transdisciplinary productivity and output. Across all countries, including Switzerland, criticism was also directed to the science advisory agencies from politics, the media, and society on the issues of legitimacy, transparency, and communication. However, these issues have to do with problems that are generic to the science advisory process and typically occur because science advice is conveyed through both formal and informal communication channels. In liberal democratic societies, policy activities conducted through informal channels naturally provoke critical debate.

A brief comparison with its neighbours reveals several specific features for the Swiss setup of science advice. Among others, these features concern the NCS-TF's origins and initiators, its status as a task force rather than an advisory council or committee, its operation outside of emergency legislation, and its change of status in federal crisis organisation from a strategic-political level to an operational level amid the pandemic. The reasons for the specific Swiss features may be found in the general political, legal, structural-organisational and procedural conditions of science advice for policy in this country.

These conditions have created a situation in which science advice is primarily channelled through offices, agencies, and departments of federal public administration. This exclusive focus on federal public administration placed a strain on the Federal Office of Public Health (FOPH) and the NCS-TF during the pandemic. Historically, it has also restricted the development of a diverse landscape of science advisory instruments and mechanisms in Switzerland, as it exists in other countries such as Germany or the UK. Consequently, contrary to other countries, the direct provision of science advice to key decision-makers along horizontal and vertical policy spheres in Switzerland is limited.

An important criterion for the performance of national science advisory systems is to separate between two different functions of science advice: "science for policy" describes scientific advice for decision-making in public policy, and "policy for science" refers to scientific advice for decision-making on how to fund or structure the scientific pursuit of knowledge (Brooks, 1964). These two roles must be separated to avoid conflicts of interest because strategic advice on science policy potentially affects the home institution and research prospects of the scientific advisor. For this reason, some countries established or activated two separate science advisory bodies to provide scientific advice to policy during the COVID-19 pandemic.

The Swiss model of science advice did not establish separate science advisory bodies to cover these different roles during the COVID-19 pandemic. The NCS-TF was only mandated to deliver "science for policy" advice. Moreover, unlike many liberal democratic countries, Switzerland has no permanent national science policy council responsible for providing advice on "policy for science", which could have stepped up during the pandemic and assume this important role. As a consequence, important national decisions for pandemic response were made without broad consultation, for example, decisions on special research promotion instruments and investments, such as vaccines or clinical studies. The main conclusion of this study is that the Swiss model would have profited greatly from an independent national council authorised explicitly to advise on short-term science policy matters of national significance: to set national goals, to formulate national strategies, and to develop national action plans. Such an advisory body is likely to have disburdened the FOPH and the NCS-TF and may have prevented debate over their respective tasks and responsibilities.

One way to consider the performance of a national science advisory system is to study the interplay of demand and supply of scientific advice. The analysis suggests that several key decision-making authorities on the demand side were not reached by the science advisory

channels during the public health crisis. First, the Swiss parliament has no science advisory instruments at its disposal, nor are direct science advisory instruments at the disposal of the Federal Council, as in other countries such as New Zealand, Germany, or the UK. Second, the same holds true for cantonal authorities and organisations which, in the Swiss federalist system, possess substantial decision-making power over policy matters. Third, professional associations and unions are strongly dependent on offices, agencies, and departments in federal administration because they have no direct access to other science advisory sources. Despite concerted and professional efforts by the FOPH and the NCS-TF, increased demand for science advice for policy could not be met during the COVID-19 pandemic. However, analysis of the Swiss case suggests that the reasons for this imbalance between supply and demand for scientific advice may be found in the broader circumstances of the Swiss science advisory system rather than in the special science advisory agencies and measures established for the COVID-19 pandemic.

Over the past few years, several countries have revised, expanded and professionalised their national systems of science advice for policy (e.g. New Zealand, Japan, and the UK), often spurred by past experiences with infectious diseases. Switzerland is not part of this group; if anything, a contrary trend may be observed in the country. In the past decade, scientific advisory responsibilities have been increasingly concentrated in the domain of public administration. This may be explained in part by the new Research and Innovation Act (RIPA) of 2012, which introduced the notion of "policy research" ("Ressortforschung") as a statutory research category in its own right. This category, indirectly but at a stroke, assigned responsibility for many aspects of national science advice for policy in bulk mode to the domain of public administration. The range and scope of these responsibilities include decisions on science policy agendas and goals, strategic planning, coordination, administration, and management. The pandemic has shed light on this concentration of tasks and responsibilities and has shown that public administration cannot shoulder them on its own.

Furthermore, the current system of science advice favours the instrument of short-term consulting projects and the advisory format of evaluations. As a result, the majority of science advice for policy is delivered by private consulting companies. This predisposition raises issues of transparency, quality, and independence of the expertise consulted in the policy process. In addition, the prominence of evaluations comes at the expense of science advice for decision-making in other stages of the policy process, such as agenda setting, policy formulation, strategy building, and policy implementation. At the same time, this focus leaves untapped the potentially valuable scientific expertise at higher education and research institutions.

Meanwhile, there is little incentive for scientists at higher education and research institutions to actively participate in science advice for policy. This type of scientific activity is not remunerated in monetary terms or by academic recognition, nor does it benefit higher education and research institutions, as science advice is not a criterion for institutional accreditation. In sum, science advisory activities are not part of Switzerland's cultural tradition of science. The NCS-TF has provided ample evidence that the Swiss scientific community is motivated and willing to engage in science advice for policy. However, contrary to other countries, the

task force was not assisted by professional societies, exchange platforms, communication channels, guidelines, and codes of practice on science advice for policy to respond to the great demand for science advice during the COVID-19 pandemic.

Apart from these systemic obstacles, scientific policy advice for the Swiss policy response to the COVID-19 pandemic displays a good track record which is mainly due to the exceptional professional commitment and concerted efforts of individuals in science, public administration, public policy, professional associations, the media, and others. Several of the difficulties encountered along the way concern problems which are generic to the professional trade of science advice. At the same time, the record also shows potential for improvement. The analysis has disclosed systemic problems in the broader conditions of science advice in Switzerland that do not fall within the scope of the FOPH or the NCS-TF. No evidence has suggested that establishing one or two new temporary science advisory bodies can meet the massive national short-term demand for science advice for policy during a global health crisis. There is, however, evidence to suggest that the overall condition, flexibility, and resilience of national science systems are important requirements to address this demand. For this reason, this study recommends that Switzerland undertake steps to disburden public administration and revise and diversify its national science advisory agencies, instruments and mechanisms.

The following options for actions are proposed to initiate this reform process.

1. Establish an independent, permanent national *Science Policy Advisory Council (SPAC)*, responsible for advising on short-term science policy goals, strategies, and action plans on scientific matters of national importance;
2. Establish a post-COVID-19 *Special Commission on Science Advice* under the auspices of the SPAC, which is composed of decision-makers in politics, science, professional associations, and the media. To draw lessons from the pandemic for the future, the special commission will
   - Carry out a strategic appraisal of the national science advisory system to propose measures and instruments to strengthen its resilience, quality, and professionalism,
   - Assess the science advisory demands of decision-makers in parliament, cantonal authorities, and professional associations, and propose science advisory instruments to meet their needs as best they can, and ensure their availability in times of crises,
   - Develop national rapid-response research promotion instruments and measures for times of crises (e.g. North-South research partnerships, transdisciplinary research involving stakeholders),
   - Develop national funding instruments and measures to promote independent research projects for science advice for policy, with particular emphasis on the "policy for science" side,
   - Formulate quality standards for science advisory activities in Switzerland by developing guidelines, principles, and codes of practice;

3. Specify the science advisory roles for policy of the five main science institutions at the science policy interface (Swiss National Science Foundation, ETH-Domain, swissuniversities, Swiss Academies of Arts and Sciences, Swiss Science Council) in the light of events;
4. Join and actively participate in international initiatives to improve science advice for policy on global problems, such as the International Network for Government Science Advice (INGSA);
5. Develop competences and structures for science advice for policy to support cooperation between key actors at the interface of science and politics (science journalism, universities, politics, professional associations), e.g. through new educational and training courses; research centres; exchange platforms; transdisciplinary pilot projects;
6. Recognise science advice for policy as an essential component of future scientific culture at Swiss universities and research institutions and consider adjusting standard criteria for academic performance appraisal.

Synthèse

Dans le monde entier, les gouvernements ont consulté des scientifiques pour obtenir des conseils sur les questions politiques liées au nouveau coronavirus SARS-CoV-2. Cependant, les rôles que les différents pays ont attribués à la science dans le cadre de leur réponse politique diffèrent considérablement. Il n'existe pas encore d'études de cas à échelle nationale sur le rôle que la science a joué dans les réponses politiques des différents pays à la pandémie. Contrairement aux idées reçues, les conseils scientifiques visant à orienter les décisions politiques impliquent bien plus qu'un simple transfert de connaissances aux responsables, sans compter qu'ils sont tributaires des systèmes et procédures politiques, des dispositions légales et des institutions. Ces conditions, déjà peu simples, se compliquent dans les situations d'urgence.

Le présent rapport de recherche examine le rôle de la science dans le cadre de la réponse politique apportée par la Suisse à la pandémie de COVID-19 entre janvier et décembre 2020 et analyse ce rôle au moyen d'outils analytiques provenant du domaine des études des sciences et technologies (STS). Ses conclusions sont fondées sur un projet de recherche empirique mené entre octobre 2020 et mai 2021, qui s'appuie sur des entretiens avec des responsables de politique publique, des associations professionnelles, l'administration publique, des scientifiques et des journalistes.

Au-delà des frontières nationales, un bref regard sur les conseils scientifiques prodigués aux responsables politiques en Autriche, en France, en Allemagne, en Italie et au Royaume-Uni pendant la pandémie confirme l'existence d'une grande variété de dispositions légales, de mandats, de structures et de compositions disciplinaires. Au niveau international, aucun modèle privilégié en matière de conseils scientifiques pour une réponse politique en cas de pandémie ne peut être identifié, et il n'existe aucun exemple de bonnes pratiques (Capano et al., 2020 ; Allen et al., 2020 ; Jasanoff et al., 2021b).

En Suisse, le rôle de la science dans le cadre de la réponse politique à la pandémie a connu une évolution en plusieurs phases, qui ont été influencées par la répartition évolutive des compétences entre les gouvernements cantonaux et la Confédération ainsi que leurs manières respectives de gérer la crise. Contrairement à de nombreux pays européens, le rôle accordé à la science durant la situation d'urgence sanitaire en Suisse n'a pas été réglementé par des dispositions légales telles que la loi sur les épidémies, le Plan suisse de pandémie Influenza ou la loi COVID-19. Par défaut, ce sont les réglementations habituelles en matière de conseils scientifiques en Suisse qui ont été appliquées. Celles-ci confèrent un rôle central aux offices et départements de l'administration publique fédérale.

Dans le cas de la Suisse, il convient également de mentionner la création de la Swiss National COVID-19 Science Task Force (NCS-TF) en date du 1er avril 2020, une première dans l'histoire du pays. Celle-ci présente plusieurs caractéristiques particulières : d'une part, son bilan qui témoigne des excellents résultats obtenus dans plusieurs domaines qui ont provoqué des remous dans d'autres pays en 2020, et, d'autre part, sa composition disciplinaire, l'efficacité de sa structure opérationnelle ainsi que sa productivité et ses résultats inter- et transdiscipli-

naires. Dans tous les pays, y compris en Suisse, les responsable politiques, les médias et la société civile ont critiqué la légitimité, la transparence et la communication des organismes de conseils scientifiques. Cependant, ces questions ont trait à des problématiques qui sont propres au processus de conseil scientifique et qui surviennent généralement parce que les conseils scientifiques sont relayés via des canaux de communication formels et informels. Dans une société démocratique et libérale, les activités politiques menées par le biais de canaux informels donnent naturellement lieu à des débats et des critiques.

Une brève comparaison avec les pays voisins permet d'observer plusieurs caractéristiques propres au système suisse de conseil scientifique. Parmi celles-ci, il convient de citer la genèse de la NCS-TF et ses initiateurs, son statut de groupe de travail et non de conseil ou comité consultatif, ses activités en dehors de la législation d'urgence et son changement de statut dans le cadre de la gestion de crise de la Confédération, passant ainsi d'un niveau politico-stratégique à un niveau opérationnel pendant la pandémie. Les origines de ces spécificités suisses sont à rechercher dans les conditions générales politiques, juridiques, structurelles, organisationnelles et procédurales du conseil scientifique destiné aux responsables politiques.

Ces conditions font que les conseils scientifiques sont principalement relayés par les offices, les agences et les départements de l'administration publique fédérale. Cette attention exclusive portée sur l'administration publique fédérale a fait peser une forte pression sur l'Office fédéral de la santé publique (OFSP) et la NCS-TF durant la pandémie. Par le passé, cela a aussi limité le développement d'une panoplie diversifiée d'instruments et de mécanismes de conseil scientifique comme il en existe en Allemagne ou au Royaume-Uni, par exemple. Par conséquent, contrairement à d'autres pays, la transmission directe de conseils scientifiques aux principaux décideurs dans les sphères politiques horizontales et verticales est limitée en Suisse.

Pour garantir le bon fonctionnement des systèmes nationaux de conseil scientifique, il est crucial de faire la distinction entre deux fonctions de ce dernier : la science au service de la politique *(science for policy)* désigne les conseils scientifiques visant à aider les prises de décision politiques, alors que la politique en matière de science *(policy for science)* fait référence aux conseils scientifiques ayant pour but d'aider les prises de décision en matière de financement ou de structuration de la recherche scientifique (Brooks, 1964). Ces deux rôles doivent être scindés afin d'éviter les conflits d'intérêts, car les conseils stratégiques en matière de politique scientifique pourraient affecter l'institution d'origine et les perspectives de recherche du conseiller scientifique. Pour cette raison, certains pays ont institué ou activé deux organes consultatifs distincts pour transmettre des conseils scientifiques aux responsables politiques durant la pandémie de COVID-19.

Le modèle suisse de conseil scientifique n'a pas opéré une telle séparation pour couvrir ces différents rôles lors de la pandémie. La NCS-TF a uniquement été mandatée pour prodiguer des conseils scientifiques aux décideurs politiques. En outre, contrairement à de nombreuses démocraties libérales, la Suisse ne dispose pas d'un conseil permanent de politique scientifique au niveau national qui serait chargé de prodiguer des conseils relatifs à la « politique en matière de science » et qui aurait pu assumer ce rôle important durant la pandémie. Par conséquent, d'importantes décisions au niveau national relatives à la lutte contre la pandémie ont été prises

sans faire l'objet d'une large consultation. C'est par exemple le cas des décisions concernant les investissements et les instruments spéciaux visant à promouvoir la recherche, comme les vaccins ou les études cliniques. La principale conclusion de la présente étude est que le modèle suisse aurait grandement bénéficié d'un conseil indépendant au niveau national autorisé explicitement à jouer le rôle de conseiller sur des questions de politique scientifique à court terme d'importance nationale, en fixant notamment des objectifs nationaux, en formulant des stratégies nationales et en concevant des plans d'action nationaux. Un tel organe consultatif aurait probablement déchargé l'OFSP ainsi que la NCS-TF et aurait peut-être évité les débats concernant leurs tâches et responsabilités respectives.

L'une des manières d'examiner le succès d'un système national de conseil scientifique est d'étudier l'interaction entre la demande et l'offre de tels conseils. Il ressort de l'analyse que, pendant la crise sanitaire, les conseils scientifiques ne sont pas parvenus à plusieurs instances décisionnelles clés se trouvant du côté de la demande.

Premièrement, le Parlement suisse ne dispose d'aucun instrument de conseil scientifique et le Conseil fédéral n'a pas non plus de tels outils directs à sa disposition, contrairement à d'autres pays comme la Nouvelle-Zélande, l'Allemagne ou le Royaume-Uni. Deuxièmement, le constat est le même pour les autorités et organismes cantonaux qui, dans le système fédéraliste suisse, possèdent un pouvoir de décision considérable en matière de politique. Troisièmement, les associations professionnelles et les syndicats dépendent fortement des offices, agences et départements de l'administration fédérale, car ils n'ont pas d'accès direct à d'autres sources de conseil scientifique. Malgré les efforts communs et professionnels de l'OFSP et de la NCS-TF, la demande accrue de conseil scientifique de la part des responsables politiques n'a pas pu être satisfaite durant la pandémie de COVID-19. Cependant, l'analyse du cas suisse laisse suggérer que ce déséquilibre entre l'offre et la demande en matière de conseil scientifique serait dû aux caractéristiques du système suisse de conseil scientifique plutôt qu'aux agences et mesures spéciales de conseil scientifique établies dans le cadre de la pandémie de COVID-19.

Ces dernières années, souvent après avoir dû faire face à la gestion de maladies infectieuses, plusieurs pays ont revu, élargi et professionnalisé leur système national de conseil scientifique destiné aux responsables politiques (p. ex. la Nouvelle-Zélande, le Japon et le Royaume-Uni). La Suisse ne fait pas partie de ce groupe ; d'ailleurs, on peut même observer une tendance contraire dans le pays. Ces dix dernières années, les responsabilités en matière de conseil scientifique ont été de plus en plus intégrées dans le domaine de l'administration publique. L'une des raisons pouvant expliquer cette tendance est la nouvelle loi sur l'encouragement de la recherche et de l'innovation (LERI), qui a introduit la notion de « recherche de l'administration » comme étant une catégorie de recherche officielle à part entière. Celle-ci, de manière indirecte mais d'un simple trait de plume, a attribué à l'administration publique la responsabilité de nombre d'aspects tous azimuts du conseil scientifique destiné aux responsables politiques au niveau national. Ces responsabilités, nombreuses et vastes, comprennent les décisions sur les programmes et les objectifs en matière de politique scientifique, la planification stratégique, la coordination, l'administration et la gestion. La pandémie a mis en lumière cette concentration des tâches et des responsabilités de même qu'elle a démontré que l'administration publique ne peut pas les assumer toute seule.

En outre, le système actuel de conseil scientifique favorise l'instrument des projets de consultation à court terme et le format consultatif des évaluations. Par conséquent, la majorité des conseils scientifiques destinés aux responsables politiques sont dispensés par des entreprises de conseil privées. Cette prédisposition soulève des questions concernant la transparence, la qualité et l'indépendance des experts consultés dans le cadre de l'élaboration des politiques. En outre, l'importance accordée aux évaluations se fait aux dépens des conseils scientifiques servant à la prise de décisions lors d'autres étapes de l'élaboration des politiques, telles que la définition du programme, la formulation de politiques, le développement de stratégies et la mise en œuvre de politiques. Dans le même temps, l'expertise scientifique des établissements d'enseignement supérieur et de recherche, qui pourrait s'avérer précieuse, n'est pas exploitée en raison de cette attention portée aux évaluations.

Parallèlement, les moyens ne sont pas vraiment mis pour que les scientifiques de ces établissements s'engagent activement à la formulation de conseils scientifiques destinés aux responsables politiques. En effet, ce type d'activité scientifique n'est pas assorti d'une rémunération financière ou d'une reconnaissance au niveau académique et ne profite pas aux établissements d'enseignement supérieur et de recherche, car le conseil scientifique n'est pas un critère d'accréditation institutionnelle. En résumé, les activités de conseil scientifique ne font pas partie de la tradition scientifique en Suisse. La NCS-TF a clairement démontré que la communauté scientifique suisse est motivée et prête à s'engager en faveur du conseil scientifique destiné aux responsables politiques. Cependant, contrairement à d'autres pays, le groupe de travail n'a pas été soutenu par des associations professionnelles, des plateformes d'échange, des canaux de communication, des lignes directrices et des codes de pratique relatifs au conseil scientifique destiné aux responsables politiques. Il n'a ainsi pas pu répondre à l'importante demande en conseils scientifiques durant la pandémie de COVID-19.

À l'exception de ces obstacles systémiques, les conseils scientifiques destinés aux responsables politiques suisses pour lutter contre la pandémie de COVID-19 affichent un bilan positif, qui tient principalement à l'exceptionnel engagement professionnel et aux efforts conjoints de personnes issues notamment du domaine des sciences, de l'administration publique, de la politique publique, des associations professionnelles et des médias. Certaines des difficultés rencontrées ont trait à des problèmes qui sont dus à la nature de l'activité de conseil scientifique. Dans le même temps, l'étude montre aussi que des améliorations demeurent possibles. L'analyse a révélé des problèmes systémiques dans le domaine général du conseil scientifique en Suisse qui ne relèvent ni de l'OFSP ni de la NCS-TF. Aucun élément ne laisse à penser que la création d'un ou de deux nouveaux organes temporaires de conseil scientifique puisse répondre à l'énorme demande à court terme en conseils scientifiques destinés aux responsables politiques au niveau national durant une crise sanitaire mondiale. Il semblerait toutefois que la situation générale, la flexibilité et la résilience des systèmes scientifiques nationaux sont des critères importants permettant de répondre à cette demande. La présente étude recommande donc à la Suisse de prendre des mesures pour soulager l'administration publique ainsi que de revoir et diversifier ses agences, instruments et mécanismes nationaux de conseil scientifique.

