S4D4C

USING SCIENCE FOR/IN DIPLOMACY
FOR ADDRESSING GLOBAL CHALLENGES

Science Diplomacy in the Making: Case-based insights from the S4D4C project

Edited by Mitchell Young, Tim Flink and Elke Dall

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Preface

The volume of case studies you now hold in your hands was developed as part of the Horizon 2020 project 'Using science for/in diplomacy for global for addressing global challenges' (S4D4C). The case studies were researched and developed in the period between June 2018 and December 2019 by mixed teams of researchers from the project partners. Within the project, the case studies sat at the empirical heart and had multiple roles: supporting the work on a governance framework and training materials for science diplomats, while in themselves serving to advance the understanding of how science diplomacy is being developed, enacted, and understood. The cases, as they are presented in this volume, should be taken as empirically rich, descriptive incursions into various aspects of science diplomacy. They are not meant to tell a single story or address a particular theoretical approach; rather, they bring together a range of authors working in a range of related disciplinary traditions: political science, diplomacy, law, sociology, and science and technology studies, to expose the workings of science diplomacy governance, knowledge dynamics, and policy-making.

The S4D4C project looks at science diplomacy from a European perspective in the context of global challenges. We took inspiration in selecting cases from the now-classic Royal Society/AAAS categories of science diplomacy practice, choosing ones that would likely bring to light the interrelations between science and diplomacy in foreign policy areas that sometimes included but also reached beyond science policy and the role of diplomats in supporting interactions between scientists of different countries. We wanted to be sure that we provided an opportunity for the less well-established categories, science for diplomacy and science in diplomacy, to reveal themselves. In the end, all three categories enter the picture in various ways. The cases take a multi-actor approach; each includes the European Union as an actor within their specific topic of science diplomacy, but the other key actors they bring in vary: some cases use a subset of Member States while others introduce international organizations and specific third countries.

Science diplomacy is very much in the making, and our cases attempting to broadly capture the breadth of what is coming to be subsumed under the concept. We selected cases by looking at the intersection of science and policy from three distinct angles, defined by the primary drivers and areas of uncertainty within the scientific and political systems. Within each of the perspectives, we selected three case topics. First, foreign policy driven cases are ones in which the foreign policy relevance is well established, and science plays a supporting role. These we framed as 'diplomacy challenges' as we believed that the greatest obstacles would be in the diplomatic rather than the scientific sphere. Here we have cases on infectious diseases, water management, and cybersecurity. Second, cases that are science-led, address the ways that the advance of science presents new opportunities and challenges, and thus potentially can play an active role in shaping foreign policy approaches. These we framed as 'science opportunities' to reflect the hypothesis that new developments in science would open up opportunities for diplomacy. Here we have cases on science funding for food security, large scale thematic research investments, and open science. Finally, we have a set of cases that focus on the role of coordination that emerges from policy instruments. Here we examined different types of policy initiatives that inherently appeared to constitute a diplomatic drive. We called these 'coordination options' as they potentially presented rich opportunities for diplomatic coordination to occur. Here we have cases on the SESAME infrastructure, joint research programming, and science advice mechanisms.

This volume presents all nine cases from the project. The cases were researched independently and not standardized, but they share common interests and themes of analysis which are brought out in the structure of the volume. Each case study has two main parts: the first addresses the governance arrangements within the case's particular area of science diplomacy, and the second part deals with more analytic questions of knowledge dynamics, multi-level governance, and science diplomacy as a specific concept. In the first part on governance arrangements, the authors focus on three topics: the governance arrangement, the stakeholder landscape, and the de-facto governance practices. The governance arrangement refers to the formal organization of the case topic. This includes legal frameworks, rules, policy instruments, governmental strategies, official guidelines, and prescribed actors. The section on the stakeholder landscape identifies the key actors involved in the case topic and their attributes (interests, roles, power, influence, etc.), tasks, skills, and strategies. This section also delves into the procedures, channels, and interfaces through which actors relate to each other, or fail to do so. Finally, the de facto governance practices section exposes the actual workings of the case topic. These include the mix of formal processes and procedures as well as informal activities in which actors both comply with and deviate from the formal governance arrangements. This section also summarizes the issues, discussions, and disagreements in the case area, with particular attention paid to the interfaces which have developed between science and foreign policy.