Les mesures suivantes sont suggérées pour lancer ce processus de réforme :

1. Créer un *Conseil consultatif de la politique scientifique (CCPS)* indépendant et permanent au niveau national, chargé de dispenser des conseils sur les objectifs, les stratégies et les plans d'action à court terme visant à répondre aux questions de politique scientifique d'importance nationale ;

2. Créer une *Commission spéciale de conseil scientifique* post-COVID-19, placée sous l'égide du CCPS, qui soit composée de responsables politiques, scientifiques, des associations professionnelles et des médias. Afin de tirer des leçons de la pandémie, la commission spéciale :
   - procédera à une évaluation stratégique du système national de conseil scientifique afin de proposer des mesures et des instruments pour renforcer la résilience, la qualité et le professionnalisme de celui-ci ;
   - évaluera les demandes de conseil scientifique provenant du Parlement, des autorités cantonales et des associations professionnelles et proposera des instruments de conseil scientifique pour répondre au mieux à ces besoins et garantir la disponibilité de ces instruments en cas de crise ;
   - développera des instruments et des mesures de promotion de la recherche de réponses rapides au niveau national pour les périodes de crise (p. ex. partenariats de recherche Nord-Sud, recherche transdisciplinaire impliquant les parties concernées, etc.) ;
   - élaborera des instruments et des mesures de financement au niveau national visant à promouvoir des projets de recherche indépendants traitant du conseil scientifique destiné aux responsables politiques, en mettant l'accent sur la politique en matière de science ;
   - établira des normes de qualité pour les activités de conseil scientifique en Suisse en développant des lignes directrices, des principes et des codes de pratique ;

3. précisera, à la lumière des événements, les rôles des cinq principales institutions scientifiques (Fonds national suisse, Domaine des EPF, swissuniversities, Académies suisses des sciences, Conseil suisse de la science) en matière de conseil scientifique destiné aux responsables politiques ;

4. participera activement aux initiatives internationales visant à améliorer le conseil scientifique destiné aux responsables politiques sur les problèmes mondiaux, telles que le Réseau international pour les conseils scientifiques gouvernementaux (INGSA) ;

5. développera des compétences et des structures pour le conseil scientifique destiné aux responsables politiques afin de renforcer la collaboration entre les acteurs clés situés au croisement de la science et de la politique (journalisme scientifique, universités, politique, associations professionnelles), par exemple au moyen de nouveaux cours de formation, de centres de recherche, de plates-formes d'échange et de projets pilotes transdisciplinaires ;

6. reconnaîtra le conseil scientifique destiné aux responsables politiques comme étant un élément essentiel de la future culture scientifique dans les universités et établissements de recherche suisses et envisagera d'adapter les critères d'évaluation des performances académiques.

1. Introduction

The COVID-19 pandemic has upended the fabric of 21st-century society and has exposed how tightly science is interwoven with it. Science was hurled into the public spotlight as a beacon of hope, as a harbinger of news both good and bad, and as an object of fierce critique. Science was expected to research the new virus and present knowledge on a broad range of subjects including, for example, diagnostics, vaccines, therapeutics, and models. However, beyond that, science was also expected to provide advice for policy decisions. This role, of course, is by no means new to science. In liberal democracies, political procedures and traditions rely heavily on science and scientific advice. For various reasons, however, this role is not showcased and largely operates in the background.

One reason for this low-key public performance of science advice is that the image of a model scientist and their career do not blend well with political collaboration. A model scientist is expected to produce objective knowledge detached from any kind of political, financial, or other influences. Scientific proficiency and excellence, after all, are measured not in terms of science advice to policy but through methodological robustness. Scientists do not achieve academic recognition through advisory activities, public reports, or policy statements but by citation count.

Furthermore, particularly in the Western liberal democracies of Europe, a certain measure of discomfort is expressed over the notion of having scientists mingle with politics. The political appropriation of science during World War II has left its imprint on the social role of science in the post-war years and has led many liberal democracies to eventually recognize the principle of the freedom of science as a constitutional right. Political action and public debate during the COVID-19 pandemic, however, publicly conveyed to the world that this freedom is not set in stone. Across the world, science has been recruited to advise policy to combat the new virus and scientists were primarily recruited to do so within the bounds of the nation-state. Although international and transnational organisations such as the World Health Organisation (WHO) or the European Centre for Disease Prevention and Control (ECDC) played significant science advisory roles and some regional policy coordination has been reported, scientific agency for pandemic response was first and foremost directed at decision-makers and governance systems within the nation-state.

As the pandemic spread and increased in intensity in March 2020, national emergency provisions were activated, and measures were imposed to contain the spread of the SARS-CoV-2 virus. Overall, policy responses have differed considerably among nations and even neighbouring countries. This variation is often explained with reference to differences in political systems and traditions. However, the roles assigned to science in policy responses were also significantly different across nations. Political systems and traditions expectedly differ among nations. Science,

on the other hand, is reputedly a global public good with knowledge and standards that apply everywhere. Why, then, did science assume different roles in different countries? Why, indeed, were scientists primarily active in and preoccupied with national problems? Why did governments rely so heavily on advice from local scientists? These questions are particularly important because we are dealing with a problem of global proportions requiring concerted global efforts and solutions – the impacts of this harsh reality are evident from the uneven distribution of infection rates, as vaccines have been available for citizens in some countries, while the virus has rampaged and mutated in countries with lesser resources.

As the SARS-CoV-2 virus continues to spread throughout the globe, comprehensive and conclusive scientific studies on the role of science in national policy responses to the pandemic for 2020 are not yet available. However, three international comparative research projects in the academic field of Science & Technology Studies (STS) are currently underway: the *Comparative Covid Response: Crisis, Knowledge, Policy (CompCoRe)* project; the *Evaluation of Science Advice in a Pandemic Emergency (EScAPE)* project, and the *INGSA-COVID-19* project. These cover different aspects of the role of science in policy responses to the pandemic.

CompCoRe examines how public trust, leadership and political culture have influenced different countries' responses to COVID-19.[1] The EScAPE project studies 'the role science itself has played in influencing how countries and their leaders have responded – and what that response (or lack thereof) has meant for citizens'.[2] It cooperates with the INGSA which is headquartered in Auckland, New Zealand and has launched a data collection project via its *Covid-19 Policy-Making Tracker*. The INGSA-COVID-19 project 'aims to understand the kinds of evidence and mechanisms used to develop and implement COVID-19 interventions by governments in different jurisdictions globally' (Allen et al., 2021: 6).[3]

1.1. The Swiss case

In Switzerland, the role of science in policy has been a topic of constant debate in public discourse, in parliamentary proceedings and interventions, and in social media, print, TV, and broadcast media. The debate has centred on the ad hoc science advisory agency formed during the pandemic: the Swiss National COVID-19

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[1] The CompCoRe project published synthesis and interim reports in January 2021. Preliminary project results suggest a three-fold classification of countries that distinguishes between chaos, control, and consensus countries. (https://compcore.cornell.edu/publications/).

[2] 'The EScAPE project investigates whether scientific agencies, advisory committees and protocols put in place to prepare countries for emergencies are really working and, if not, why (https://escapecovid19.org/).

[3] The aim of the INGSA-COVID-19 project 'is not to compare and assess the success of these interventions, but rather to compare the various ways in which evidence has been marshalled and applied, first to articulate a country-specific response goal and then to address it within particular national contexts' (Allen et al., 2021: 6).

Science Task Force (NCS-TF). Questions raised over this task force include its institutional and political legitimacy, disciplinary composition, public communication, models and predictions, and recommendations.

Several evaluations have been conducted or are underway on the Swiss policy response to the COVID-19 pandemic. Two evaluations on the Swiss crisis management (KSBC, 2020; Bundeskanzlei, 2020)[4] emphasise the importance of integrating science in national policy response in a global health crisis. The Swiss Federal Office of Public Health (FOPH) has authorised an evaluation on its preparedness and performance during the COVID-19 crisis.[5] Furthermore, in January 2021, the audit committees of the federal council appointed the Parliamentary Control Committees to evaluate how the FOPH administered scientific findings in connection with the Corona crisis. Along with these assessments, the Center for Security Studies (CSS) of ETH Zürich has dedicated its Bulletin 2020 to the Swiss security policy for the COVID-19 crisis.[6] These evaluations, however, generally focus on crisis management in government and public administration. Moreover, several of these evaluations are carried out by private consulting companies that regularly provide services for public administration.[7] To date, no academic research has been conducted on the role of science in the Swiss policy response to the pandemic.

The study presented here maintains that these evaluations must be complemented by a systematic and independent scientific analysis of the role of science in the Swiss policy response to the pandemic that adheres to current scientific standards and be peer-reviewed by the international scientific community. Furthermore, questions on the role of science in the Swiss policy response to the COVID-19 pandemic not only concern federal government and public administration. An analysis of the role of science needs to consider the broad range of stakeholders involved at the interface of science and policy, such as cantonal authorities and organisations, professional associations, businesses and industry, science and research institutions, science policy agencies, and science journalists.

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[4] KSBC. 2020. Schlussbericht. Krisenstab des Bundesrats Corona, KSBC. Eidgenössisches Departement des Innern. Bern, 19.06.2020; Bundeskanzlei (BK). 2020. Bericht zur Auswertung des Krisenmanagements in der Covid-19 Pandemie (1. Phase / Februar bis August 2020). Bern, 11. Dezember 2020.

[5] The FOPH has commissioned the evaluation 'Evaluation Krisenbewältigung COVID-19' from the private consulting companies INFRAS and INTERFACE. Factsheet, 4.12.2020.

[6] The CSS's analyses of Swiss crisis management conclude with a set of important questions to be considered going forward. These include the question at what stages (planning, early warning network) and at which strategic levels (cantonal, federal, departmental, executive) science should be involved in crisis management, what model should be followed to administer cooperation between public administration and science, and what should be the disciplinary composition of the scientific expert body (Thränert & Zogg, 2020: 37-8).

[7] The private consulting companies INTERFACE and INFRAS have partnered to carry out the FOPH evaluation; INTERFACE also carried out the background study for the report on the crisis management of public administration (KSBC, 2020) (Balthasar, 2020).

Throughout the pandemic, surveys have been conducted to gauge Swiss citizens' trust in science. These surveys have generally yielded positive results. However, the measure of public trust in science is not automatically reflected in the position assigned to science in policy processes and decisions. Such position is not fixed but amendable and can be subjected to different influences and forces. For this reason, it is necessary to analyse the specific arrangements that have determined the role of science in the policy realm during the COVID-19 pandemic.

1.2. Objectives, research approach and sources

This research report aims to provide an independent scientific study on the role of science in the Swiss policy response to the COVID-19 pandemic from January to December 2020. It considers specific characteristics of the Swiss case against international trends and uses analytical tools from the interdisciplinary academic field of Science & Technology Studies (STS) to interpret these findings and draw conclusions. Research sources include government documents and reports, minutes of meetings, policy briefs, and Internet websites. In addition, some 40 interviews were conducted with public authorities from politics, professional associations, science and research agencies, and public administration, and the media in Switzerland.[8]

An ongoing pandemic presents unusual conditions for empirical research. The research project began in October 2020, in the midst of the second COVID-19 wave in Switzerland, and was concluded in June 2021.[9] In addition, official documents remain sparse, reference empirical studies are only underway, and rigorous analyses are not yet available for comparative purposes. Therefore, the results presented here are explorative and do not claim to be exhaustive. From this, one might conclude that it is premature to already offer an analysis while the pandemic is ongoing. There are, however, several reasons not to wait for such an analysis until the last chapter of the COVID-19 crisis has been written.

First, although the role of science during the pandemic was dynamic and complex and documentation was not comprehensive, generic questions and patterns may already be discerned and examined. Second, the complexity of the problems that have emerged worldwide with the pandemic waves needs to be faced and dealt with

[8] For reasons of confidentiality, interviews have been anonymised and were used as background material for this study. No personal quotes are used and statements made in the report are referenced to public documents only.

[9] This project was conducted between October 2020 and June 2021. It was conceived and designed on short notice in September 2020, when the second wave of COVID-19 began to accelerate in Switzerland and new policy measures to contain the spread of the virus were being debated. As the project report is finalised in July, vaccinations have been made available to the Swiss population and public authorities have scaled back several policy restrictions.

continuously, lest the floor of debate be left with simplistic ideas and misconceptions with poor evidentiary basis. While the conclusions offered are preliminary, they provide a background for various stakeholder groups to formulate specific questions relevant to their mission and activities and to consider strategic issues of the near future.

Finally, it is important to emphasise that the present manuscript was written in the style of a scientific report and not of a policy report. The downside of this choice is that decision-makers and stakeholders might find much of the text too detailed, and their expectations for straightforward recommendations and solutions cannot be met. Despite these drawbacks, this format was chosen for two reasons. First, in this day and age of mainstream hearsay, misinformation, and fake news, it is important, once in a while, to document in detail the sources that inform research at the risk that it may appear too lengthy. Second, this report intends to offer a case study for international comparison and therefore must be as comprehensive as possible. Third, and most importantly, this report is scientific and detailed because there is an urgent need to step back and consider the entire complexity of the issue of science advice for policy to discern current patterns and trends.

Chapter 2 provides a brief overview of the four phases that have shaped the role of science in the Swiss policy response to the pandemic between January 2020 and December 2020. Chapter 3 considers the general conditions for science advice in Switzerland, and Chapter 4 examines the Swiss case using analytical tools from the field of STS. Finally, Chapter 5 presents several conclusions and proposes options for action.

2. Science advisory arrangements for policy in 2020: Four phases

The role of science in the Swiss policy response to the COVID-19 pandemic has moved through *four phases* (TABLE 1). In the first phase, covering the weeks up until mid-March 2020, decision-makers relied on the advisory structures of the Federal Office of Public Health (FOPH), its national network of scientific experts, and information from international organisations such as the World Health Organisation (WHO) and the European Centre for Disease Prevention and Control (ECDC). Without an official science advisory body in place to voice their concerns regarding the situation, scientists communicated through academic publications and the media, and began coordinating the scientific community. These efforts increased after the declaration by the Swiss Federal Council of a Special Situation, citing the Epidemics Act,[10] on February 28, 2020.

On March 16, the Swiss Federal Council declared an Extraordinary Situation, the highest possible level of public health emergency in the country. The role of science entered a brief but consequential *second phase*, in which the presidents of four of the main national science organisations representing the Swiss scientific community approached executive decision-makers to propose the establishment of a national science advisory agency. At this stage, an internal task force had already been established for the ETH-Domain, a group of federally funded universities and research institutions. This phase was marked by high-level negotiations that took place among representatives from politics, public administration, crisis management and scientists. During this two-week period in the second half of March 2020, important decisions were made that would affect the future role of science in pandemic response. The launch of the NCS-TF on April 1 marks the beginning of the *third phase*, in which science was attached to the Federal Council Coronavirus Crisis Unit, the KSBC. During this phase, the NCS-TF provided direct advice to decision-makers and produced a great number of policy briefs. The *fourth phase* started with the Federal Council's declaration of a Special Situation. While the KSBC was discontinued, the science advisory agency was retained. The NCS-TF was reassigned to the crisis management unit of the FOPH, which advised the Federal Council via the crisis steering committee of the Federal Department of Home Affairs (FDHA).

The changing role of science in policy was influenced by the Epidemics Act's provisions on the control of communicable human diseases and its model of alert stages in a public health crisis in Switzerland. Contrary to many other European countries, the Swiss political system has no provisions for declaring a state of emergency, a state of public health emergency, or a state of disaster/

[10] Federal Act of 3.12.2010, on the control of communicable human diseases (Epidemics Act) (revised in 2016).

catastrophe.[11] Instead, the Swiss Epidemics Act presents a model that distinguishes between three stages of public health emergency according to special provisions on the distribution of authority and responsibility between the confederation and the cantons (SEE TABLE 1.)

PHASE	NATIONAL SCIENCE ADVISORY ARRANGEMENT	PRIMARY ROLE OF SCIENCE	EMERGENCY SITUATION (EPIDEMICS ACT)
PHASE I January to March 16, 2020	Federal Department of Public Health (FOPH) and its network of scientific institutions and experts	To raise the alarm	Normal Situation Special Situation (February 28, 2020)
PHASE II March 16 to April 1, 2020	Federal Department of Public Health (FOPH) and its network of scientific institutions and experts	To negotiate a scientific advisory agency	Extraordinary Situation
PHASE III April 1 to June 19, 2020	NCS-TF (attached to the Federal Council Coronavirus Crisis Unit, KSBC) and the Federal Department of Public Health (FOPH)	To provide direct scientific advice to crisis management	Extraordinary Situation
PHASE IV June 19 to December 31, 2020	Federal Department of Public Health (FOPH) and NCS-TF (attached to the crisis structures of the Federal Department of Public Health (FOPH)	To provide indirect scientific advice to the FOPH	Special Situation

Table 1: Four phases in the role of science in the Swiss policy response to the COVID-19 pandemic.

Switzerland's three-stage emergency model for combating infectious diseases

The Epidemics Act defines three stages of emergency for public health situations: Normal, Special, and Extraordinary. In a Normal Situation, responsibility of implementing the Epidemics Act rests with the cantons. Meanwhile, a Special Situation arises when competent implementing authorities cannot prevent and control the outbreak and spread of communicable diseases and when significant

[11] Engler et al., quote Edgell et al., who identify primary legal instruments used to adopt main national-level emergency measures: Declaration of state of emergency (Bulgaria, Czech Republic, Finland, Hungary, Italy, North Macedonia, Moldova, Portugal, Romania Serbia, Spain), declaration of state of public health emergency (France, Lithuania, Slovakia); declaration of state of disaster / catastrophe (Albania, Bosnia and Herzegovina); other legislation (Austria, Belgium, Croatia, Denmark Greece, Ireland, Norway, Poland, Slovenia, Sweden, Switzerland, Ukraine, UK); no national-level emergency response (Germany, Netherlands) (Engler et al., 2021: 4).

public health risks are present (Epidemics Act, Art. 6). Finally, in an Extraordinary Situation, the Federal Council may order necessary measures for the entire country or for individual parts of it (Epidemics Act, Art. 7).

These situations have far-reaching consequences on decision-making distribution between federal and cantonal authorities and, by implication, on the role of science in Swiss policy response. Only in an Extraordinary Situation is the Federal Council empowered to unilaterally impose national measures without first consulting with the cantons. In 2020, this situation was declared for only two and a half months. **FIGURE 1** shows a timeline indicating the various stages of public health emergency in relation to the four phases in the role of science in the Swiss policy response to the COVID-19 pandemic.

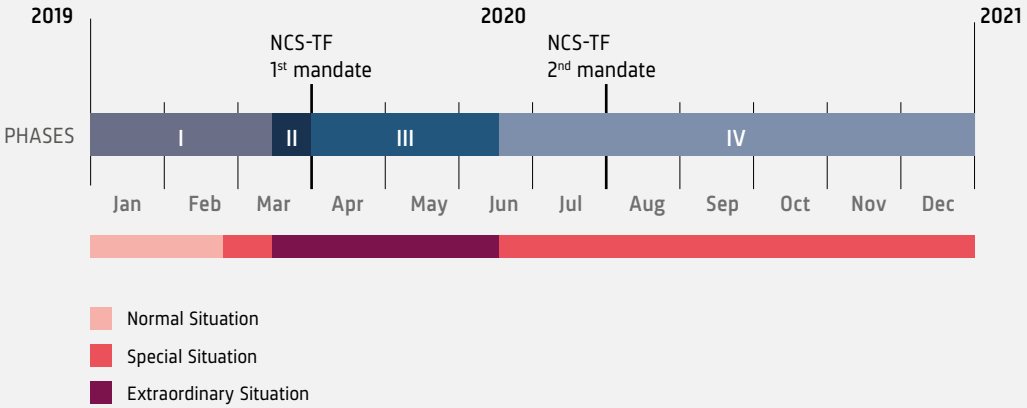

Figure 1: Timeline of the four phases in the role of science in the Swiss policy response to the COVID-19 pandemic, relative to the stages of public health emergency in Switzerland in 2020.

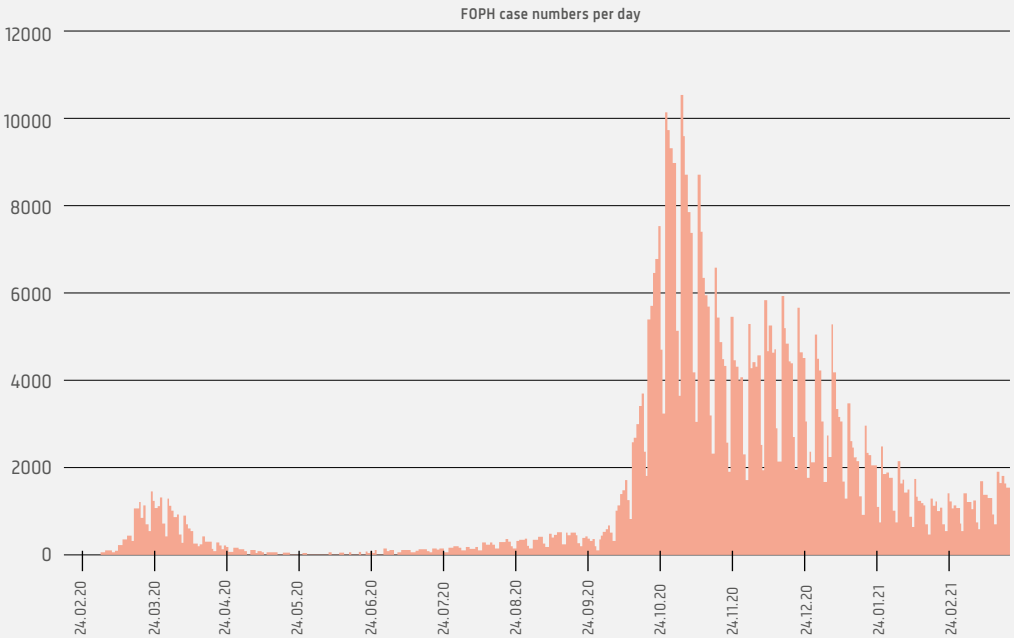

Figure 2: SARS-CoV-2 case numbers issued by the FOPH for 2020 (Source: Parlamentsbibliothek, 2021).

2.1. Raising the alarm (before 16.3.2020)

Policy response: Stepping up crisis organisation in public administration

This first phase of Swiss policy response to the SARS-CoV-2 virus was dedicated to early detection, risk assessment, and strategy development (Wenger, et al., 2020). The Epidemics Act assigns primary operational responsibility for the early detection and monitoring of infectious diseases to the Federal Office of Public Health (FOPH) in cooperation with other federal offices and cantonal authorities (Epidemics Act, Art. 3). The FOPH is also tasked to coordinate with international organisations and authorities.[12] At the cantonal level, the responsibility for implementing health measures rests with cantonal officers of health,

[12] The FOPH may instruct cantons to take preparatory measures to detect and monitor with regard to threats to public health. The office is also responsible for communicating public health risks to the cantons and the public (Epidemics Act, Art 9). It can also designate individual laboratories to assume the role of national reference centre.

represented by the Swiss Association of Cantonal Officers of Health (VKS), and the Conference of Cantonal Health Directors (GDK), which promotes 'cooperation between the 26 cantons and between them, the federal government, and key healthcare organisations.'[13]

In late January, with rising numbers of SARS-CoV-2 infections in China and mounting alarms from the WHO and the ECDC, the FOPH gradually amplified crisis coordination. The Epidemics Act and the Swiss Pandemic Plan do not prescribe the processes to be initiated for early detection and surveillance, and for communication between federal and cantonal authorities (Wenger et al., 2020).[14] Nor do they make provisions for the process by which these health emergency levels are decided on. The Federal Commission for Pandemic Preparedness and Response (FCP), which is responsible for risk assessment according to the Pandemic Plan, did not play a visible role (Wenger et al., 2020: 104); instead, the FOPH took on this responsibility.

On January 23, the FOPH established an internal COVID-19 Task Force and notified the Federal Civil Protection Crisis Management Board (BSTB). At this stage, Chinese authorities had identified SARS-CoV-2 as the causative agent (January 7), and Chinese researchers had released (January 10) and published (12 January) viral genome sequences on the Global Initiative on Sharing All Influenza Data (GISAID) (ECDC, 2020b: 2). Between January 10 and 12, the WHO issued a comprehensive package of guidance documents for countries on managing a disease outbreak, which included infection prevention and control, laboratory testing, risk communication and community engagement, clinical management, and surveillance case definitions.[15] Switzerland has no national early warning system for infectious diseases and as a non-member state of the European Union, has no access to its Early Warning and Response System (EWRS). On January 27, the FDHA applied to the European Union for access to this monitoring tool for public health threats.[16] Three days later, the WHO issued its highest alarm level and declared the novel coronavirus outbreak a public health emergency of international concern.

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[13] https://www.gdk-cds.ch/de/die-gdk.

[14] According to Wenger et al., it remains unclear how the national risk assessment process should be structured and in which form risk assessment should be prepared for the Federal Council (Wenger et al., 2020: 104).

[15] https://www.who.int/emergencies/diseases/novel-coronavirus-2019/interactive-timeline#!.

[16] https://www.ecdc.europa.eu/en/publications-data/early-warning-and-response-system-european-union-ewrs.

As the new coronavirus spread globally and the number of infections and deaths in Italy rose rapidly, discussions took place at BSTB meetings on taking action based on the Epidemics Act.[17] However, with no SARS-CoV-2 cases confirmed in Switzerland, authorities considered it too soon to speak of an epidemic wave.[18] On February 27, the FOPH started an information campaign on protection measures against the new coronavirus. A day later, shortly after the first SARS-CoV-2 case was confirmed in Switzerland, the Federal Council declared a Special Situation in terms of the Epidemics Act and issued a first ordinance that prohibited events involving more than 1000 people. Until this time, the general strategic approach was to adapt the Influenza Pandemic Plan to the particular circumstances brought about by the SARS-CoV-2 virus and to examine the scenarios of the ECDC for planning guidance (Wenger et al., 2020: 106). With the declaration of the Special Situation, several cantons activated crisis units and cantonal pandemic plans.[19]

Responsibility for coordinating public communication rested with the FDHA and the FOPH,[20] until the declaration of the Special Situation, when it was transferred to the Federal Chancellery.[21] From that point on, the Federal Chancellery instituted regular media conferences by the Federal Council and the FDHA / FOPH. The function of BSTB meetings changed into a crisis coordinating unit. Internationally and in Switzerland, infection counts rose in the next two weeks. By March 9, Italy, Switzerland's southern neighbouring country, had been declared a SARS-CoV-2 hotspot, France and Germany registered more than a thousand cases, and Switzerland, with 374 reported cases, registered two deaths from the new virus.

On March 11, the WHO classified the SARS-CoV-2 virus as a pandemic, and the next day, the ECDC urged European states to change their strategy from containment to mitigation (Kohler et al., 2020: 89). Two days later, the Federal Council issued its second ordinance and imposed several additional measures, such as restricting the number of persons at restaurants, limiting events with more than 100 people, and implementing home schooling, and decided on a first package of economic support measures. Parliament cut short its spring session on March

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[17] See minutes of the 1st and 2nd BSTB meetings of January 28 and 31, 2020.

[18] See minutes of the 3rd BSTB meeting on February 24, 2020.

[19] However, an overview of the specific strategic measures taken at cantonal level during this time is not yet available.

[20] The FOPH held two press conferences on January 28 and 31, 2020.

[21] The Conference of Information Services (KID) is the coordinating agency for interdepartmental information and communication. It consists of the Federal Council spokesperson (chair) and the information officers of the departments, the Federal Chancellery and the parliamentary services (https://www.bk.admin.ch/bk/de/home/bk/organisation-der-bundeskanzlei/ueberdepartementale-gremien/konferenz-der-informationsdienste-kid.html).

15, and a day later, after meeting with the cantons, the Federal Council declared an Extraordinary Situation. Switzerland, France, and Austria all imposed national lockdowns on March 16, but compared with those of its neighbouring countries, Switzerland's restrictions were milder and therefore often referred to as a 'soft lockdown.' This country's early policy response to international warnings has been described as hesitant (Kohler et al., 2020; Sager & Mavrot, 2020).

The role of science in the first phase of policy response

Science performed no extraordinary advisory role for policy during this phase of policy response. The advisory network of the Federal Office of Public Health (FOPH) was activated, and information from international organisations such as the World Health Organisation (WHO) and the European Centre for Disease Prevention and Control (ECDC) was consulted. The Swiss Epidemics Act and the Influenza Pandemic Plan offer no provisions regarding the role of science in early detection, risk assessment, and strategy development.[22] Nor were strategic measures considered to consult an additional scientific advisory body for policy decisions. Therefore, the normal advisory regulations and provisions for scientific advice in public administration applied. These initially rely on in-house expertise of the FOPH and then on external advice through procurement processes. Both permanent expert commissions attached to the Communicable Diseases Division of the FOPH – the Federal Commission for Pandemic Preparedness and Response (FCP) and the Federal Vaccination Commission (FVC) – assumed no prominent role during this phase. However, toward the end of this phase, the question of how to integrate external scientific advice loomed large in crisis management, and the FOPH reportedly made special efforts to involve scientific knowledge and perspectives.[23]

Scientists in Switzerland monitored the evolution of the new virus from the beginning. Since Switzerland does not implement a national early warning network but relies on the EWRS of the European Union, scientists had no formal point of contact to provide advice for policy and were active in other ways. Scientific articles on COVID-19 were published by Swiss scientists as early as January (Riou & Althaus, 2020) and February (Battegay, 2020; 2020; Bischof et al., 2020; Neher et al., 2020) in international (e.g., New England Journal of Medicine) and local medical journals (e.g., Swiss Medical Weekly).[24] Scientists provided

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[22] The ordinance of the BSTB (2018) instructs this body 'to coordinate expert knowledge at federal level'. (Verordnung über den Bundesstab Bevölkerungsschutz, VBSTB, Art. 4).

[23] See minutes to the 5th BSTB Conference of Directors on COVID-19, 9.3.2020.

[24] Information on newly published articles in Swiss Medical Weekly also appears in the print journal Swiss Medical Forum, which is sent to all members of the Swiss Medical Association FMH (https://smw.ch/index.php?id=4#c573). The Swiss Medical Weekly is the official scientific publication of the Swiss Society of General Internal Medicine, the Swiss Society of Infectiology, the Swiss Society of Rheumatology and the Swiss Society of Pulmonary Hypertension (https://medicalforum.ch/de/ueber-uns).

information on COVID-19 over the media, gave interviews on TV, radio shows, and newspapers, and posted statements on social media. The public broadcasting company SRF invited experts for interviews and information on TV programmes on health (Puls), politics (Arena), and science (Einstein) and on radio programmes (SRF Tagesgespräch).

Risk assessments delivered by scientists through various media formats sometimes differed from those issued by public authorities. Furthermore, scientists raised concerns regarding the outdated system of reporting used to monitor the situation, which had been a point of critique even before the pandemic. There were reports of tensions between the FOPH and individual scientists during this phase, particularly in early March (Clalüna et al., 2020). On March 12, during the Special Situation, 25 scientists working in Switzerland in the fields of biology, epidemiology, ethics, medical supply, genetics, infectiology, life sciences, public health, social and preventive medicine, hospitals, statistics, and virology, sent a letter to the Federal Council appealing for the declaration of an Extraordinary Situation.[25]

In addition, scientists launched several initiatives during these early months of the pandemic. First, on March 15, the ETH-Domain[26] established an internal 'ad hoc ETH-Domain COVID-19 Task Force' to pool resources and provide support to deal with the new coronavirus. With this initiative, the ETH-Domain sought to identify 'research and innovation opportunities', and 'advising opportunities'[27] and aspired to use its 'huge potential to positively influence the outcome of this crisis' and be a role model 'as the main scientific arm of the confederation' (ETH Board, 2020). Several elements of the ETH task force were carried over into the NCS-TF when the latter was established two weeks later.[28]

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[25] Offener Brief an den Bundesrat bzgl. Coronavirus. Basel, Bern, Genf, Lausanne, Tessin, Zürich, 12. März 2020. Unterzeichnet von Expertinnen und Experten.

[26] The ETH-Domain designates a federally funded national network of technical universities and research institutions which also includes the ETH-Board, a steering governance body appointed by the federal council. The ETH Domain comprises the two Federal Institutes of Technology ETH Zürich and EPFL, the four research institutes PSI, WSL, Empa and Eawag, as well as the ETH Board (a strategic management body) and the Internal Appeals Commission of the ETH (an independent appeals body). https://www.ethrat.ch/en/eth-domain/overview.

[27] Mandate for the ad hoc ETH Domain COVID-19 Task Force. Board of the Swiss Federal Institutes of Technology, 16.3.2020.

[28] The task force was to report directly to the ETH-Domain directorate, was open to including a limited number of external experts and intended to collaborate closely with federal authorities and other institutions. It identified seven priority tasks, including testing, relation to clinical care, exchange platform (experience, equipment, data), masks, and communication with the student body.

Second, on January 27, only a day before the Federal Council declared the Special Situation, the Swiss National Science Foundation (SNSF) announced that it would issue an 'Emergency Call for Coronavirus Research' in early March with projects to start as soon as June 2020. This call was addressed to scientists from all disciplines and explicitly referred to the broader context of the WHO's research agenda and 'the priorities defined by the Federal Office of Public Health (FOPH)'.[29] As a general policy, Switzerland does not implement any mission-oriented funding promotion programmes, except for the National Research Programmes (NRP) which require Parliament approval. The SNSF funding programme disposed of a budget of around 10 million Swiss Francs[30] and, in only 20 days, received 284 applications. The call was designed and issued at the initiative and under the auspices of the SNSF.

At the cantonal level, some evidence suggests that several governments or their crisis units consulted with scientists at their higher education institutions or their university hospitals over imposing measures.[31] However, the 26 cantonal systems of governance and crisis management structures are diverse, and comprehensive assessment of the role of science advice for policy at the cantonal level goes beyond the scope of this study.

To conclude, the Federal Council made decisions on policy measures of unprecedented magnitude during this first phase of the pandemic relying on the in-house expertise of the FOPH and made no special arrangements to secure additional scientific expertise. Science was assigned no specific role in these early decisions that were made under high uncertainty and time pressure.

2.2. Negotiating a scientific advisory agency (16.3.–1.4.2020)

Policy response: new crisis organisation structures and strategies

With the declaration of the Extraordinary Situation, policy agency during the second phase rested with the Swiss Federal Council, while the cantons remained responsible for the implementation of measures. As in many other liberal democratic countries, this transfer of power to the executive government posed great challenges to the political order. Parliament was only scheduled to reconvene in May 2020.

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[29] http://www.snf.ch/en/funding/programmes/coronavirus/Pages/default.aspx

[30] The SNSF call for proposals was proclaimed as the first of its kind as a rapid response instrument. The SNSF announced that it would 'define criteria to help decide when and how to react to similar situations in the future' that are 'based on the experience gained in this call'. http://www.snf.ch/en/funding/programmes/coronavirus/Pages/default.aspx

[31] For example, when the cantonal government of the Canton Baselland at a press conference on March 15 2020 declared a state of emergency and imposed a series of cantonal measures, members of the state council mentioned that they had, as part of their decision-making process, consulted with scientists at the University of Basel.

On March 20, upon the request of the FDFA, the Federal Council announced the establishment of a crisis unit (KSBC) pursuant to the crisis management directives in federal administration.[32] The main purpose of the KSBC was to coordinate the various crisis groups in federal administration and support the Federal Council's leadership and decision-making (KSBC, 2020). Until this time, ad hoc solutions had directed crisis operations at the political-strategic level of crisis management (Wenger at al., 2020) and no overall strategy drove federal and cantonal crisis organisation and management. Crisis units were introduced one by one: first the COVID-19 Task Force of the FOPH, then the BSTC and eventually the KSBC. In only two weeks, the Federal Council imposed several further measures[33] and along with the FOPH held ten press conferences.

At its first meeting on March 25, the KSBC announced that it had formed three intersectoral working groups that included representatives from the business sector, science, and civil society. At the same meeting, the FOPH informed that it had established an advisory board ("Wissenschaftsausschuss"), to assess the inputs from scientific experts. Parallel to this, negotiations were underway to formalise the involvement of external scientific advisors in federal crisis management. These discussions would lead to the establishment of the NCS-TF, on April 1, 2020, affiliated with the political-strategic level of the KSBC (Wenger et al., 2020).

The role of science in the second phase of policy response

Despite only covering two weeks, this phase was crucial to the future role of science in pandemic policy response. In the days before the Extraordinary Situation was declared, the scientific community had become more active. On March 15, the ad hoc COVID-19 task force was established for the ETH-Domain (Sciena, 2020). Three days later, on March 18, a meeting was held at the Bernerhof involving representatives of the Federal Council, the FOPH and the scientific community, but no specific outcomes regarding this event were publicly reported.[34]

On March 24, the KSBC director was contacted by e-mail by the presidents of some of the main organisations representing the Swiss scientific community at the interface of science and politics, referencing an earlier phone call and with an appended draft mandate (in three languages) for the establishment of an ad hoc Swiss national COVID-19 task force. This task force would build on and expand the other task force that had been set up for the ETH-Domain and would

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[32] Weisungen über das Krisenmanagement in der Bundesverwaltung vom 21. Juni 2019.

[33] These measures included further restrictions on entering the country (March 19), and public gatherings (March 21).

[34] No official documents are available to document this meeting, its initiators, participants, objectives, and results. Media reports have stated that the FOPH invited scientists to the meeting (Bühler, et al., 2020). There are no public records to confirm or reject this claim.

consist of several expert groups and a 'high-level advisory panel'. This panel would be tasked to advise the Swiss government and consist of representatives of the Swiss National Science Foundation (SNSF), the ETH-Domain, swissuniversities and the Swiss Academies of Arts and Sciences (a+).[35] The mandate set out a list of urgent topics in need of scientific attention including diagnostics, clinical care, surveillance and forecasting, contact tracing, public health, ethical and legal issues, and exchange platforms. Ideally, this task force would be invited by the federal government 'to advise and support it, transforming it into a federally mandated national task force'.[36]

The next day, on March 25, the KSBC convened for its first meeting. By the end of the month, the NCS-TF was established by federal mandate with three contracting authorities: (1) the State Secretariat of Education, Science, and Innovation (SERI) (by order of the Federal Councillor of the Federal Department of Economic Affairs, Education and Research (EAER)), (2) the FOPH (by order of the Federal Councillor of FDHA) and (3) the KSBC. The mandate was signed by the presidents of the four organisations: the SNSF, ETH-Domain, swissuniversities, and the a+. The third meeting of the KSBC, on March 30, was dedicated to research and the state secretary of the SERI presented the new task force. The presidents of the ETH-Domain, the EPFL, the ETHZ and the SNSF also attended the meeting as guests.

A few additional specifications of the first mandate of the NCS-TF are necessary to complete the picture. The mandate lists three tasks for the NCS-TF: (1) Advise politics and authorities to support higher authorities and decision-makers of the FDHA / FOPH, the KSBC, and the EAER / SERI with the knowledge of Swiss scientists. Cantonal authorities can also place requests and solicit advice from the NCS-TF in coordination and consultation with the above. 2) Identify research opportunities for Swiss researchers to contribute to a better understanding of COVID-19. (3) Identify innovation opportunities for scientific know-how to develop products or services that help combat COVID-19. The latter two tasks explicitly mention advising the SERI on a special national research programme and special innovation promotion measures.

The mandate also specified that the members of the NCS-TF would not be remunerated for their work. The president of the SNSF was appointed as NCS-TF head and was tasked to build its membership in consultation with contracting au-

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[35] For the record, there is some inconsistency in the mandate: it first states that the Task Force is 'called into life' by the three institutions swissuniversities, the ETH-Domain and the Swiss National Science Foundation but later on in the document specifies representatives of four institutions (including the Swiss Academies of Arts and Sciences) to form part of its advisory panel.

[36] Draft Mandate Swiss National COVID-19 Science Task Force, dated 24 March 2020.

thorities and the leadership of their home research and higher education institutions. No specifications were made on the issue of communication other than the principle that the NCS-TF would not communicate independently except in consultation with the SERI / FOPH / KSBC.

These details are critical when considering the role of science in the Swiss policy response to the COVID-19 pandemic. In less than two weeks, a scientific advisory agency to policy was established and endorsed at the highest level involving two federal departments, their agencies, the national crisis management unit. Moreover, the mandate was assigned to and approved by the presidents of the four main national agencies representing the scientific community. By any measure, this must be considered a remarkable achievement, especially given the many urgent issues all parties involved had to deal with during the first peak of this crisis. This manner of procedure is highly unusual in the Swiss policy context, which is known for extensive and lengthy consultation procedures before eventually taking action. No documentation is available on the negotiations between the parties, but the mandate did not provide the task force a legal standing or legitimacy in law.

During this phase, another science advisory contribution is important to mention: the medical-ethical guidelines on triage for intensive-care treatment under scarce resources developed by the Swiss Academy of Medical Sciences (SAMS) and the Swiss Society of Intensive Care Medicine, which were published on March 20, with a revised version a few days later on March 24 (SAMS, 2020). These guidelines supplemented the medical-ethical guidelines on "intensive-care interventions" issued by the SAMS in 2013 to support health professionals in intensive care situations and intensive care units with guidelines on triage decisions under resource scarcity.[37] They were widely reported in the media and generated public debate.

2.3. Direct science advice for federal crisis management (1.4.–19.6.2020)

Policy response: The KSBC

The third phase covers the period of the Extraordinary Situation when decision-making rested primarily with the Swiss executive government. Federal ordinances had imposed a national 'light lockdown' and were updated several times during this phase. Updates included restrictions on medical supplies, private and public social gatherings, entry into Switzerland, and closing schools, shops and institutions (Sager & Mavrot, 2020). At the beginning of this phase,

[37] The guidelines supplement the SAMS guidelines on "Intensive-care interventions" and thus concerned only the group of severely ill patients requiring intensive care. The guidelines were revised on March 24, and on November 4, 2020. https://www.samw.ch/en/Ethics/Topics-A-to-Z/Intensive-care-medicine/Triage-in-case-of-bottlenecks-chronology.html

the main policy objective was to bring down the number of SARS-CoV-2 infections. With measures installed, the challenge quickly changed to planning measures to contain the spread of the virus. At the end of this phase, the Federal Council returned to the Special Situation and suspended the KSBC.

Three different strategies were required to address the challenges of this phase: a mitigation strategy to bring down infection numbers; a containment strategy to keep infection numbers low after suspending the Extraordinary Situation, and a transition strategy to ensure a smooth passage to the Special Situation. The mitigation strategy of the Federal Council was successful during this first wave of the pandemic and infection numbers declined considerably over the course of April[38] and remained low throughout the month of May.

The role of science in the third phase of policy response

Contrary to the previous two phases, scientific advice was included in executive decision-making processes at the strategic-political level in this phase. The NCS-TF was attached to the Crisis Unit of the Federal Council, the KSBC, and it contributed scientific advice for three main policy challenges of the Federal Council during the Extraordinary Situation: first, to impose adequate measures to implement mitigation strategy,[39] second, to map out a detailed containment strategy[40], and third, to plan an effective transition strategy.[41]

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[38] The daily number of COVID-19 infections decreased from 1,016 on April 1, to 101 on April 30, and to 7 on May 7.

[39] Even before its formal appointment, the NCS-TF started providing scientific advice on the mitigation strategy, at the request of the FOPH and the KSBC. The first date of publication published on the NCS-TF website actually pre-dates the Task Force's establishment on April 1, 2020. The 'consensus report' presented an 'analysis of Swiss Epidemic as of 18 March 2020' and was composed by an expert panel of various Swiss research institutions, dated March 28. The document was written in response to a request to the Swiss scientific community by the FOPH to address four questions. The request was made at 3 pm on Thursday, April 27, and feedback was requested by 9 am the next day.

[40] On May 25, the NCS-TF published a policy brief presenting a strategy to 'control the epidemic in Switzerland in which it requested measures to expand contact tracing and facilitate access to testing,' and to 'coordinate cantonal, regional, and international action plans'. It demonstrated the economic value of investing 'substantial resources' into keeping numbers low and emphasised that 'it is more effective and less costly to control the epidemic at low rather than high daily case numbers'. This strategy, in their view, 'is the best option from all perspectives – health, economic and social'.

[41] The Federal Council early on decided on a step-by-step course to lessen the measures, to start at the end of May. Giachino et al. identify three phases of opening: 27.4. Phase I; 11.5. Phase II, 8.6. Phase III (Giachino et al., 2020:6). This course reportedly followed scientific recommendations by the NCS-TF (KSBC, 2020).

The extent to which the NCS-TF's advice was followed by decision makers during this phase cannot be determined. In broad terms and with a few exceptions[42], however, the policies and measures of the Federal Council appear to accord with the scientific advice provided by the NCS-TF. This correspondence suggests that this advisory agency's scientific advice was taken up in policy decisions during the Extraordinary Situation. For example, on May 8, 2020, the Federal Council instructed the FDHA and the Federal Department of Economic Affairs, Education and Research (EAER) to provide strategic guidance on moving from a strategy of mitigation to a strategy of containment, 'in consideration of scientific knowledge' (Kohler et al., 2020: 92). On the same day, the NCS-TF received a formal request by the KSBC to develop a transition strategy. The NCS-TF published proposals for a transition strategy only three days later which included scientific indicators for deciding on easing measures.

Within a few days, the NCS-TF had determined the areas and composition of its ten expert groups, established digital platforms and channels for information exchange and communication, set up a weekly meeting plan, designed a standard format for publishing scientific statements, and started building relations with the KSBC, the FOPH and the FDHA. The president of the NCS-TF was represented in the KSBC meetings on a weekly basis and provided the update on the current epidemiological situation, which had previously been delivered by the FOPH at the BSTB meetings.

During this phase, the NCS-TF provided substantial science advice on a broad range of topics and at a rapid pace. From the beginning, the NCS-TF received a great number of requests for science advice from the KSBC, the FDFA, the FOPH, and other public and private agencies and organisations. In addition to science advice for strategy development, the NCS-TF offered state-of-the-art scientific knowledge on the SARS-CoV-2 virus and on data collection and monitoring tools, indicators, scenarios and models. The task force published more than 50 "policy briefs"[43] between April and mid-June to communicate science advice. From the beginning, policy briefs were developed in an iterative process open to all expert groups, which included economic, social, ethical, and legal per-

[42] Nevertheless, at the end of this phase, the Federal Council unexpectedly changed this course and accelerated the easing of measures at short notice and decided to open restaurants earlier than originally planned (Sager & Mavrot, 2020).

[43] Although the NCS-TF's statements were all published under the rubric of 'policy briefs', and most of them followed this format, other labels were also used for its publications, such as 'consensus report', 'analysis', or 'strategy'. All of these publications provided not only scientific advice but additional information on the expert groups and sometimes the individuals who had collaborated and provided input. They also specify which group or individual had assumed the lead in drafting the document.

spectives.[44] These scientific statements were published publicly from the end of April, authorised by the KSBC and the Federal Council. During this phase, policy briefs were predominantly composed in response to external requests, but also included topics considered of importance to the NCS-TF. They were compiled at great speed and generally appear to correspond with the questions that were occupying executive decision-makers. Such direct correlation between policy briefs and policy issues of the day is not discernible for the subsequent phase of science advice for policy.

The NCS-TF received comparatively few requests from cantonal authorities, although there appears to have been a great deal of demand and its mandate stipulated scientific advisory services to support both federal and cantonal authorities.[45] This issue was discussed at the KSBC meetings and the cantons were invited to submit requests for science advice via the KSBC.[46] Similarly, the question of how the NCS-TF could provide science advice to Parliament was discussed at the KSBC meetings.[47]

Another issue relating to the provision of science advice to policy tabled at the KSBC meetings was communication of science advice. Responsibility for the NCS-TF's communication policy during this phase rested with the SERI. The NCS-TF was instructed by mandate to provide 'unified communication' and to communicate with 'one voice',[48] and only the NCS-TF president was authorised to communicate with the media unless otherwise approved by the SERI.[49] The president of the NCS-TF and its members appeared in media outlets and sporadically also participated at the FOPH's press conferences.[50]

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[44] Topics included, among others, face masks, risk factors for infection, confinement, vaccines and treatments, test-trace-isolate quarantine strategies (TTIQ), a country comparison between Sweden and Switzerland, gender aspects, digital proximity tracing, and who should pay for testing, government debt repayments, the effects of seasonality on COVID-19 infections, the psychological effects of confinement, the care of elderly, protection of the physical and mental health of healthcare workers, phylogenetic analysis in surveillance, the disruption of the labour market.

[45] Some direct collaboration between the cantons and the NCS-TF took place via the Conference of Cantonal Health Directors (GDK). The minutes of the KSBC meeting on 4.5.2020 informs that the GDK would also participate in 'Teleconferences with the NCS-TF'.

[46] Minutes of the KSBC meeting, 14.4.2020: Short info by the NCS-TF: 'The cantons are invited to ask the NCS-TF questions. Cantons shall not approach the NCS-TF individually but pool their requests through the KSBC.

[47] Minutes of the KSBC meeting, 24.4.2020.

[48] SERI. 2020. Task Force "Swiss National COVID-19 Science Task Force" Regelung der externen Kommunikation vom 3. April 2020.

[49] The original plan was for important communications of the NCS-TF to be issued by press release consigned by the KSBC, FOPH, and the SERI.

[50] For example, the President of the NCS-TF presented the new NCS-TF to the Swiss public only one day after its formal establishment at a press conference on April 2, 2020.

One of the operational challenges for the NCS-TF during these weeks was to filter and prioritize the flood of requests and to devise procedural and structural formats to master it. Formally, the NCS-TF was supported by the SERI which contributed in-kind support by dispatching human resources for the position of the coordinator to the NCS-TF and by assuming official responsibility for the external communication of the NCS-TF through the head of the SERI's communication office. This was important support for early communication logistics such as the website and email address, and early media inquiries.

During this phase, a National Research Programme (NRP)[51] was launched on COVID-19 (NRP 78). The NRP comprised four modules[52] that aimed to develop knowledge on the new Coronavirus, clinical management and public health response, and development of vaccines, therapeutics and diagnostics (SNSF, 2020). The terms and conditions of the NRP call, issued on 30 April, were adapted to the urgent circumstances.[53] The NRP's focus on natural and medical scientific questions invited criticism from parts of the scientific community who emphasised the importance of interdisciplinary scientific contributions from the social, legal, psychological and economic disciplines.[54]

2.4. Indirect science advice via the FOPH (19.6.–31.12.2020)

Policy response: Wrangles between federal and cantonal authority

From a policy perspective, this phase is characterised by a persistent tug of war over authority between federal and cantonal governments and between executive and legislative branches of government. During a Special Situation, the Federal Council has to consult with cantons before imposing measures and its

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[51] NRPs are standard and highly regulated Swiss national research-promotion instruments that require approval by the Swiss Parliament.

[52] Module 1: Basic aspects of SARS-CoV-2 biology, pathogenicity and immunogenicity; Module 2: New approaches in Covid-19 epidemiology and disease prevention; Module 3: Covid-19 vaccine, drug and diagnostics development; Module 4: Clinical Covid-19 research and therapeutic interventions (SNSF, 2020).

[53] For example, the Organisational Regulations of the National Research Programmes (NRPs) did not apply, to expedite the evaluation of proposals (SNSF, 2020). In addition, special organisational structures ran the evaluation procedures. The Presiding Board received evaluated proposals from an international panel, which was advised by a 'sounding board', composed of members of the National Research Council, as well as by representatives of the Federal Office of Public Health (FOPH) and Innosuisse (SNSF, 2020).

[54] Seventeen previous members of the SNSF's research council sent an open letter to the SNSF in early May 2020. The letter raised concerns about the NRP's 'almost exclusive' focus on researchers from biology and medicine and its disregard of the short and long-term impact of policy measures on social life. It also drew attention to the potential contributions of the social sciences and humanities and argued for a more comprehensive systemic and interdisciplinary view on science and health that included a broader set of social, legal, psychological and economic considerations. The letter demanded that the SNSF support research on these issues. Offener Brief an die Leitung des SNF zum NFP 78 Covid-19. Basel/Bern, 3. Mai 2020.

federal crisis management and communication structures have to be adapted to this shift in political power. The KSBC was discontinued, and the new model of federal crisis management included the crisis steering committee of the Federal Department of Home Affairs (FDHA), and the COVID-19 Task Force of the FOPH, which had been instituted on January 28, 2020.

During this phase, Parliament convened for fall and winter sessions in September and December 2020.[55] Both sessions were preoccupied with COVID-19 legislation, COVID-19 measures, and COVID-19 interventions (questions, postulates, motions). The Federal Council submitted a draft COVID-19 Act to Parliament on August 12,[56] and the law was endorsed by Parliament on September, 25.[57] Government decisions included the allocation of financial support of more than CHF30 billion to companies and individuals affected by public measures to control the spread of the SARS-Cov-2 virus.

During the first few months of this phase, few new policy measures were introduced, including compulsory wearing of masks in public transport and quarantine for certain inbound travellers. On August 12, the Federal Council even decided to permit public events with more than one thousand people with a safety concept approved by public authorities. From mid-July onwards, however, infections started rising slowly but steadily, reaching 541 new daily infections by the end of September. In October, infections increased exponentially and, within a month, 10,559 daily infections were registered on November 2, 2020.[58] The Federal Council eventually started ordering new policy measures in mid-October and, step-by-step, continued to tighten restrictions on public life until the end of the year.[59] As stipulated by the Epidemics Act, it consulted with the cantons before imposing these measures and made specific provisions for the cantons for stricter measures in their jurisdictions. In December, the Federal Council urged cantons with high infection rates to act immediately and adopt additional regional measures. Contrary to its neighbouring countries, Switzerland imposed no "full" lockdown or curfews during the second wave of COVID-19 and, at times, figured among the European countries with the highest daily COVID-19 fatalities per inhabitants.

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[55] Fall session of Parliament from 7.9.2020 to 25.9.2020; winter session of Parliament from 30.11.2021 to 18.12.2020.

[56] The COVID-19 Act establishes the legal basis for decisions taken by the government under emergency rule in the first six months of the pandemic. Swiss legislation requires the Federal Council to propose a law to Parliament within six months of imposing emergency ordinances because of decisions taken without the regular involvement of parliament.

[57] The Swiss COVID-19 Act was later confirmed in a nationwide referendum in June 2021.

[58] Source: https://www.covid19.admin.ch/de/epidemiologic/case?detRel=abs&geoView=table

[59] New measures were imposed by the Federal Council on 28.10.2020, on 4.11.2020, on 11.12.2020, on 18.12.2020, on 6.1.2021 and on 12.1.2021 (Parlamentsbibliothek, 2021).

At the end of this phase, with infection rates still high, Swissmedic,[60] the national authorisation and supervisory authority for drugs and medical products, approved the first vaccine, paving the way for the Swiss vaccination campaign to start rolling out in the new year. Concurrently, the Federal Office of Civil Aviation (FOCA) discontinued air traffic with the UK and South Africa due to the new variants that had appeared in these countries.

At the end of the year, Switzerland, like many other European countries, was in the midst of the second COVID-19 wave with high daily infection cases and a complex set of pandemic policy measures in place.

The role of science in the fourth phase of policy response

With the return to the Special Situation and suspension of the KSBC after June 19, 2020, the fate of the NCS-TF became uncertain. Its continuation appears not to have been seriously contested; its future association and contracting agencies, however, had to be renegotiated.[61] From August 1, 2020, the NCS-TF was newly attached to the COVID-19 Task Force of the FOPH, which provided policy input via the steering committee of the FDHA. A new mandate was signed between the FOPH and the FDHA as contracting authorities, with the new president of the NCS-TF and the president of the ETH-Board as recipients ad personam. The SERI, the SNSF, swissuniversities, and the Swiss Adademies of Arts and Sciences also signed the mandate under the addition 'consenting approval'.[62] Thereafter, the SERI no longer assumed responsibility for the NCS-TF's external communication and discontinued in-kind support for the NCS-TF's coordination tasks.

The new arrangement for science advice for policy complicated channels and procedures and brought about several operational difficulties. First, the NCS-TF's science advice formally no longer reached the strategic-political level of the Federal Council directly but instead was channelled via operations of the COVID-19 Task Force of the FOPH and the steering committee of the FDHA. Second, during the Special Situation, the Federal Council shared decision-making power with the cantons and was not empowered to act unilaterally on scientific or other recommendations. Third, according to the new NCS-TF mandate, all interaction between the NCS-TF and other federal offices and cantonal authorities had to take place via the COVID-19 Task Force of the FOPH. Fourth, the competences of the working groups of the COVID-19 Task Force of the FOPH overlapped with those of the NCS-TF's expert groups. The advisory structures of the FOPH and the NCS-TF had matured in parallel under high pressure and ur-

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[60] https://www.swissmedic.ch/swissmedic/en/home/about-us.html

[61] The NCS-TF published a strategy paper on 'The future of the NCS-TF' to consider its continuation after the transition from an Extraordinary to a Special Situation.

[62] Original expression in German: "Zustimmende Kenntnisnahme".

gency during the Extraordinary Situation. Collaboration between the FOPH and the NCS-TF during the Special Situation required new procedures to coordinate and streamline these structures.

The NCS-TF issued a great number of policy briefs during this phase. Until November 2020, its science advice pursued the following overarching goals:

- to explain the significance of rising case numbers (exponential growth, transmission) and their potential damage to health and economy,[63,64,65]
- to improve the TTIQ containment strategy and its implementation measures,[66,67,68]
- to strengthen the surveillance-response plan to reduce case numbers in case of resurgence in the form of a second wave,[69]
- to clarify the economic benefits of investing into maintaining low case numbers.[70]

The NCS-TF's policy briefs covered a wide range of topics, including procurement quality; face masks (regulations, benefits, costs); the SwissCovid App; economics of digital proximity tracing; opening borders; the role of children and adolescents in transmission: the impact of therapies on mortality; investment and credit programmes; immune responses and protection; quarantine; vaccines

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[63] NCS-TF policy brief, 3.7.2020: 'NCS-TF alarmed over rapid increase of number of SARS-CoV-2 infections in Switzerland'.

[64] NCS-TF policy brief, 7.1.2021: 'Why far-reaching health policy measures make sense from a macroeconomic perspective in the current situation'.

[65] NCS-TF policy brief, 3.7.2020: 'NCS-TF alarmed over rapid increase of number of SARS-CoV-2 infections in Switzerland'.

[66] For example, as early as July, 2020, the NCS-TF issued an 'Alert' policy brief, which issued 'urgent recommendations for immediate action' to members of society, organisations and public authorities to avert major damage to health, society and the economy because infections were 'increasing at an alarming rate in Switzerland'. The document emphasised the importance of reacting quicky, because 'late introduction of measures makes it difficult to control the epidemic and avoid a second wave'. The members of the NCS-TF saw it 'as [their] responsibility to call for immediate action'. At the time of publication, 96 cases were recorded in Switzerland. At the end of October, the NCS-TF released a policy brief reporting that 'many cantons are no longer able to ensure sufficient contact tracing', that Switzerland lagged behind in testing in international comparison, and that more public resources needed to be invested into TTIQ from an economic and health perspective.

[67] NCS-TF policy brief, 10.11.2020: 'Scalability and efficacy. Considerations for Test-Trace-Isolate-Quarantine (TTIQ)'.

[68] NCS-TF policy brief, 26.10.2020: 'The rationale for a substantial increase of resources for contact tracing and testing'.

[69] NCS-TF policy brief, 14.9.2020: 'Widespread community spread of SARS-CoV-2 is damaging to health, society and the economy'.

[70] NCS-TF policy brief: 18.8.2020: 'Is there a health-wealth trade-off during the COVID-19 crisis?'.

(priority, allocation, national and international responsibilities); the role of aerosols in transmission; economic costs of quarantine; support to businesses; testing and quarantining strategies; risk factors for severe COVID-19 infections; intensive care units; protecting the elderly in long-term care; multisystem inflammatory syndrome in children; and assessment of different quarantine strategies. Most of the policy briefs during this phase named no requesting agency. One policy brief is written in response to a request from the cantons through the GDK.[71]

It is not within the scope of this report to evaluate the efficacy of the NCS-TF's policy briefs or its recommendations in terms of their reception and influence in pandemic policy responses. However, in contrast to the previous phase when the NCS-TF was attached to the strategic-political policy level, no general correspondence between NCS-TF's science advice and decision-makers' policy measures may be discerned. Science advice for policy did not succeed in preventing a second COVID-19 wave and the number of infections and deaths, compared to the first wave, was significantly higher.

A disconnect between science advice and policy actions was reported on by the media, followed by heated public and political debates. Public administration, science, and the media were variously blamed for spreading public uncertainty and confusion. This situation challenged science journalists, public administration, politicians, and scientists alike. The NCS-TF, with the assistance of the ETH-Board, solicited communication services from a private company to navigate the ensuing challenges professionally.[72] The ETH-Board also stepped in to provide in-kind support to the NCS-TF to ensure continued coordination assistance, since the task force was not equipped with an operational budget. The FOPH stepped up its press conferences in October, with members of the NCS-TF participating regularly to answer questions from journalists.

The arrangements for science advice for policy during this phase took a few months to settle and required concerted efforts from the FOPH, the FDFA, and the NCS-TF. Protracted negotiations on responsibility for policy measures between the federal and cantonal governments exasperated these efforts during the second wave of COVID-19. Professional communication services to the NCS-TF, science journalism's quality, and the Federal Chancellery's communication policy were key levers to steer public discourse through these difficult circumstances.

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[71] This policy brief considers the implications of COVID-19 for the influenza vaccination strategy for influenza season 2020/2021: 'We suggest that the federal government increases its involvement and together with the cantons immediately provides the resources for a very substantial upgrade of both activities. In an economic cost-benefit sense, this is one of the most effective and least-invasive investments into curbing the spread of the pandemic. Increasing public funding for TTIQ therefore also represents sound economic policy.' Policy Brief, 26.9.2020: COVID-19 and the influenza vaccination strategy for influenza season 2020/2021.

[72] Bernet Relations. https://bernet.ch/

2.5. Profile of the Swiss case

What does this brief history of the role of science in Switzerland's policy response to the COVID-19 pandemic tell us about this country's particular characteristics and the performance of its scientific advisory system? Detailed comparative studies are not available yet,[73] and therefore, no comprehensive analysis can be offered within the scope of this study. To compare the Swiss experiences with other countries, this research project profiled the science advisory arrangements of a selected group of countries including its neighbouring countries (Austria, France, Germany and Italy), and the UK (see Appendix II). In all of these countries, ad hoc expert committees, science advisory councils, and research promotion instruments were established or activated for emergency purposes.

The following special scientific advisory instruments and measures were set up in Austria, France, Italy, Germany and the UK. Austria convened the Coronavirus Task-Force on February 28, 2020, and an affiliated science advisory group, and the *COVID-19 Future Operations Platform*.[74] France launched two new science advisory bodies, the *Conseil Scientifique* and *Le Comité Analyse, Recherche et Expertise (CARE) Covid-19* on March 10 and 24, 2020 respectively. Italy set up the *Comitato Tecnico Scientifico* in early February 2020. The UK activated its *Scientific Advisory Group for Emergencies (SAGE)* on January 22, 2020 and the Scientific and Technical Advisory Cell (STAC) in late April 2020. Furthermore, this country established an additional advisory body, the *Joint Biosecurity Centre (JBC)* on June 1, 2020. Germany instituted no new national scientific advisory instrument and instead relied on an intricate network of scientific advisory institutions and agencies at federal and state level.

The national advisory arrangements for policy during the pandemic differed considerably across countries. National science advisory mechanisms and instruments can be compared by their legal provisions, disciplinary composition, mandate, and structure. Issues that have attracted criticism across countries are also of interest, such as the affiliation, transparency, and communication of science advisory instruments and mechanisms.

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[73] The UK is the only country in this group that has already issued a review of its science advisory arrangement during the pandemic. In January, 2021, the Science and Technology Committee of the UK House of Commons published the report The UK Response to COVID-19: Use of Scientific Advice. First Report of Session 2019-2021. To date, the international comparative research projects by INGSA, CompCoRe and EScAPE have not issued detailed country studies that consider the role of science in pandemic policy response.

[74] No information is currently available on the founding dates of the Austrian scientific advisory agencies during the COVID-19 pandemic.

When comparing the role of science in policy response across countries, a general distinction can be made between countries that launched new instruments and mechanisms, countries that activated special advisory mechanisms and instruments according to emergency provisions, and countries that have activated existing systems, organisations, and procedures of science advice rather than establish new ones. Based on this country review, the following section offers a profile of the specific science advisory arrangement for policy response in Switzerland during 2020.

Legal provisions: Switzerland's legal provisions for national health crises and emergency situations assign no specific role to science. Science and scientific advice are not mentioned in the Epidemics Act (and its ordinances), the national Swiss Influenza Pandemic Plan or the new Swiss Covid-19 Act of 2020. Therefore, no special statutory plans were in place to consult science advice for policy during the COVID-19 pandemic. In the beginning, expertise was provided in-house by the Federal Office of Public Health (FOPH) and its external network. On April 1, two weeks after the declaration of the Extraordinary Situation, the NCS-TF was established by mandate by several federal public administration authorities, initiated by representatives of the Swiss scientific community. However, this task force was given no statutory status and its mandates were issued by public administration at federal departmental level and at federal office level, respectively. Notably, the NCS-TF was not anchored in law when the Federal Council and Swiss Parliament passed new legislation on the COVID-19 pandemic in September 2020.

Strategy and planning: Pandemic and contingency planning in Switzerland in 2020 included no designated role for science and scientific advice at federal or cantonal levels of government. Switzerland has no national early warning system for infectious disease but relies on access to the early warning mechanism of the ECDC. Therefore, no scientific advisory mechanisms set in to support early detection, risk assessment, and strategy development. Pandemic planning and provisions for crisis management relied on the expertise of the Federal Office of Public Health (FOPH), which also consulted with its network of scientific and other experts. Scientists outside of this network found no point of contact to get involved in this stage of pandemic response. The Federal Commission for Pandemic Preparedness and Response (EKP), a standing expert commission of the FOPH vested with advisory responsibilities for pandemic planning, did not assume a prominent role.[75]

[75] The other extra-parliamentary commission, the Federal Commission for Vaccination (FCV), became more active towards the end of 2020.

Although, like several other countries, Switzerland's pandemic preparations did not include plans or provisions on the role of science for policy, in comparison it appears to have hesitated to establish new science advisory mechanisms. As a result, the Swiss Federal Council declared two consecutive national health emergency stages on February 28 (Special Situation), and on March 16, 2020 (Extraordinary Situation), without consulting an external scientific advisory agency for decision-making. In the Extraordinary Situation, the NCS-TF provided advice for three key strategic policy challenges of the federal government: the mitigation strategy of the first wave, the containment strategy after the first wave, and the transition between the two.

National science advisory arrangement: The national science advisory arrangement included two central agencies: the FOPH and the NCS-TF. The FOPH's communicable disease division has in-house expertise, a network of experts in the academic community and medical professionals, and is advised by two extra-parliamentary commissions, the Federal Commission for Pandemic Preparedness and Response (FCP) and the Federal Vaccination Commission (FVC). The NCS-TF is a network of around sixty scientists with expertise from a variety of fields of knowledge, organised into ten standing expert groups. It has no own budget, its members are not remunerated, and its operations are directed by a small advisory council and a management team. Working relationships of these two agencies were influenced by the respective crisis management structures during the Extraordinary and Special Situations. In the Extraordinary Situation, the NCS-TF provided direct advice at strategic-political level (see Figure 3), during the Special Situation, its advice was channelled via the FOPH (see Figure 4).

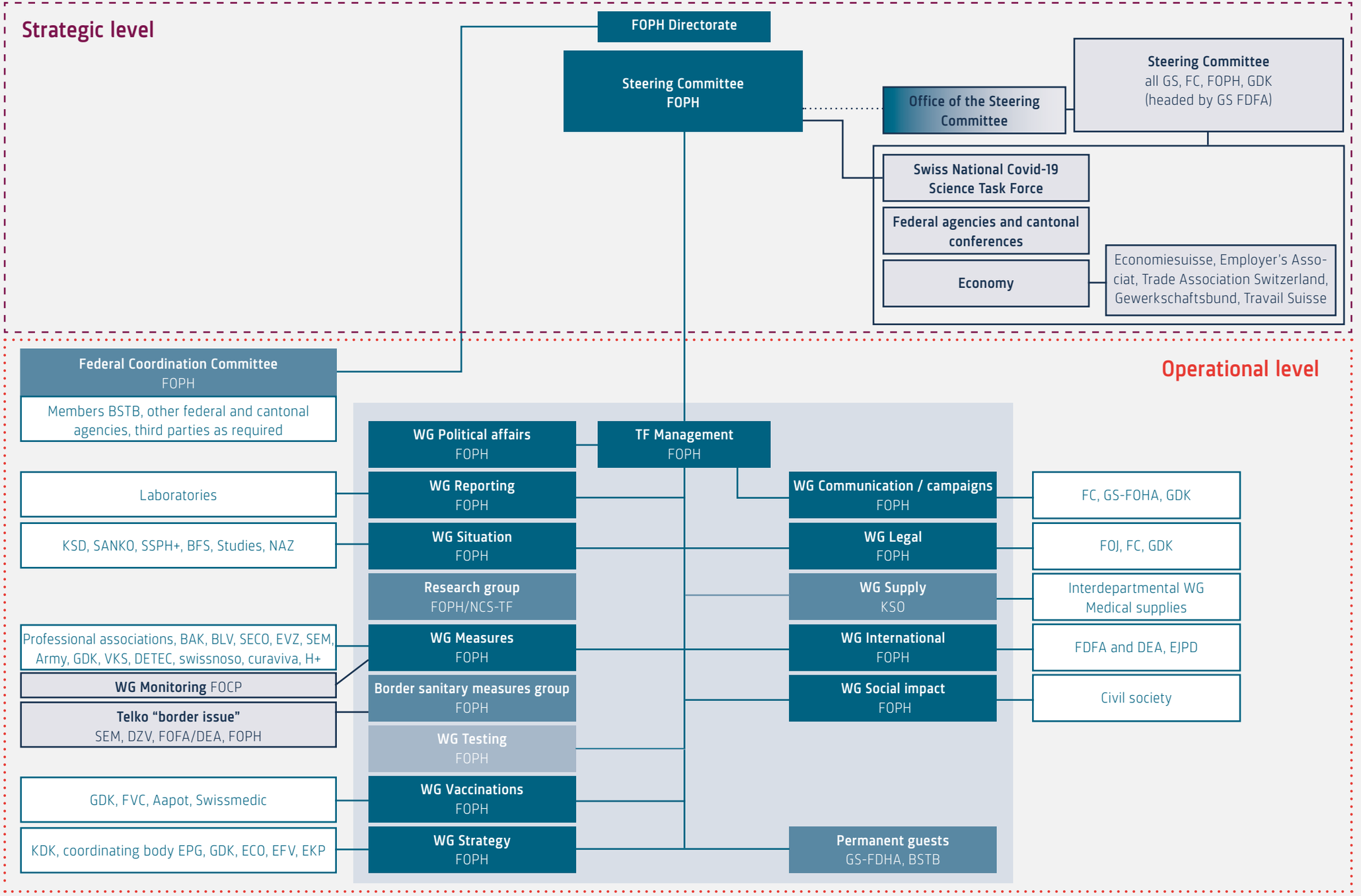

Figure 3: Organisation chart showing the position of the NCS-TF at strategic-political level of federal crisis management during the Extraordinary Situation (Source: KSBC, 2020).

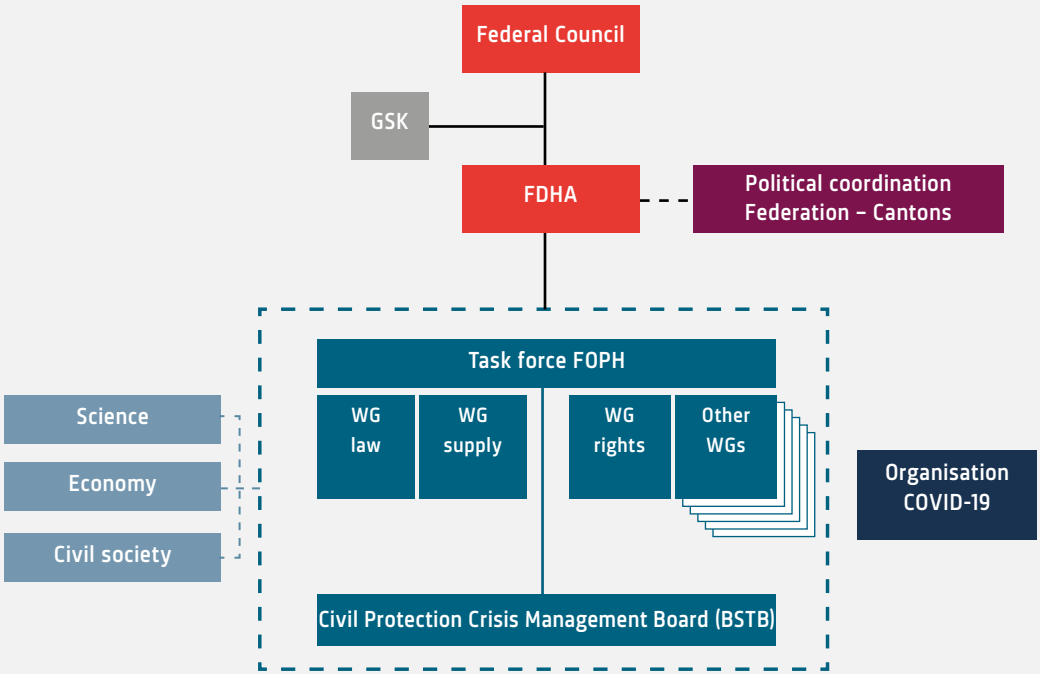

Figure 4: Organisation chart of the NCS-TF in federal crisis management during the Ordinary Situation (Source: Mandate of the NCS-TF, July 2020).

The record suggests that the idea of a science advisory agency for policy was considered in various circles following the declaration of the Extraordinary Situation. In the end, however, the presidents of four national science agencies stepped up and directly approached executive government to propose the establishment of a national COVID-19 science task force. The design of the new NCS-TF – a national task force by status rather than council or committee – built on an existing task force which had just been established for the ETH-Domain. Its terms and conditions were determined by negotiation, in only a few days, between two government departments, the Crisis Unit of the Federal Council, and the presidents of four Swiss science agencies. The new task force was convened two weeks after the highest level of national health emergency, the Extraordinary Situation, had been declared and two COVID-19 ordinances issued.

Mandating authorities: The NCS-TF is authorised by mandate. Two different mandates directed its operations in the year 2020. The first mandate attached the NCS-TF to the political-strategic level of the Crisis Unit of the Federal Council, the KSBC. The second mandate assimilated the NCS-TF as an extended arm of public administration and attached it to the administrative-operational level of the COVID-19 Task Force of FOPH at the FDHA. Consequent to this major change, direct science advice to the highest level of executive government remained limited and informal for the second half of the year 2020.

The first mandate issued on March 31, included seven signatory parties: the State Secretariat of Education, Research and Innovation (SERI), the Federal Office of Public Health (FOPH) (on behalf of the Federal Department of Home Affairs (FDHA)), and the Crisis Unit of the Federal Council (KSBC), signed as contracting authorities. Recipients of the mandate included four national science organisations positioned at the interface of science and politics: the Swiss National Science Foundation (SNSF), the ETH-Domain, swissuniversities, and the Swiss Academies of Arts and Sciences (a+). The president of the SNSF was appointed as president to direct and convene the NCS-TF. The NCS-TF's second mandate was signed in late July 2020 by new contracting authorities (the FOPH and the FDFA) and new recipients (the president of the NCS-TF and the president of the ETH-Domain, ad personam).

Composition and operations: the NCS-TF from the beginning was composed of ten expert groups in the fields of clinical care; data and modelling; diagnostics and testing; digital epidemiology; economics; ethics, legal, social; exchange platform; immunology; infection prevention and control; public health. Lean management structures, regular and frequent communication and exchange, and interdisciplinary collaboration characterised its internal operations, which remained largely unaffected by the task force's change in institutional affiliation in August. Despite extreme time pressure, especially during the Extraordinary Situation, its policy briefs were consistently composed in interdisciplinary processes and, on a few occasions, by including additional external experts. The NCS-TF's calendar of regular, emergency, and other meetings was densely packed.

External communication: the NCS-TF runs a website which publishes regular policy briefs and updates on the epidemic situation, and provides information on its mandate, objectives, organisation, and members.[76] The issue of external communication has preoccupied the NCS-TF. From an operational perspective, responsibility for the NCS-TF's communication first rested with the SERI (first mandate) and was then transferred to the FOPH (second mandate).

[76] https://sciencetaskforce.ch/en/home/.

However, media requests increased considerably with the advent of the second wave, and the NCS-TF subsequently obtained additional communication support from the communications unit of the ETH-Board and a public relations agency.[77] The NCF-TF's communication practices were the topic of heated debate in public, politics, and the media, especially in the run-up to the second COVID-19 wave. These debates concerned the task force's communication policy, its predictions, models, and independence.

Requests: In the crisis management model of the Extraordinary Situation, the KSBC was appointed as the main contact point for requests for scientific advice. The NCS-TF's second mandate, issued during the Special Situation, specified that the COVID-19 Task Force of the FOPH acts as coordinating unit for such requests. From the very beginning, however, the NCS-TF also received many direct requests from a wide range of stakeholder groups and individuals, including cantonal and municipal authorities, parliamentary commissions, professional associations, citizens, businesses, and others. Repeatedly, initially at the behest of the KSBC, the NCS-TF made efforts to reach out to Parliament, cantonal authorities, and professional associations but its high workload left little room for pro-active pursuit.

This brief profile of the specific science advisory arrangement during the Swiss policy response to the COVID-19 pandemic raises several questions: Why did the relatively new Epidemics Act and the Pandemic Plan not include legal provisions for the role of science in a public health crisis? Why did federal government not seek the advice of the Swiss scientific community on its own accord? Why was the Swiss National COVID-19 Science Task Force given no statutory provisions in the COVID-19 Act? Why was the original affiliation of the NCS-TF to the strategic-political level moved further down along the decision-making chain to the COVID-19 Task Force of the FOPH, amidst an ongoing pandemic? How did decision-makers in Parliament, the cantons, and professional associations in public health obtain scientific data and advice to guide their policy decisions?

National arrangements of science advice depend on the specific political, legal, structural-institutional, and procedural conditions in which they are organised and embedded (Lentsch & Weingart, 2009; OECD, 2015). For this reason, the following chapter will consider the broader conditions of science advice for policy in Switzerland.

[77] https://sciencetaskforce.ch/en/home/.

3. Conditions for science advice for policy in Switzerland

In Switzerland, science has no specific role in legal provisions for emergency policy responses – health or otherwise. By default, the standard regulations for science advice for policy applied during the COVID-19 pandemic, which assign a central role to offices, agencies, and departments of federal public administration. Unfortunately, these conditions have not yet been studied comprehensively and systematically and, therefore, the following section attempts to profile the broader political, legal, structural-organisational and procedural conditions for science advice in Switzerland.

3.1. Political conditions

Three guiding principles characterise the Swiss political system: direct democracy, federalism, and concordance. Knowing the system's general structure is useful for understanding these principles. First, the national executive function in Switzerland is not conducted by a single person but, since 1848, by a group of seven Federal Councillors with equal power. They make decisions jointly, and each also heads a Federal Department.[78] In turn, the seven departments are led by General Secretariats.[79] For the past half century, although only by unwritten rule, the four largest political parties have been represented in the Federal Council, which is elected by Parliament.

The Swiss confederation has 26 cantons, each with cantonal constitutions in addition to the federal constitution. Because of their strong political power, especially compared to divisions of other liberal democracies, the cantons are often described as nations in their own right (Sager et al., 2018). They play a central role in the federalist system because, ahead of federal and municipal governments, they 'are the default location for unallocated state functions' (Sager et al., 2018: 25). In Switzerland's political system of direct democracy, the general electorate participates in important decisions at three governmental levels: local, cantonal and federal. In addition to voting, citizens can bring issues to the political agenda through referendums and initiatives. In a sense, these instruments function as institutionalized opposition (Sager et al., 2018: 22).

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[78] Swiss national administration is divided into seven Federal Departments: Foreign Affairs (FDFA), Home Affairs (FDHA), Justice and Police (FDJP), Defense, Civil Protection and Sports (DDPS), Finance (FDF), Economic Affairs, Education and Research (EAER), and Environment, Transportation, Energy, and Communications (DETEC).

[79] General Secretariats play a significant role in the individual Departments. They coordinate administrative work for the Swiss parliament and the Federal Council and serve as the interface between the various offices in a department and the respective Federal Councillor. They assume planning, coordination, consulting, communication, controlling and monitoring tasks and exert influence on personnel and finances (Ladner, 2019).

In Switzerland, distribution of competences among government levels is often explained by *subsidiarity* (Linder, 2010), in which only those tasks a lower governmental level cannot efficiently perform are delegated to a higher level (Sager et al., 2018). This has led to a relatively weak central state, dependent for many responsibilities on cantons and civil organisations' cooperation (Himmelsbach, 2019). An important component of this political culture is the militia principle, by which members of institutions such as the army, engage in these state institutions not in their main professional role but as citizens.

Switzerland's political system is regarded as a classic example of concordance democracy based on a pronounced institutional division of power (Linder, 2021). Unlike a majority democracy – for instance, the British Westminster model – Switzerland has strong institutional veto players and a government that includes all major political forces. This tames majority rule and creates broad division of power through minorities' political participation. Pronounced federalism, direct democracy with the obligatory constitutional referendum, and the proportional electoral system have led to a political decision-making process characterized by consensual conflict resolution and compromise solutions (Sager et al., 2018). As informal rules, consensus orientation and political compromise pervade the political system and have been consolidated into formal institutional regulations and political procedures (Klöti et al., 2014). The Swiss Federal Council is composed of members from four political parties but is not formed by coalition agreement. The compulsion to adopt a united position urges members of executive government to compromise (Linder, 2021). Thus, the Federal Council's division of power 'should lead to political solutions that command a broad majority both in parliament and in the population' (Linder, 2009: 573). Consequently, political decision-making processes in Switzerland often take longer than in majority democracies and the political system has been criticized for 'its anti-innovation and inefficiency' (Klöti et al., 2014: 198).

Not surprisingly, the Swiss political system's structural and cultural circumstances strongly affect conditions for science advice for policy (Himmelsbach, 2019: 458). In general terms, these circumstances favour a view of science as an economic factor rather than an independent element of political decision-making (Rotten et al., 2003, in Himmelsbach, 2019: 459). This political tradition affects science advice as follows:

- Science advice and scientific evidence are not typically used to legitimate political action before the public (Himmelsbach, 2019; Sager, 2018).
- Science is afforded no exclusive or exceptional role in the Swiss political system and science advice is considered as one of many perspectives in the political consultation process.
- Therefore, science advice for policy is seen as an extended expert arm of public administration rather than as itself a constituent agent in the policy process and, accordingly, is ranked as part of public administration's departmental research portfolios.

- As a result, science advice for policy is primarily channelled through offices, agencies and departments of federal public administration with few direct points of contact with political authorities and decision-makers.
- Because science advice is classified as an administrative matter, it is not believed to require policy support or strategic guidance.

3.2. Legal conditions

Swiss legislation specifies no general provisions for science advice for policy. Therefore, conditions for such advice result from various legislative acts and ordinances. Collectively, these provide for the following five instruments of science advice for policy:

- Extra-parliamentary advisory committees;
- Government-funded research ("Ressortforschung");
- Public procurement;
- National Research Programmes (NRP);
- The Swiss Science Council (SSC).

The Research and Innovation Promotion Act (RIPA), its ordinances and related legislation[80] outline the cornerstones for science advice for policy, establishing the terms and conditions for government-funded research, for NRPs and for the Swiss Science Council (SSC). An ordinance of the Government and Administration Organisation Act (GAOA)[81] stipulates regulations for extra-parliamentary commissions; the Federal Act on Public Procurement (PPA) and its ordinances[82] define rules for public consulting procedures.

Strictly speaking, the first three agencies involve science advice for public administration but not for policy. The fourth instrument, the NRP, is designed to produce scientific knowledge relevant to current societal problems and requires approval by the Swiss Parliament. Its literal purpose, however, is to present scientific knowledge that can be 'transferred' to society rather than to provide science advice to policy.[83] The last instrument, the SSC, was established in 1965 as the Federal Council's science advisory agency. Its statutory advisory responsibilities were amended in the 2012 revision of the original Research Act of 1984 (Bundesrat, 2011).

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[80] SR 420.1: Federal Act of 2012 on the Promotion of Research and Innovation (RIPA), December 14, 2020 (as of April 15, 2021); 420.11: Ordinance on the Federal Act on the Promotion of Research and Innovation (O-RIPA), November 29, 2013 (as of April 15, 2021); and the 414.20 Federal Act on Funding and Coordination of the Swiss Higher Education Sector (Higher Education Act, HEdA) of September 30, 2011 (as of March 1, 2021).

[81] 172.010: Government and Administration Organisation Act (GAOA), March 21, 1997 (as of December 2, 2019).

[82] 172.010.1: Regierungs- und Verwaltungsorganisationsverordnung (RVOV), November 25, 1998 (as of April 1, 2021).

[83] https://www.snf.ch/en/ELxP53n5RBBa08a2/funding/programmes/national-research-programmes-nrp.

This national legislative arrangement places the offices, agencies and departments of public administration at the centre of science advice for policy. During the past decade, notably, two longer-term developments have particularly impacted the legal setting for science advice: complete revision of the Research Act of 1984 into a much more detailed and densely regulated RIPA and its ordinances, and the 2000 constitutional reform on the evaluation of government policy. Consequent to this new legislation, science advice is principally solicited in support of public administration, and responsibility for science advice to the government is implicitly vested in government departments and their subordinate units.

By law, the RIPA has assigned governmental research a full-fledged research category ("Ressortforschung") in its own right. This category, indirectly but at a stroke, assigned responsibility for many aspects of national science advice for policy in bulk mode to the domain of public administration. The range and scope of these responsibilities include decisions on science policy agendas and goals, strategic planning, coordination, administration, and management.

Additionally, the RIPA changed the legal scope of the SSC's advisory responsibilities. (SWTR, 2011; Bundesrat, 2011). In the new act, '[The SSC] is formally limited in its function to the regulatory matters of the FIFG […] i.e. it is no longer, as before, an advisory body of the Federal Government for all questions of science policy, including education and higher education policy. Its tasks are specified accordingly and are also adapted to the simplified planning procedure.' (Bundesrat, 2011: 89). The SSC is tasked to '[advise] the Federal Council on all questions relating to research and innovation policy on its own initiative or when asked to do so by the Federal Council or the EAER' (RIPA, Art. 54, 1).[84]

Current legal conditions for science advice for policy in part also result from constitutional reform in the 2000s, which introduced requirements on the evaluation of government activities. The new statutory requirements for government policy evaluation have been the 'driving force' of a growing agenda of applied research in public administration (Frey & Widmer 2011, in Himmelsbach 2019: 458).

Although the RIPA, the GAOA and the PPA determine the broad legal framework for science advice and confer on public administration broad and general responsibilities, in practice, activities of individual departments, offices, and agencies are determined by a much larger set of legal provisions. In addition, they are bound by

[84] On behalf of the Federal Council or the EAER, the SSC is tasked to '[evaluate] in particular the Confederation's promotion measures; the research bodies' fulfilment of their tasks; the funding instruments of the research funding institutions and Innosuisse; and the efficacy of policy research measures; to '[comment] on specific plans or problems in research and innovation policy'; to '[support] the EAER with the periodic review of Swiss research and innovation policy; and to '[advise] the Federal Council on the implementation of this Act' (RIPA, Art. 54, 2a-d).

provisions stipulated in departmental ordinances and a large number of detailed statutory specifications that vary depending on their responsibilities. As an example, for the case of the FOPH, the following statutory provisions are relevant: ordinances of the FDHA, Federal Act on Data Protection (FADP), Federal Law on Health Insurance (KVG), Federal Act on Narcotics and Psychotropic Substances, Federal Act on Research Involving Embryonic Stem Cells, Federal Act on Medically Assisted Reproduction, Federal Act on Protection against Dangerous Substances and Preparations, Federal Act on Freedom of Information in the Administration, Radiological Protection Act, Radiological Protection Ordinance, Federal Act on the Protection of the Environment, Federal Statistics Act, and so on.[85]

These legal conditions have the following effect on science advice for policy in Switzerland:

- There is no comprehensive legal framework for science advice for policy at the national level.
- In legal terms, science advice is framed as a service to federal public administration, not as a direct source of knowledge for political decision-making at the executive level.
- Accordingly, compared internationally, Swiss legislation provides for a limited variety and number of science advisory instruments for policy. Collectively, these instruments fall predominantly under the auspices of public administration and favour expert advice by private consulting companies.
- At the level of offices, agencies and departments of public administration, science advice for policy is densely regulated by an array of specialist provisions.
- Science organisations representing the Swiss science community in Switzerland have no formal statutory mission to provide science advice to policy.
- The scientific advisory responsibilities of the council that had been established in 1965 to directly advise the Federal Council, were recently changed in new legislation on research and innovation (RIPA).
- No legally binding or official government guidelines, terms of reference, principles or rules are issued to certify quality standards for science advice to policy in Switzerland.

3.3. Structural-organisational conditions

As mentioned above, Switzerland's institutional landscape of science advice specifies provisions for five main instruments for science advice, all dependent on federal funds. Of subordinate significance, especially in comparison with those of other countries, are associations and think tanks that engage in providing science advice (Himmelsbach, 2019).[86]

[86] Exceptions are the network "FUTURE", the think tank "foraus", economiesuisse (and its think tank "Avenir Suisse").

Compared with France, Germany or the United Kingdom, Switzerland has developed limited specialized research and advisory structures in public administration (Himmelsbach, 2019 :459). Instead, the advisory system of public administration has developed networks for securing science advice (Himmelsbach, 2019).[87] Government-funded departmental research is conducted by international experts, public research institutions, the private sector, cantons, municipalities, and private organisations (Himmelsbach, 2019). Networks of government departments, agencies, and offices cover a range of actors but private consulting companies are their main source of expert advice. Much of public administration's demand for expertise is covered by short-term mandates to external consultants, and private consulting companies have increased their share of government funding research and procurement. Federal administration also solicits ad hoc scientific expertise (rather than advice) at various stages during the legislative process, with private consulting companies as main actors (Himmelsbach, 2019); their growing significance contrasts with the decreasing significance of extra-parliamentary commissions' scientific expertise. However, until the COVID-19 pandemic, no comprehensive research studies on departmental research had reached conclusions on the function and role of departmental research in science advice for policy (Himmelsbach, 2019).[88]

Higher education and research institutions become involved in science advice through research commissioned or funded by government departments or through membership in extra-parliamentary commissions. However, there are few incentives for scientists to engage in science advisory instruments. For one, science advice to policy is not valued in performance assessments of Swiss cantonal universities and their scientists. Therefore, this activity is not acknowledged as scientific contribution, but rather as public service that does not benefit the institutions or their scientists' careers; thus, such activity does not really constitute part of their scientific culture.

Nevertheless, in addition to scientific advisory instruments specified by legislation, several institutions at the interface of science and politics assume advisory roles in scientific concerns. These include the Swiss National Science Foundation (SNSF), the ETH-Board, swissuniversities, and the Swiss Academies of Arts and Sciences (a+). However, this policy advisory role is not explicitly expressed in statutory missions, and as a group, these agencies have no joint format for advising policymakers. Nevertheless, they indirectly conduct important scientific advisory roles through their operations and activities, and their presidents are consulted infor-

[87] The Swiss centre of excellence for agricultural research, Agroscope, which is affiliated with the Federal Office for Agriculture, is an exception.

[88] The RIPA makes provision for a standing interdepartmental coordination committee for federal policy research (RIPA, Art. 42), which is headed by the SERI, to coordinate the process for the development of the multi-year programme and to issue guidelines on quality assurance in the field of policy research. (ROPA, Art. 45).

mally. Moreover, as mentioned in the previous section, the SSC's statutory science advisory role at the interface of science and politics was amended in the revised Research and Innovation Act of 2012 (Bundesrat, 2011).

Limited scientific advisory instruments affect the availability of scientific advice for policy across several important sites of decision-making. Cantonal governments, with considerable decision-making power in public policy, do not typically have formal scientific advisory instruments. Nor has Parliament any scientific advisory instruments at its disposal. Parliamentary commissions, too, can solicit either individual scientific experts or representatives of the ERI-Institutions to appear before them. However, whether this consultation classifies as provision of scientific advice rather than information has been questioned because it does not require developing or assembling new knowledge (Himmelsbach, 2019). At times, associations, organisations and think tanks issue scientific advice, but in comparison to other countries, this amounts to only a small proportion of national science advisory activities.

In Switzerland, structural-organisational conditions affect science advice for policy in the following ways:

- The overall landscape of scientific advisory agencies for policy has grown in response to dense but dispersed legislation and ordinances that follow no uniform strategy.
- Consequently, individual government departments' needs and requirements predominantly shape this landscape, private consulting companies are the main source of expert advice to public administration, and there is little institutional diversity in science advisory agencies for policy.
- Science advice for policy is not earmarked as a key priority or mission of cantonal universities and universities of applied science, or the ETH-Domain.
- Few systemic and operational incentives are offered for higher education, research institutions and individual scientists to engage in scientific advisory activities.
- No network of scientific advisors or platform of exchange has developed to connect federal and cantonal levels.
- Other than through the parliamentary library's information services or by inviting scientists to report at meetings of parliamentary committees, members of parliament have no formal instruments for soliciting science advice.
- Science institutions representing the Swiss science and research community at the interface of science and politics (the ETH-Board, the Swiss Academies of Arts and Sciences (a+), swissuniversities and the SNSF) perform important scientific advisory roles but have no explicit statutory mandates for science advice for policy.
- Other than in evaluation, specifically, there are no national professional associations, standards, best-practice guidelines, or platforms of exchange on science advice for policy.

3.4. Procedural conditions

Procedural conditions for science advice are particularly important because, as the COVID-19 pandemic has demonstrated, scientific advisory activities do not involve straightforward transfer of knowledge from scientists to decision makers. Scientists 'act as intermediaries who translate, aggregate and synthesize varied perspectives and sources of evidence' (Mulgan, 2013, in Wilsdon et al., 2014: 9). Their advisory activities depend on formal and informal 'communication channels, contact points and platforms of exchange' (Wilsdon et al., 2014: 7). Furthermore, use of scientific evidence to inform policy is not a stable, predictable and objective factor, but rather 'the product of dynamic processes, relationships, institutional contexts, histories and trade-offs' (Allen, et al., 2020: 6). In large part, procedural circumstances for science advice for policy in nation states result from particular political, legal and structural-organisational conditions as outlined above. They determine the national character of the professional community of science, its traditions and cultures, and its guidelines and standards.

As mentioned previously, the number of Swiss statutory agencies of science advice for policy, compared internationally, is relatively limited and this limitation translates directly into the professional community of scientific advisors that has grown around these agents. The concentration of scientific advice in public administration, the prominence of expert advisory services from private consulting companies, the focus on evaluation and the lack of incentives and culture to engage in scientific advisory activities at higher education and research institutions has not favoured development of a national professional community of scientific advisors.

As an important force in moulding national traditions for science advice, procedural conditions can be influenced by setting professional standards, establishing guidelines for good practice, and formulating clear provisions and responsibilities for advisory agents and their clients. Science advice for policy in the Swiss tradition of services to public administration takes on a counselling rather than an advisory function (Himmelsbach, 2019), that is, advisory traditions concentrating on evaluation and standards shaped by private consulting companies. Consequently, no guidelines or professional standards have been developed to oversee scientific advisory agents' quality or their national professional disposition. In other countries, various government and scientific agencies have developed tools to assist in these processes: general codes of practice for scientific advice; principles, terms, and conditions for science advice to gov-

ernment; or individual organisations' strategic frameworks for science advice.[89] In Switzerland, no such tools exist to certify the quality of the scientific advisory process. The one exception indicates scientific advice's focus in the country: The Swiss Evaluation Society (SEVAL),[90] a professional association established in 1996, has issued standards for good practice.

As a general conclusion, particular conditions for science advice in Switzerland have impeded development of a vibrant, active community of scientific advisors with established organisations, communication and exchange channels, directives, and principles. Moreover, ethical, and practical guidelines on communicating with the media would have supported the work of scientific advisors for policy during the crisis.

[89] As an example, UK government agencies have published several documents on professional standards for scientific advice for policy: f.e., 'Guidance for government Chief Scientific Advisers and their Officials' (2020); 'Principles of Scientific Advice to Government' (2010); 'Strategic Framework for the Scientific Advisory Group for Emergencies (SAGE)' (2012); 'Terms of Reference for STAC' (2021); and 'Codes of Practice for NERVTAG' (2015).

[90] https://www.seval.ch/ueber-uns/

4. Perspectives from Science & Technology Studies (STS)

This section uses concepts from Science & Technology Studies (STS) to analyse national science advisory arrangements and conditions that have shaped the role of science in the Swiss policy response to the COVID-19 pandemic.

4.1. Analytical tools

From an STS perspective, the policy role of science is viewed as part of the relationship between science and politics, which are mutually dependent. Political institutions and decision-makers depend on science to obtain knowledge and information, and to legitimise policy choices. Scientific institutions and scientists depend on politics for financial and institutional resources, and to justify their value to society.

The relationship between science and politics, however, is inherently shaped by tension produced by knowledge and power's varied rationalities, which begin with different assumptions, follow different aims, and employ different instruments and procedures to achieve their objectives. Importantly, these rationalities are often contradictory and, fundamentally, tension between science and politics is irreconcilable. To make matters worse, the relationship between science and politics is complex and dynamic, and changing over time.

Moreover, the relationship between science and politics is shaped by 'systems of rules, social practices and organisational forms and national political traditions' (Lentsch, 2016a: 318). These systems also determine conditions for science advice to policy and, by implication, the relationship between science and politics and issues of science advice, from an analytical perspective, are inseparable (Lentsch, 2016a).

National science advisory arrangements differ considerably because they are shaped by political, legal, structural-organisational, and procedural conditions and histories. These determine particular national regimes of science advice and result in specific cultures of practice by which politically relevant knowledge is deliberated, validated or challenged (Jasanoff, 2005; Miller, 2008, in Lentsch & Weingart, 2009).[91]

[91] The notion of "civic epistemologies" is often used to describe these national traditions (Jasanoff, 2005; Miller, 2008).

Science advice to policy is usually provided by a great variety of structures and institutions (OECD, 2015: 13). The STS literature identifies four types of science advisory organisations: cooperative advisory bodies;[92] research-based advisory organisations;[93] academies of science;[94] and the model of the chief scientific adviser[95] (Weingart and Lentsch, 2008, 2011; and Wilsdon et al., (2014)). Typically, not all these types are employed in all countries. Some countries, such as Germany or the UK, use a variety of types, others rely more on expertise in public administration with implications on 'the size, power, structure, and legitimacy of national advisory systems' (OECD, 2015: 13). Often, the first source of science advice will be the expertise already available in the policy environment (Jeffares, 2019: 63), which frequently is specialist entities in public administration.

One way to frame this national variety of science advisory systems is through the ecosystem: ecosystems of science advice for policy (Wilsdon et al., 2014: 7) include 'knowledge production, consultation and decision making at the interface of science and policy (Lentsch, 2016a: 318). Science plays an important role in virtually every dimension of policy making at every level of government, from local to international (Gluckman, 2016) and the ecosystem perspective captures science advisory activities across vertical and horizonal sites of decision-making. As the pandemic has shown, however, vertical demand for science advice is not limited to national executive government, especially in federalist countries with decentralised decision-making authorities. Conversely, horizontal demand includes not only departments, offices, and agencies within public administration but a great number of other stakeholder groups, for instance, civil organisations, the media, and business and professional associations.

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[92] Cooperative advisory bodies include advisory councils and advisory committees. Advisory councils 'designate high-level councils for science with representatives from science, industry, higher education and civil society'. Typically, the focus of these bodies is on 'policy advice in relation to the science system'. Advisory committees include a range of 'specialised scientific and expert committees' on regulatory or technical issues (Weingart and Lentsch (2008; 2011).

[93] Research-based advisory organisations range from policy think tanks to intermediary organisations and federal or regional departmental research institutes (Weingart and Lentsch, 2008; 2011).

[94] The category of academies of science may include learned societies and international networks, and has been viewed as 'becoming increasingly active in science for policy and policy for science' (Wilsdon et al., 2014: 7).

[95] The model of the chief scientific advisor shows considerable variety across countries. For example, while the model of the Chief Scientific Advisor to the UK Government includes approximately 80 employees, in New Zealand, the chief science advisor of the prime minister has grown 'from a part-time individual position to an office with a semi-formal network of chief science advisors within ministries' (Jeffares et al., 2019: 62). This science advisory structure 'has been increasingly introduced internationally'. In 2014, Wilsdon lists Australia, Cuba, Czech Republic, India, Ireland, Malaysia, New Zealand and the European Commission as having adopted the model of the chief scientific advisor (Wilsdon et al., 2014).

Contrary to much legal and policy literature, 'the use of evidence is not a stable, predictable and objective factor, but rather 'the product of dynamic processes, relationships, institutional contexts, histories and trade-offs' (Allen, et al., 2020: 6). The ecosystem concept highlights the interplay among structure, agency, and history: national ecosystems depend on a nation's legal, institutional and organisational circumstances but also on its particular historical, political, and cultural traditions. The character of a national ecosystem of science advice is significant because it shapes expectations of science, trust in the knowledge presented, and scientific experts' public credibility. For instance, in some countries (f.e. Germany, the United States), a single public figure emerged as the voice of science during the pandemic while in other countries, this was a lesser expectation.

A key distinction when considering ecosystems of science advice at the interface of science and policy is the advisory activities' two basic purposes: advice on technical, regulatory or specific thematic policy issues, and advice on strategic and policy issues relating to science, usually referred to as "science for policy" and "policy for science" (OECD, 2015). Separating these functions is essential for the system's healthy performance because they both influence the relationship of science and politics. Their respective advisory and decision-making requirements and processes usually differ, however (OECD, 2015: 13). In many systems, advisors or advisory bodies combine a responsibility for use of scientific evidence in policy-making ("science for policy") with a role in determining the research and innovation system's budgets and structure ("policy for science"). Still, lines between these two easily become blurred, not least because areas of "science for policy" have implications for particular research priorities or a funding structure. Where possible, however, keeping the two roles distinct is useful to avoid limiting the advisory remit by being seen primarily as a lobbyist for scientific resources (Wilsdon et al., 2014: 8).

A simple way to consider national science advisory systems is to cast science advice in terms of supply and demand at the interface of science and policy, and to examine organisational structures developed at this interface (Wilsdon et al., 2014). This perspective highlights the relationship between the advisor or the advising agency and the contracting authority or party (Lentsch, 2016b). Typically, as the COVID-19 pandemic has confirmed, 'debates about scientific advice often focus on the "supply-side" of the science-policy interface' (Wilsdon et al., 2014: 8). In practice, however, again demonstrated by COVID-19, the demand side is equally important because 'an effective advisor needs a sophisticated understanding of how policy-making processes work, and the pressures and constraints under which ministers, civil servants and decision-makers operate' (Wilsdon et al., 2014: 8).

In addition, a critical distinction is made between formal and informal provision of science advice (Jeffares et al., 2019, Wilsdon et al., 2014). The model of the government chief scientific advisor illustrates this point. This model is for-

malised by statutory provisions in several countries, for instance, Canada, New Zealand, Australia and the UK, but actually exists in a variety of arrangements, some more centralised and hierarchical, and some more decentralised (Wilsdon et al., 2014). Often the informal actions of the chief scientific advisers can be the most valuable and influential to decision-makers (Allen, 2014). This important activity, however, creates a crucial tension between 'the need for transparency and peer review' and 'the desire to have confidential advice within the policy environment' (Jeffares et al., 2019: 65).

One way to consider the dynamic of science advisory activities in the policy process is to examine them in relation to the policy cycle, often used to simplify the complex system of procedures that constitute public policy. The policy cycle frames the process as an iterative series of stages that include agenda setting, policy formulation, decision-making, policy implementation, and policy evaluation. This perspective's advantage is that it allows us to consider for what purpose science advice is solicited, and which science advisory institutions are involved at which stage of the policy process.

As an analytical tool, however, the policy cycle does not capture the complicated, iterative processes and interactions that occur among interest groups, policy- makers, and decision-makers (Gluckman, 2016). In increasingly complex circumstances for science advice in policy, new scientific practices have emerged, sometimes referred to as "post-normal science" (Funtowicz and Ravetz, 1993), "mode 2 knowledge production" (Gibbons et al., 1994) or "post academic science" (Ziman, 1996). These practices reflect growing recognition across advisory systems that no linear relationship exists between evidence and decision-making and that societal problems often require inter- and transdisciplinary knowledge and iterative processes.[96]

4.2. Science advisory arrangements in Switzerland

During the COVID-19 pandemic, many countries have instituted new science advisory instruments and mechanisms to provide policy advice; others have activated provisions for special scientific commissions or councils. The Swiss National COVID-19 Science Task Force (NCS-TF) was established on April 1, 2020, following a proposal of a small leadership group in the Swiss scientific community. In contrast to advisors in several of its neighbouring countries, this advisory

[96] For example, the UK's Parliamentary Office for Science and Technology recently established a social science section. Social scientists are also expected to form part of the network of departmental chief scientific advisors, and proposals for the appointment of 'chief social scientists' or 'chief historians' alongside chief scientists have been put forward. According to Wilsdon et al., (2014), however, 'creating separate structures ducks the more important challenge of how to integrate an appropriate mix of advice and evidence from a wide range of disciplines' (Wilsdon et al., 2014: 10)

body was not assigned a statutory role in provisions for crisis management or pandemic policy response (Swiss Epidemics Act, Influenza Pandemic Plan and COVID-19 Act). By default, the role of science came to depend on conditions that determine the Swiss national system's particular nature of science advice.

Timing is significant for the NCS-TF's establishment: the task force was mandated after the Swiss Federal Council had already declared two stages of emergency situations (Special Situation on February 28, 2020; Extraordinary Situation on March 16, 2020) and issued two COVID-19 ordinances with far-reaching socio-economic consequences. During these first weeks of the pandemic, decision-making for policy measures rested primarily with the cantons, in line with the Swiss political model of federalism. The FOPH geared up its crisis management organisation and relied on its in-house skills, a local network of scientific expertise, and information from international organisations like the World Health Organisation (WHO) and the European Centre for Disease Prevention and Control (ECDC) for guidance to conduct its statutory duties of early detection and risk assessment. During the Extraordinary Situation, the NCS-TF was attached to the political-strategic level of the Crisis Unit of the Federal Council. When this level was lowered to the Special Situation after the first COVID-19 wave, the NCS-TF was relocated to the crisis unit of the FOPH at the FDHA, and its mandate changed. The role of science in policy was impacted by the changed distribution of power between federal and cantonal governments and their corresponding mode of crisis organisation.

In the first phase, during the weeks before March 16, 2020, policy decisions on early detection, risk assessment, and strategy development were not informed by special science advisory arrangements. The Swiss Federal Council declared two consecutive levels of health emergency alert by relying on crisis organisation as set forth in the Swiss Influenza Pandemic Plan of 2018. These decisions were supported by expertise of the FOPH and its professional network, and information from the WHO and the ECDC. Scientists monitored information on SARS-CoV-2 and contributed scientific papers in epidemiology, public health, and infectious disease, contacting the media to raise the alarm about the gravity of the new virus's rapid spread.

The second phase began with the Federal Council's highest level of health emergency alert on March 16, 2020. Federal authorities had recognised that the strategic approach in the 2018 Swiss Influenza Pandemic Plan was insufficient to address this pandemic's magnitude. Leaders from four institutions representing the Swiss scientific community – the SNSF, the ETH-Domain, swissuniversities, and the Swiss Academies of Arts and Sciences (a+) – approached executive decision-makers to propose establishment of a national science advisory body. After brief negotiation, the Swiss National COVID-19 Science Task Force (NCS-TF) was founded by mandate on April 1, 2020, and affiliated with the strategic-political level of the Crisis Unit of the Federal Council (KSBC).

In the third phase, the NCS-TF provided specific advice on scientific issues related to the new virus, developed monitoring and surveillance indicators and tools, and proposed strategies for mitigation and containment of the SARS-CoV-2 virus. After the first wave and with the return to a lower alert level on June 19, responsibility for policy measures during the fourth phase partially shifted back to the cantons, and the NCS-TF was relocated to the FOPH crisis management unit. Consequently, during the following six months, the NCS-TF's scientific advice was channelled and administered through the FOPH and the crisis steering committee of the FDHA; formally, the NCS-TF no longer had direct access to the strategic-political level of government.

Compared internationally, notwithstanding its late establishment, the NCS-TF's composition, management, operations and products testify to excellent performance. Contrary to several neighbouring countries, from the beginning its disciplinary composition included the social sciences, humanities and economics. Furthermore, early transparent publication on the NCS-TF's composition and its policy briefs appears to have been exceptional. In addition, its policy brief's quality and interdisciplinary orientation stand out because, in other countries, such materials' availability and quality was often subject to fierce critique. Finally, the NCS-TF's lean, efficient structure and transdisciplinary operations testify to its efforts to integrate diverse perspectives into its advisory statements.

Nonetheless, criticism of both the NCS-TF and the FOPH from politics, the media, and society was constant during 2020. However, these grievances' number and style were relatively minor in international comparison; they typically concerned standard issues arising at the interface of science and politics, such as communication and democratic legitimacy, which were publicly debated in other liberal democratic nation states as well. Notwithstanding these public debates, the NCS-TF's activities and contributions have, retrospectively, been met with broad approval among decision-makers. One reason for this approval, contrary to many other countries' experience, may be that decisions on the NCS-TF's original composition and operations followed scientific rather than political or strategic criteria. Nevertheless, as in most countries, several problems related to the homegrown model of science advice for policy prevailed throughout the pandemic.

4.3. Performance of the Swiss science advisory system

Several characteristics of the Swiss national science advisory arrangements during the COVID-19 pandemic can be framed and analysed as an ecosystem of demand and supply. Science 'has an important role to play in virtually every dimension of policy-making at every level of government, from local to international' (Gluckman, 2016: 1); accordingly, demand for scientific advice for decision-making in liberal democratic nation states spans horizontal and vertical policy coordination. However, the crisis has also cast light on additional demand sites for science advice normally receiving little attention. These sites came to

light because they were responsible for critical decisions that affected frontline workers who needed knowledge urgently: professional associations; media professionals, unions, and private-sector organisations.

Analysis suggests that, in Switzerland, the role of science in national policy responses was not only shaped by special science advisory agents and measures activated for national policy responses but also, to a greater extent, affected by specific conditions of the Swiss science advisory system. To assess national advisory systems' performance, we may assess the extent to which they succeed in achieving balance between demand and supply.

Separating "science for policy" and "policy for science"

For such an assessment, we inquire into national structures, organisations and procedures at the interface of science and politics that work to achieve a balance between demand and supply. Balance critically depends on separation of two scientific advisory activities that perform different but complementary functions: advice on technical, regulatory or specific thematic policy issues ("science for policy"), and advice on strategic and science policy issues ("policy for science"). There are good reasons for separating the two roles to avoid conflicts of interest because strategic advice on science policy issues potentially affects the home institution and research prospects of the science adviser.

Separation of responsibilities for scientific advisory functions and the measure of coordination between them are critical for the ecosystem's healthy performance. This explains why, in some countries such as France or Austria, two science advisory agencies were established during the COVID-19 pandemic: one in charge of providing scientific knowledge on problems pertaining to the SARS-CoV-2 virus and the pandemic; the other in charge of providing scientific advice on strategic and science policy questions. In some countries, established institutions with responsibilities for both these scientific advisory functions were activated to provide both types of science advice, such as Germany or the UK.[97]

The Swiss model of scientific advice for policy followed during the COVID-19 pandemic did not separate these responsibilities and tasks. In the absence of statutory provisions for a science advisory agency during a public health crisis, the first proposal for the NCS-TF mandate envisaged a task force model that accommodated both strategic and operational levels: an advisory council with science policy advisory duties,[98] and several expert groups with scientific advisory re-

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[97] For example, the Robert Koch-Institut (RKI), the German Science and Humanities Council ("Wissenschaftsrat") and the German National Academy of Sciences Leopoldina; or the French Conseil Scientifique and the COVID-19 Analysis, Research and Expertise Committee (CARE).

[98] Advisory council members would be presidents of major organisations (the SNSF, the ETH-Domain, swissuniversities and the Swiss Academies of Arts and Sciences) representing the scientific community at the science policy interface.

sponsibilities. The first proposal also included strategic tasks such as identifying research opportunities.[99] However, these strategic functions were not taken up in the two NCS-TF mandates, and over time, the NCS-TF gravitated to "science for policy" tasks and responsibilities.

In and of itself, setting up one science advisory body for "science for policy" activities under emergency circumstances is no problem. In some countries, independent science policy councils or organisations with statutory advisory responsibilities assumed this role during the COVID-19 crisis, for instance, the German Council of Science and Humanities, the Leopoldina (the German National Academy of Sciences) or the House of Commons Science and Technology Committee in the UK.[100] However, Switzerland has no independent council or organisations with explicit statutory mandates to conduct advisory activities on science policy issues. Therefore, at the beginning of the pandemic, no national science advisory agency was vested with the necessary authority and independence to propose the establishment of the NCS-TF. In many ways, this is problematic because representatives of public institutions acting without statutory directives potentially expose themselves to criticism.

This study's main conclusion on the role of science for the Swiss policy response to COVID-19 is that many of its problems were consequences of this gap in national science policy. In the absence of national science advisory bodies with explicit, short-term, statutory science advisory responsibilities for policy, scientists and other stakeholder groups had no recourse to make the case for establishing a national science agency to advise policy at the beginning of the Covid-19 pandemic. This explains why the four main national science organisations' presidents had to act and why they saw no option but to take the unusual step of directly approaching members of the executive government to propose establishment of a science advisory agency.

Currently, the five main national organisations with public mandates at the interface of science and policy – the Swiss National Science Foundation, the ETH-Board, swissuniversities, the Swiss Academies of Arts and Sciences, and the Swiss Science Council – have no explicit statutory mandate on science advice to policy. Their members all assume formal and informal science advisory roles on technical, regulatory, or general policies ("science for policy") since this role is implicit in their missions. However, their statutory provisions and service-level agreements with the SERI do not specify responsibilities for science advisory

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[99] The website of the NCS-TF still lists the task 'Identifying fields and opportunities for research where the Swiss scientific community can make an important contribution to understanding and combating COVID-19' but, strictly speaking, it has no formal mandate to carry out this task.

[100] In January 2021, the UK House of Commons Science and Technology Committee presented a report on The Government's Response to the Science and Technology Committee report: The UK Response to Covid-19: Use of Scientific Advice to Parliament.

activities on "policy for science". Furthermore, no official national science forum or council exists through which these organisations can provide indirect science advice to decision-makers on science policy matters. This leaves a strategic void of national proportions at the interface of science and politics that other agents cannot fill. This national gap greatly affected the role of science in the Swiss policy response to the COVID-19 pandemic.

For example, during 2020, the sister institution of the Swiss Academies of Arts and Sciences, Leopoldina or the German National Academy of Sciences, issued seven ad-hoc position papers with recommendations that included an important critique of government measures, strategies, and procedures, particularly when case numbers began rising during the pandemic's second wave. Likewise, the SSC's sister institution, the German Science and Humanities Council ("Wissenschaftsrat"), has recently provided science advice to decision-makers on the German science system's challenges and vulnerabilities due to the COVID-19 crisis, promoting it as a catalyst for transformation and systemic improvement.[101]

Furthermore, one function of advisory councils on science policy is advising on distribution of public funds for science and national science promotion instruments. Swiss science promotion is specified by the RIPA but does not provide for rapid-response research-promotion instruments. By default, then, the SERI allocated no special funds for additional research-promotion instruments; instead, the FOPH was expected to cover additional demand for science advice via its budget for departmental research. The National Research Programme's (NFP's) research-promotion instrument was also activated, and the Swiss Parliament approved the NRP "COVID-19." However, there are no public records of decision-making processes that informed these research-promotion instruments' design. Clearly, however, they did not result from a national strategic plan to guide research investments during the pandemic. This fragmentary approach to research promotion resulted in several essential gaps criticized by parts of the Swiss scientific community. One criticism, for example, concerned perceived emphasis on funding opportunities designed for the natural and medical sciences rather than for the social sciences and humanities.

Across nations, national science policy decisions had to be made at short notice during the COVID-19 pandemic such as, for instance, on strategic research investments into clinical trials and vaccine development. Countries with national science advisory bodies commissioned to provide independent short-term advice on "policy for science" issues were at a competitive advantage in addressing these questions and took action to strengthen their scientific systems and

[101] Wissenschaftsrat. 2021. Impulse aus der COVID-19 Krise für die Weiterentwicklung des Wissenschaftssystems in Deutschland. Positionspapier. https://www.wissenschaftsrat.de/download/2021/8834-21.html.

communities during the crisis. On the international stage, the statutory void in short-term national "policy for science" advice during COVID-19 in Switzerland is unlikely to benefit its science system going forward.

Yet another issue is that, given the international scientific system's inherent bias toward the global North, international scientific collaboration with the global South requires special efforts and science policy strategies. Many southern countries have developed skills and learned lessons on containment and mitigation measures and strategies from earlier disease outbreaks. Some have established special response instruments, such as the Africa Centres for Disease Control and Prevention (Africa CDC) of the African Union. Scientific contributions' national focus thus runs contrary to long-standing recognition that North-South research partnerships are essential for sustainable responses to global problems. Nevertheless, during the pandemic, global North-South research has suffered serious setbacks imperilling long-standing research partnerships and capacities. Despite early pandemic proclamations on global North-South research at the beginning of the pandemic, COVID-19 has strained the global South's already fragile science systems, often leaving their already-vulnerable scientific communities in even more precarious conditions (Coalition C-CR, 2020; Mburu, 2021; Maswime et al., 2020; Weintraub et al., 2020; UKCDR, 2020; WHO, 2020b). Without targeted national science policy measures, these developments compromise global pandemic responsiveness and threaten to compound patterns of inequity in the global economy of science.

Demand for science advice

The COVID-19 pandemic has demonstrated that Switzerland's current science advisory arrangements strain public administration's competencies and responsibilities and struggle to meet the growing policy demand. Such demand cannot be addressed simply by stepping up their horizontal and vertical coordination activities or by establishing an ancillary science advisory body, no matter how outstanding its operations and activities. Indeed, the study indicates the following problems in the Swiss science advisory arrangement for policy response:

- First, Switzerland has no formal advisory instruments and mechanisms to meet the Parliament's demand for science advice. NCS-TF members were sporadically invited to give presentations at parliamentary committee meetings – an occasional practice in ordinary times – but aside from this selective input and other than library services, Parliament has no formal access to science advisory services. In countries with coalition governments and opposition parties, such as Germany, science advisory services to members of parliament are delivered by diverse advisory agents.
- Second, the pandemic has revealed that cantonal governments typically have no statutory science advisory mechanisms or instruments. In the Swiss federalist system of direct democracy, where political power rests with the cantons unless explicitly delegated to the federal government, the absence

of formal science advisory arrangements is particularly consequential. More information is needed on how cantonal governments have met their demand for science advice during the pandemic. There is evidence that policy-makers and crisis units consulted formally and informally with scientists at local higher education and research institutions and with medical health professionals from university hospitals. However, not all 26 cantons can access such institutions' expertise.

- Third, unlike other countries such as the UK or Germany, no formal science advisory channels, platforms and networks exist to connect Swiss federal and cantonal governments in science advisory matters. COVID-19, however, demonstrated that such communication channels are essential but take time to build. They cannot reasonably be administered and coordinated by a single office or department in public administration or by a special science advisory agency.
- Fourth, as mentioned above, decision-makers in professional societies, associations, and unions responsible for guidance on practical problems, too, have an increasingly important role in science advice to policy. Real-life problems they encounter need to be returned to the scientific research agenda and, ultimately, require policy decisions. For that reason, their interaction with science advisory agencies is central to pandemic response. Transdisciplinary research competences, data literacy, and funding instruments are essential for this interaction to occur.
- Fifth, the insatiable demand for science advice during the pandemic left little room for proactive international scientific cooperation and exchange. Swiss international cooperation on the SARS-CoV-2 virus was primarily oriented to the countries of the European Union, and this is problematic because the pandemic's dimension requires global North-South research partnerships. Such selective focus also threatens to compound further the patterns of inequity in the global economy of science and compromises global pandemic responsiveness.

The Swiss case suggests that during crises, science advisory arrangements depend on the constitution and quality of the science-advice ecosystem, and the channels, networks, and practices shaped by its science advisory instruments and mechanisms. The particular role assigned to science in the Swiss policy response to the COVID-19 pandemic indicates an urgent need to diversify, upgrade, and professionalise instruments and mechanisms to meet the increased demand for science advice to policy.

Supply of science advice

In Switzerland, private consulting companies dominate the supply side of science advice for policy, as most recently illustrated by the outsourcing to private companies of evaluations of federal crisis management during COVID-19. In other words, government does not tap the entire spectrum of available resources in science, that is, representatives from higher education institutions, research organisations, science and research associations, and their international network.

This arrangement impacts the nature and content of expertise provided to government as a basis for policy decisions. Furthermore, advisory tasks outsourced to private companies mainly concern evaluations which focus on a particular (late) stage in the policy cycle. Fewer consulting projects are commissioned for decision-making in agenda setting, policy formulation and strategy building. The scale of systemic bias toward advisory services by private consulting companies, especially toward a policy cycle's particular stage, raises questions about the independence, transparency, and legitimacy of the current national science advisory arrangement in the Swiss tradition of liberal democracy. During the COVID-19 pandemic, national science advisory activities for policy suffered the consequences of relative emphasis on private-sector services over higher education and research institutions. Fewer connections existed with the latter on which to build during the crisis.

To some degree, the science advice's supply side also depends on scientists' initiative and on their institutions' requirements and conditions. The cantons primarily finance Swiss universities and universities of applied sciences with additional funds from federal government, so their institutional strategies and performance agreements are negotiated with cantonal governments. Science advisory activities are not typically part of these agreements. Because the ETH-Domain is federally funded, advisory activities for federal government and public administration are more closely ingrained and accepted in these institutions. That the initiative to establish a national science task force originated at the ETH-Domain is no accident.

Overall, however, science advice to policy is not considered "value added" to the scientists' reputation or career advancement. Indeed, such activities, often informal, are not included in scientists' performance assessments. Consequently, scientists have few professional incentives to engage in scientific policy advice. Compared with other scientific activities, scientific advice requires additional knowledge and skills in communication, collaboration, and the policy process, the latter requiring training and experience. Systemic incentives are required to increase the higher education and research sector's advisory capacity.

At the FOPH's and the NCS-TF's expense, Switzerland's national science policy gap greatly affected supply-side performance. The two agencies were reasonably unable to meet the huge demand for science advice proactively but did not have authority to propose strategies to address the imbalance. Nevertheless, problems were automatically projected onto the FOPH or the NCS-TF, so explicitly defining this gap can help ensure its future closure. This report concludes that the FOPH or the NCS-TF could not reasonably address shortcomings in national science advice individually or jointly, because they arose from Switzerland's particular systemic configuration and conditions for science advice for policy.

In recent years, Switzerland's national system of science advice for policy has received little attention, and the COVID-19 pandemic has demonstrated the urgent need to increase independent research on the system. Evidence is sufficient, however, to conclude that Switzerland has not made efforts to adjust its science advisory system to best address expanding demand, nor is there any evidence for strategic pursuits to address the imbalance. Instead, new legislative conditions have favoured and intensified consultations with private companies for science advice for policy.

4.4. Future of science advice for policy

The COVID-19 pandemic has provided unique opportunities to gain insight into national science advisory systems and cultures in the 21st century and to consider possible revisions. Even in the years previous to the SARS-CoV-2 virus, the topic had attracted increased attention. Internationally, the decision-makers' demand for science advice has greatly increased, and some scholars have observed parallel expansion of science advisory agents and concomitant change in science advice's quality (Lentsch, 2016b). Some national science advisory systems, such as in New Zealand and Germany, have responded by diversifying their instruments and mechanisms of science advice and by professionalising their science advisory activities.

Over the past few years, spurred by experiences with other infectious diseases, several international and regional initiatives and networks on science advice were created to strengthen national science advisory systems and to address transnational issues (OECD, 2015). These include the International Network for Government Science Advice (INGSA), formed in 2016 under the aegis of International Council for Science (ICSU), after the 2014 first international conference "Science Advice to Government" in Auckland, New Zealand. Additionally, the United Nations' general secretariat created a Scientific Advisory Board in 2014[102] for advice at the interfaces of science, science policy, and society. Another prominent example is the European Union's new 'Science Advisory Mechanism', established to provide independent science advice to the European Commission, to inform policy-making, and to issue recommendations to improve interaction between policy-making and science advice.[103] The number of guidelines and

[101] https://en.unesco.org/themes/science-sustainable-future/scientific-advisory-board-united-nations-secretary-general

[102] https://ec.europa.eu/info/research-and-innovation/strategy/support-policy-making/scientific-support-eu-policies/group-chief-scientific-advisors_en

[103] Examples are EASAC's publication on 'Good practice in the dialogue between science academies and policy communities' (EASAC, 2011), the guidelines for science advice to policy of the Berlin Brandenburgische Akademie der Wissenschaften (Weingart et al., 2008) or the 'Code of Practice for Scientific Advisory Committees of the UK Government Office for Science' (2011).

principles of science advice at the national level has also increased during this time.[104] In 2015, the Organisation for Economic Co-Operation and Development (OECD) diagnosed 'a time of great change for the provision of science advice', and recommended nations 'should be attentive to the use of scientific knowledge in developing better policies that respond to changing social needs and expectations'. It advised governments and scientific bodies to 'strive to improve national and international mechanisms for the provision and communication of science advice' (OECD, 2015: 42).[105]

Switzerland, during the same period, followed a contrary trend. This country's science advisory activities are increasingly channelled through offices and agencies of public administration, and no new science advisory agents, instruments and competences with systemic importance have been developed. Some effects of these systemic conditions have surfaced during the COVID-19 pandemic.

[104] OECD. 2015. Scientific Advice for Policy Making: The Role and Responsibility of Expert Bodies and Individual Scientists.

5. Conclusions and next steps

Switzerland has an exceptionally well-resourced scientific system, an excellent record of international scientific competitiveness, and political traditions of extensive policy consultation procedures. These features indicate promising preconditions for the performance of this country's system of science advice for policy during the COVID-19 pandemic. Indeed, a Swiss National COVID-19 Science Task Force (NCS-TF) was established, composed of a large interdisciplinary network of reputable scientists. In its overall performance, this science advisory body displayed several innovative, unique characteristics of composition, management, operation, and products. However, the NCS-TF was only one of many components in the national science advisory arrangement during the crisis, and the systemic performance of science advice during the pandemic raises critical questions and reveals several shortcomings.

In Switzerland, science advice for policy has increasingly been rerouted via public administration, from where it is expected to disseminate vertically and horizontally across the policy system, and from there to other societal stakeholder groups. This model appears to have worked well for the policy process's evaluation phase and ensures consultation with science as one of many constituents in the legislative process. However, the COVID-19 pandemic has revealed some problematic consequences of this model.

Analysis of science in the Swiss policy response to COVID-19 indicates that the current system is not ideally positioned to achieve balance between demand and supply. Its set of instruments and measures do not result from strategic considerations to strike such balance, but rather are inclined to implement existing rules and legal provisions. The study concludes that conditions for science advice in Switzerland require careful revision to professionalise the national system's quality and performance.

In many ways, COVID-19 has conjured historical crossroads for science's role in society. The crisis has exposed the particular conditions of science advisory systems for policy, which in most countries are likely to reveal plenty of room for improvement. How Switzerland chooses to address these challenges will likely determine the quality, effectiveness, and resilience of the science advice ecosystem, and science's role in society, for the next generation.

At this crossroads, two possibilities lie ahead for Switzerland: a path of affirmative or of transformative change. The path of affirmative change will lead toward discussions on whether to transform the NCS-TF into a more permanent advisory body, either for health crises specifically or for national crises in general. This would include addressing questions on when such a body should be activated and what its tasks, legal basis, institutional affiliation, and communication strat-

egy should be. However, this study indicates that such agency alone is unlikely to improve substantially the quality and performance of national pandemic preparedness and response. No national or international evidence indicates that any single advisory body could meet the extensive vertical and horizontal demands for science advice during crisis situations. No matter how heated and difficult these debates might be, they would eventually have relatively minor impact on the national system of science advice for policy.

The second optional path is more protracted because it involves systemic change. Since there are no one-size-fits-all models for national science advisory systems, or even standard criteria by which to measure their success, systemic change requires tailored options and solutions across varied levels and components. Although probably the more strenuous choice, this option currently offers unique opportunities because a great many science advisors and decision-makers' experiences during COVID-19 present invaluable capital with which to address the challenge and improve the system's performance. Rather than focusing exclusively on devising a single new agency for crisis situations, these efforts would address the systemic shortcomings outlined here and develop a strategic framework and measures to address them. It would also emphasise capacity building and training to professionalise contributions of the many actor groups involved in science advice for policy.

COVID-19 has demonstrated that performance indicators for national science systems, for instance, publication count or innovation index, tell us little about how well a country is equipped to face a pandemic. The crisis has reminded us that science's role in society is not quantifiable by material, social well-being and economic competitiveness but that science advice for policy is essential for liberal democracies' decision-making procedures. Contrary to common perception, this role cannot be improved simply by instituting rules to separate the scientific from the political, or by improving communication channels.

Public debates on the role of science in Swiss policy response have on occasion reverted to simplistic accounts. The interface of science and politics, however, is essentially complex, dynamic, and challenging because it mediates the inherent tension between these two domains. In liberal democratic societies, this tension requires constant and independent attention to ensure that science advisory arrangements reflect current needs and circumstances.

Status quo bias is likely to favour the first path mentioned above because it involves few new agents and measures. The second path, however, requires strategic, pioneering actions and measures to revise the Swiss system of science advice for policy to be better prepared to address the many challenges that lie before us in the 21st century. The study claims that the results of the analysis favour the second path.

The following options for action are proposed to initiate this reform process.

1. Establish an independent, permanent national Science Policy Advisory Council (SPAC), responsible for advising on short-term science policy goals, strategies, and action plans on scientific matters of national importance;
2. Establish a post-COVID-19 Special Commission on Science Advice under the auspices of the SPAC, which is composed of decision-makers in politics, science, professional associations, and the media. To draw lessons from the pandemic for the future, the special commission will
   - Carry out a strategic appraisal of the national science advisory system to propose measures and instruments to strengthen its resilience, quality, and professionalism,
   - Assess the science advisory demands of decision-makers in Parliament, cantonal authorities, and professional associations, and propose science advisory instruments to meet their needs as best they can, and ensure their availability in times of crises,
   - Develop national rapid-response research promotion instruments and measures for times of crises (e.g. North-South research partnerships, transdisciplinary research involving stakeholders),
   - Develop national funding instruments and measures to promote independent research projects for science advice for policy, with particular emphasis on the "policy for science" side,
   - Formulate quality standards for science advisory activities in Switzerland by developing guidelines, principles and codes of practice;
3. Specify the science advisory roles for policy of the five main science institutions at the science-policy interface (Swiss National Science Foundation, ETH-Domain, swissuniversities, Swiss Academies of Arts and Sciences, Swiss Science Council) in the light of events;
4. Join and actively participate in international initiatives to improve science advice for policy on global problems, such as the International Network for Government Science Advice (INGSA);
5. Develop competences and structures for science advice for policy to support cooperation between key actors at the interface of science and politics (science journalism, universities, politics, professional associations), e.g. through new educational and training courses; research centres; exchange platforms; transdisciplinary pilot projects;
6. Recognise science advice for policy as an essential component of future scientific culture at Swiss universities and research institutions and consider adjusting standard criteria for academic performance appraisal.

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Appendices

Appendix I: Abbreviations

a+	Swiss Academies of Arts and Sciences
Aapot	Army Pharmacy
BAK	Federal Office of Culture
BFS	Swiss Federal Statistic Office
BLV	Federal Food Safety and Veterinary Office
BSTB	Federal Civil Protection Crisis Management Board
DEA	Mission of Switzerland to the European Union
EAER	Federal Department of Economic Affairs, Education and Research
ECDC	European Centre for Disease Prevention and Control
EFV	Federal Finance Administration
EPG	Swiss Epidemics Act
EU	European Union
EVZ	Federal Customs Administration
EWRS	Early Warning and Response System of the European Union
FC	Federal Chancellery
FCP	Federal Commission for Pandemic Preparedness and Response
FDFA	Federal Department of Foreign Affairs
FDHA	Federal Department of Home Affairs
FOCP	Federal Office for Civil Protection
FOJ	Federal Office of Justice
FOPH	Swiss Federal Office of Public Health
FVC	Federal Vaccination Commission (EKIP)
GAOA	Government Administration and Organisation Act
GDK	Conference of Cantonal Health Directors
GISAID	Global initiative on Sharing All Influenza Data
GS	General Secretariat
GSK	Conference of the Secretaries General
INGSA	International Network for Government Science Advice
KdK	Conference of Cantonal Governments
KSB	Coordinated Medical Service of the Swiss Army
KSBC	Crisis Unit of the Federal Council
Leopoldina	German National Academy of Sciences
NAZ	National Emergency Operations Centre
NCS-TF	Swiss National COVID-19 Science Task Force
NERVTAG	New and Emerging Respiratory Virus Threats Advisory Group (UK)
NRPs	National Research Programmes
OECD	Organisation for Economic Co-operation and Development

PPA	Federal Act on Public Procurement
DETEC	Federal Department of the Environment, Transport, Energy and Communications
RIPA	Research and Innovation Promotion Act
SAGE	Science Advisory Group for Emergencies (UK)
SAMS	Swiss Academy of Medical Sciences
SANKO	Health Coordination Body
SECO	State Secretariat for Economic Affairs
SEM	State Secretariat for Migration
SERI	State Secretariat for Education, Research and Innovation
SEVAL	Swiss Evaluation Society
SNSF	Swiss National Science Foundation
SSC	Swiss Science Council
SSPF+	Swiss School of Public Health
STS	Science & Technology Studies
swissuniversities	Umbrella organisation of the Swiss universities
TTIQ	Test-trace-isolate-quarantine strategies
UK	United Kingdom
VKS	Cantonal Officers of Health
WHO	World Health Organisation

Appendix II: COVID-19 science advisory arrangements in selected countries

This appendix presents information on the legal provisions, disciplinary compositions, mandate, and structures of science advisory arrangements in selected countries (Austria, France, Germany, Italy, the United Kingdom) during the COVID-19 pandemic in 2020. Comprehensive national case studies have not yet been published. The information presented here refers to publicly available information and lays no claim to completeness.

Legal provisions for science advice for policy in health emergencies

Switzerland's neighbouring countries France and Italy both established new science advisory agencies for policy at the beginning of the COVID-19 pandemic. These new science advisory agencies were not planned for by legal provisions on science advice in emergency situations, but rather, were specified in new COVID-19 legislation. In *France*, the *Conseil Scientifique* was set up by the French president, authorised by a new law adopted by the French government on March 23, 2020, and its continuation was later decided on by the French senate (Atlani-Duault et al, 2020). Shortly thereafter, in late March, the French president founded a second advisory body, the *COVID-19 Analysis, Research and Expertise Committee (CARE).* This committee is independent but attached to the ministers of Social Affairs and Health, and of Higher Education, Research and Innovation. The *Italian* advisory committee *Comitato Tecnico Scientifico Emergenza COVID-19* was established on February 5, 2020, by decree by the Head of the Department of Civil Protection. This decree was amended several times in the year 2020, to effect changes in the CTS's membership.

Austria's policy response to the pandemic was guided by regulations passed by the Federal Ministry of Social Affairs, Health, Care and Consumer Protection (BMSGPK) and the Ministry of the Interior, which were based on the new COVID-19 Measures Act and the Epidemics Act of 1950 (Felt et al., 2020). However, both these acts do not specify provisions for the role of science. Two crisis units were convened at the Austrian Ministry of the Interior and at the BMSGPK in early February and, on February 28, 2020, a new *Coronavirus-Taskforce* was established by the BMSGPK (BMSGPK, 2020b: 2), with an affiliated science advisory group. No public record is available on its legal foundations.

The *German* Federal Government's policy response is based on a national pandemic plan[106] which includes a crisis task force jointly led by the German Federal Ministry of the Interior (BMI) and the German Federal Ministry of Health (BMG). This crisis task force was activated on February 27, 2020 to convene all ministry-specific competences for combating the national threat posed by the SARS-CoV-2 virus. It also involves liaison officers or other advisers from the federal states, who have their own pandemic plans.[107] The national pandemic plan is issued under the banner of the Robert Koch Institute, 'the government's central scientific institution in the field of biomedicine'.[108] The plan describes the legal context, federal structures and measures, committees and institutions, and coordination between the federal and state levels and with international agents.[109] Science assumes roles in institutions and procedures at both federal and state level. Germany's national science advisory system is recognized for its diversity of institutions and agencies at federal and state levels.

The *UK's* emergency management framework includes explicit provisions for integrating science in policy and determines structures for coordinating scientific and technical advice during emergency response and recovery. The country's emergency management framework is set out in the 'concept of operations (CONOPS) and the Emergency Response and Recovery (ERR) guidance (UK Cabinet Office, 2012: 3). CONOPS 'sets out the UK arrangements for responding to and recovering from emergencies' which includes ensuring 'effective arrangements' to access scientific advice by activating a *Science Advisory Group for Emergencies (SAGE).* SAGE's operations are guided by a strategic framework which is issued by the UK Cabinet office. The ERR guidance provides for the Science and *Technical Advice Cell (STAC)* to be activated within the multi-agency Strategic Co-ordination Centre (SCC) as a special advisory council in emergency situations 'to provide timely and co-ordinated advice on scientific and technical issues'.[110] These mechanisms for science advice in emergency situations had already been activated in different types of emer-

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[106] Nationaler Pandemieplan. Strukturen und Massnahmen (Teil I) und Wissenschaftliche Grundlagen (Teil II). https://www.rki.de/DE/Content/InfAZ/I/Influenza/Pandemieplanung/Pandemieplanung_Node.html

[107] https://www.rki.de/DE/Content/InfAZ/I/Influenza/Pandemieplanung/Pandemieplaene_Bundeslaender.html;jsessionid=63367BA639071F64CFB0BE76B8445C35.internet121?nn=2370466

[108] https://www.rki.de/EN/Content/Institute/institute_node.html

[109] https://www.rki.de/EN/

[110] https://www.gov.uk/government/publications/provision-of-scientific-and-technical-advice-in-the-strategic-co-ordination-centre-guidance-to-local-responders

gencies, including infectious diseases, and were improved according to the lessons learned from evaluations of these past experiences with science advice in emergency situations. Another UK national science advisory body was formed in parallel by a group of scientists, the *Independent Scientific Advisory Group for Emergencies (indie_SAGE).* It is led by a former UK Government Chief Science Adviser (Ballo et al. 2021) and aims 'to provide independent scientific advice to the UK government and public on how to minimise deaths and support Britain's recovery from the COVID-19 crisis'.[111] Finally, the UK Government launched a new Joint Biosecurity Centre (JBC) on June 1, 2020 as a directorate within the Department of Health and Social Care (UK Science and Technology Committee, 2021: 12). The centre aims to '[bring] together data science, assessment and public health expertise to provide analysis and insight on the status of the COVID-19 epidemic in the UK'.[112]

Switzerland's legal provisions for national health crises and emergency situations assign no specific role to science.[113] Science advice is not mentioned in the Epidemics Act (and its ordinances), in the national Swiss Influenza Pandemic Plan or in the new Swiss COVID-19 Act of 2020. Therefore, no statutory plans were in place for science advice to policy during the COVID-19 pandemic. Expertise for policy was provided in-house by the Federal Office of Public Health (FOPH) and its external network of experts. An advisory body, the Swiss National COVID-19 Science Task Force (NCS-TF), was set up on April 1, initiated by representatives of the Swiss scientific community. The NCS-TF was given no statutory status and its mandates were issued by public administration at federal departmental level and at federal office level, respectively.

Disciplinary composition

The fourteen members of *France's Conseil Scientifique* represent a broad range of disciplines, including immunology, public health, virology, epidemiology, infectious diseases, modelling, intensive care, general and family practice, sociology, information technology, social anthropology (Atlani Duault et al., 2020: 220). Two other representations are noteworthy; a representative from civil society and the president of the international non-governmental organisation ATD Fourth World.[114] The *COVID-19 Analysis, Research and Expertise Committee*

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111 https://www.independentsage.org/.

112 https://www.gov.uk/government/groups/joint-biosecurity-centre

113 The closest mention of scientific advice may be found in provisions on crisis management which assigns responsibility for the 'coordination of expert knowledge at federal level' to the BSTB (Verordnung über den Bundesstab Bevölkerungsschutz, Art. 5, 1d)..

114 ATD Fourth World stands for 'All Together in Dignity to Overcome Poverty'. https://www.atd-fourthworld.org/.

(CARE) consists of twelve 'internationally recognised scientific experts' and 'researchers and doctors' (Atlani Duault et al., 2020: 220). Its members cover a range of scientific disciplines including virology, infectiology, anthropology, ontology, crisis management, many of which were appointed by research institutions.[115] It is chaired by the Nobel prize laureate Françoise Barré-Sinoussi, who is credited with having discovered the HIV-AIDS virus. Two members of the Conseil Scientifique COVID-19 also form part of CARE to ensure coordination between the two committees. CARE's twelve members have diverse backgrounds in epidemiology, immunology, virology, anthropology, public health, diagnostics, oncology, and social science. CARE is active in four focus areas: diagnostic tests, trials of new treatments, the leads to a future vaccine, the contribution of digital technology, and artificial intelligence.[116]

The composition and number of members of the *Italian CTS* was changed several times by decree of the Civil Protection Services during 2020. Members are listed on the website of the Department of Health in their institutional capacity as directors of institutions and not in their scientific capacity. The panel has been described as having 'world-class figures in pulmonology, infectious diseases, gerontology and epidemiology', but as '[lacking] critical areas of expertise in molecular diagnostics, molecular virology and high-throughput screening' (Pistoi, 2021. The CTS is chaired by the head of the National Civil Protection. Criticism has been raised on the CTS's composition, in particular with respect to the small number of infectious disease experts and advice given 'on topics where its members have little to no expertise' (Pistoi, 2021). Furthermore, the Italian government has been perceived by some as 'too reliant on technocratic and unaccountable expert committees, which were said to duplicate and bypass parliamentary prerogatives' (Allegra at al., 2021).

SAGE is headed by the UK Chief Science Advisor and has several sub-groups. SAGE members are not remunerated but the UK Government reimbursed universities with a flat rate for academic duties missed due to the services of their scientists during COVID-19. The advisory group is currently composed of some sixty members from diverse fields of knowledge.[117] The UK Government at first did not disclose the names of SAGE's members and only published a

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[115] These research institutions include Inserm, CNRS, CEA, Inrae, Inria, and the Institut Pasteur. https://recherchecovid.enseignementsup-recherche.gouv.fr/le-comite-analyse-recherche-et-expertise-care-covid-19-48157

[116] https://recherchecovid.enseignementsup-recherche.gouv.fr/le-comite-analyse-recherche-et-expertise-care-covid-19-48157

[117] https://www.gov.uk/government/publications/scientific-advisory-group-for-emergencies-sage-coronavirus-covid-19-response-membership/list-of-participants-of-sage-and-related-sub-groups

membership list on 4 May 2020, more than one month after lockdown had been imposed and over three months after its first meeting. The independent *Scientific Advisory Group for Emergencies (indie_SAGE)* was formed in response to this lack of transparency (Ballo et al., 2021). SAGE has come under scrutiny over the question of selection criteria for participants (Freedman, 2020: 515), the disciplines and fields of expertise represented, particularly on non-medical issues, such as the involvement of economics, the channels of communication to decision-makers and the media, and expert access to data (UK Science and Technology Committee, 2021: 29, 39, 41). The members of STAC include 'principal medical advisors' (Jersey's Medical Director, Medical Officer of Health, Consultant in Communicable Disease Control, Associate Medical Directors, Chief Nurse, Group Director of Health and Community Services), and data analysts, strategists and advisors in communicable diseases and epidemiology and public health.[118]

Scientific advice for policy during the pandemic in *Austria* is described as having taken place in background mode, provoking critique on the lack of transparency, which also concerned membership of advisory agencies (Traxler, et al., 2020). Information on the members of the *Advisory Group to the Coronavirus Task Force*, their appointment, tasks, and remuneration was unavailable to the public and had to be requested by way of Parliament. Its members are listed in their institutional capacity and not by area of expertise.[119] Information on the membership of the *Future Operations Platform* was only made public almost six months after its establishment and currently includes institutions from economics, data science, public health, psychology and logistics.[120] The office of the Federal Chancellery also solicits expert advice from various disciplines at short notice but does not issue information on experts involved (Traxler, et al., 2020).

The *Swiss National COVID-19 Science Task Force* is organised in ten expert groups of around sixty scientists. Its expert groups have remained the same since early April 2020 and include Clinical Care; Data and Modelling; Diagnostics and Testing; Digital Epidemiology; Economics; Ethics, Legal, Social; Exchange Platform; Immunology; and Infection Prevention and Control. Mem-

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[118] https://www.gov.je/Health/Coronavirus/ScientificAndTechnicalAdvisoryCell/Pages/AboutScientificAndTechnicalAdvisoryCell.aspx#anchor-1

[119] https://www.sozialministerium.at/Informationen-zum-Coronavirus/Neuartiges-Coronavirus-(2019-nCov)/Coronavirus---Taskforce.html

[120] https://futureoperations.at/organisation/

bers of the NCS-TF are appointed by the NCS-TF's president in consultation with the task force's commissioning agencies. They are selected by virtue of their areas of expertise and not based on their professional institutional affiliation.

Mandate and structures

Most of the new advisory bodies in the countries examined received statutory regulations in the early months of the pandemic. *Austria's Coronavirus Task-Force* received 'rules of cooperation' with the BMSGPK on April 25, 2020. The *French Conseil Scientifique* is guided by the Règlement interieur du Conseil Scientifique COVID-19 of April 15, 2020. *Italy's* Head of the Civil Protection Department issued a decree to mandate the *CTS* on February 5. 2020. On the other hand, the *UK's SAGE* and other science advisory agencies were given guidelines and regulations prior to the pandemic (except for the new Joint Biosecurity Centre (JBC)). Not much information is available publicly on the administration and operations of these advisory agencies. This has given rise to critique over their transparency in the media, politics, and the public.

For example, the *UK SAGE* is attached to the Cabinet Office Briefing Rooms (COBR) via the Government Chief Scientific Adviser and the Chief Medical Officer for England, and a secretariat at the Government Office for Science. However, overall government decision-making structures were changed over the course of the pandemic (UK Science and Technology Committee, 2021: 17) with implications on COBR, the 'high-level body responsible for coordinating central Government decision-making in response to emergencies', which had activated SAGE in January 2020 (UK Science and Technology Committee, 2021: 10). SAGE had already been activated nine times since it was installed in 2009, and it was the fourth time the emergency concerned an infectious disease-related health emergency (UK Science and Technology Committee, 2021: 10).

The UK's scientific advisory structures in the pandemic included the *Scientific Advisory Group for Emergencies (SAGE),* additional scientific advisory committees and the UK Government's network of departmental *Chief Scientific Advisers (CSAs)* and the *Joint Biosecurity Centre.* Additional complementary structures for scientific advice were established in the devolved nations, such as the *Scottish Government COVID-19 Advisory Croup* or 'a technical advisory cell' of the Welsh Government (UK Science and Technology Committee, 2021: 13). Its initial purpose was to 'provide real-time analysis of infection rates' and to advise 'the four UK Chief Medical Officers of a change in the COVID-19 alert level' (UK Science and Technology Committee, 2021: 13). There have been indications of discussions 'that the JBC could function as a replacement for

SAGE in the longer term' (UK Science and Technology Committee, 2021: 13). Several other departmental expert committees were consulted during the pandemic, such as the *New and Emerging Respiratory Virus Threats Advisory Group (NERVTAG).*[121]

France's two new advisory bodies, the *Conseil Scientifique* and the *COVID-19 Analysis, Research and Expertise Committee (CARE)* are designed as different but complementary bodies for pandemic response. The Conseil Scientifique advises on technical, specific or regulatory scientific issues ("science for policy"), and CARE advises on strategic and science policy issues ("policy for science") (Règlement, 2-9).[122] The new advisory bodies have caused 'coordination issues' because they 'set aside already existing scientific and policy institutions' (Lafon & Laurent, 2021), suggesting that there was no strategic plan on integrating national science advisory mechanisms.

The *Conseil Scientifique* was created to act 'as main source of scientific advice to the government' to support decision-making (Lafon & Laurent 2021). It is instructed to interact with various French health and academic institutions, (particularly the director general for health, the High Council for General Health, Santé Publique France, Inserm, REACTing, the French Academy of Science, and the National Academy of Medicine) and may also interact with international research and health agencies (Règlement, 2-8). The council's ethical framework is spelled out in protocols which profess that its activities be guided by the principles of integrity, confidentiality, independence and impartiality. Members are not remunerated for their services. The council's chairman and communications officer are responsible for media communication. Members of the Conseil are not authorised to communicate on opinions before they are officially published (Règlement 2-6). The Conseil Scientifique has issued over fifty documents, most of which are classified as 'avis' ('advisory') but also include several 'notes d'eclairages' ('enlightening notes'), 'notes d'alerte' ('alert notes'), and 'notes'.

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[121] NERVTAG is an expert committee of the Department of Health and Social Care (DHSC) which advises the Chief Medical Officer (CMO), and, through the CMO, ministers, DHSC and other government departments. It provides scientific risk assessment and mitigation advice on the threat posed by new and emerging respiratory viruses and on options for their management. https://www.gov.uk/government/groups/new-and-emerging-respiratory-virus-threats-advisory-group.

[122] REGLEMENT INTERIEUR DU CONSEIL SCIENTIFIQUE COVID-19. Règlement intérieur du 15 avril 2020: Version corrigée et définitive du 30 avril 2020. https://solidarites-sante.gouv.fr/actualites/presse/dossiers-de-presse/article/conseil-scientifique-covid-19.

CARE, in turn, supports the authorities' reflections on strategic issues related to the management of the epidemic (Bakhta et al., 2020: 1327). The committee is tasked to comment, organise and evaluate research on COVID-19, to advise the ministers responsible for health and research on short-term proposals; to conduct national and international surveys to alert ministers on any subject relevant to the fight against the epidemic; and to provide recommendations on to how to mobilize research and innovation capabilities to combat the epidemic[123]. For this purpose, it offers opinions on requests from the government, analyses proposals, and provides briefing notes for the French ministers responsible for health and research.

In *Austria,* several open questions remain over the mandates and operations of the *Coronavirus-Taskforce* and the *Future Operations Platform (FOP).* The Coronavirus-Taskforce was established to complement in-house expertise at the BMSGPK (BMSGPK, 2020b:2). Its objectives are to 'advise the BMSGPK on technical issues', to serve as a "sounding board" 'for critical reflection and additional source of information for a selection of upcoming decisions, questions or documents to be published' (BMSGPK, 2020b:2). The task force addresses scientific and medical-strategic issues in connection with the current COVID19 pandemic (BMSGPK, 2020b:3).[124]

The objectives of the *Future Operations Plattform (FOP)* are to provide a platform for informal exchange among scientific experts and public authorities, to address challenges of the COVID-19 pandemic and to share research results and information to assist decision-making. In addition, individual experts are consulted by the BMSGPK to prepare legislation, ordinances and decrees (BMSGPK, 2020c:8). The platform consists of a 'Clearing Board' and a project office, and runs several working groups in the field of health, primary care and logistics, economics and labour market and society and psychology.

This second advisory body is not tasked with science advice for policy only, but also with advising in strategic matters of science policy, including 'finding new paths for Austrian science to contribute to new products or services in relation to COVID-19; contributing to the development of strategic concepts to

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[123] https://recherchecovid.enseignementsup-recherche.gouv.fr/le-comite-analyse-recherche-et-expertise-care-covid-19-48157.

[124] The Task Force provides information to assess the current situation and developments, reviews new scientific knowledge, and provides feedback on proposed measures, questions or documents (BMSGPK, 2020b: 3). Its advice is not binding on the Federal Minister and members assume no individual liability (BMSGPK, 2020b: 4).

secure Austria's resilience and competitiveness after the crisis; and to identify research areas and possibilities for Austria to contribute to the prevention and combat of crises.

While Austria has established a pool of various agents and bodies to provide scientific advice to government, it has been described as 'taking place in background mode' and it has been 'difficult to gain an overview' (Traxler, et al., 2020). There are no references to an official national strategy and the lack of transparency of these advisory arrangements strongly suggests that there may not be a comprehensive national strategy on how to solicit scientific advice that informs this arrangement.

Not much is known about the mandate, activities and structure of *Italy's CTS*. Weekly monitoring briefs by the CTS are published regularly on the website of the Department of Health. Its general policy response has been described as chaotic (Jasanoff et al. 2021a) and there are no references to strategies on how to integrate science advice in decision-making.

The Swiss *NCS-TF* was established by mandate signed by seven parties on April 1, 2020. After two and a half months, the task force's mandate was revised in July 2020. Its advisory role was not certified by law when the Swiss Parliament passed the COVID-19 Act in September 2020. The three contracting authorities of its first mandate were the State Secretariat for Education, Research and Innovation (SERI), the Federal Office of Public Health (FOPH) (on behalf of the Federal Department of Home Affairs (FDHA)), and the newly established Crisis Unit of the Federal Council (KSBC). Its recipients were the four main science organisations that represent different aspects of the scientific community: ETH-Domain, swissuniversities, the Swiss Academies of Arts and Sciences (a+) and the Swiss National Science Foundation (SNSF). The NCS-TF's second mandate was signed by new contracting authorities (the FOPH, on behalf of the FDFA) and new recipients (the president of the NCS-TF and the president of the ETH-Domain).

Appendix III: List of interviewees

Martin Ackermann
Manuel Battegay
Chérine Baumgartner
Crispino Bergamaschi
Laura Bernardi
Lukas Bruhin
Monika Bütler
Myriam Cevallos
Lukas Engelberger
Astrid Epiney
Yves Flückiger
Yvonne Gilli
Balthasar Glättli
Andrea Gmür
Maya Graf
Lukas Gresch-Brunner
Jürg Grossen
Rita Grünenfelder
Gregor Haefliger
Rudolf Hauri
Thomas Häusler
Michael Hengartner
Eva Herzog
Martina Hirayama
Samia Hurst
Stefan Kuster
Monique Lehky Hagen
Anne Lévy
Brigitte Meier
Mattea Meyer
Heinz Rhyn
Vincenzo Ribi
Andrea Schenker-Wicki
André Simonazzi
Thomas Steffen
Roman Stocker
Pascal Strupler
Sabine Süsstrunk
Marcel Tanner
Thomas Weber