Following the more empirical and descriptive first part of the case studies, the second part analyzes three central issues for science diplomacy. First, the knowledge dynamics of the case, which relate primarily to the relationship between knowledge and policy-making. It delves into the questions of what is recognized as valuable knowledge, its role in the policy process, and the channels by which it gets into foreign policy. Second, the cases examine multi-level policy-making issues. Each of the cases has some degree of multi-levelness. While all of the cases address the EU, beyond that, each case includes a unique set of policy actors that function on different levels. Some cases also embed a comparative approach by analyzing the national level through a set of key Member States. This second section addresses how the multi-level actor constellation has developed and changed, under what conditions cooperation across levels functions effectively, and where there are frictions. It also considers what is different about doing science diplomacy at a supranational (i.e. EU) level. Finally, the last section of part two addresses how the case is (or is not) changing our understanding of science diplomacy.

The case research in this book is the result of wide-ranging documentary research as well as a large set of interviews with actors from the EU, Member States, and non-governmental organizations. While the interviews were all conducted under anonymity, we would like to take this opportunity to thank all of those who participated, as we could not have done this without your candor and cooperation. For those readers who are still looking for more after having read this volume, we have put aggregated data from the interviews online and also have created a Zotero group with a larger set of references to the issues covered in the case studies, than what you will find in the bibliography. These can be found on the project website: www.S4D4C.eu. The next step in our project is a transversal analysis of the case data, for which we will identify and explicate a range of issues that matter for science diplomacy based on the work in this volume. We believe that the research on and practice of science diplomacy are on the cusp of broadened interest and acceptance, and we hope that in reading these cases, you will be inspired to join us in pursuing it further. We invite you to visit our project website and also to get in touch directly with remarks, comments, questions, or suggestions via contact@s4d4c.eu.

The editors

Mitchell Young, Tim Flink, and Elke Dall

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1. Science diplomacy as a means to tackle infectious diseases: The case of Zika

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List of Acronyms

AV	Czech Academy of Sciences
BMBF	Ministry of Education and Research
CEPI	Coalition for Epidemic Preparedness Innovations
Coll.	Official Journal of Laws and Regulations of the Czech Republic
CR	Czech Republic
DG SANCO	Directorate General for Health and Food Safety
DZIF	German Center for Infection Research
ECDC	European Centre for Disease Prevention and Control
EDCTP	European and Developing Countries Clinical Trials Partnership
ESPHC Council	Employment, Social Policy, Health and Consumer Affairs Council
EU/EEA	European Union / European Economic Area
FAPESP	Sao Paulo Research Foundation
G7/G20	Group of Seven (Canada, France, Germany, Italy, Japan, the United Kingdom and the United States), Group of Twenty (Argentina, Australia, Brazil, Canada, China, Germany, France, India, Indonesia, Italy, Japan, Mexico, Russia, Saudi Arabia, South Africa, South Korea, Turkey, the United Kingdom, the United States and the European Union)
GAČR	Grant Agency of the Czech Republic
GCRF	Global Challenges Research Fund
GCSA	Government Chief Scientific Advisor (in the UK)
GHPP	Global Health Protection Programme
GHSI	Global Health Security Initiative
GloPID-R	Global Research Collaboration for Infectious Disease Preparedness
HIV/AIDS	Human immunodeficiency virus infection and acquired immune deficiency syndrome
MERS	Middle East Respiratory Syndrome
MRC	Medical Research Council
ODA	Official Development Assistance
PDP	Product development partnership
PHE	Public health emergencies
PT-DLR	Project Management Agency of the German Aerospace Center
RKI	Robert-Koch-Institute
SAGE	Scientific Advisory Group for Emergencies (in the UK); Pre-SAGE = precautionary SAGE
SARS	Severe acute respiratory syndrome
TAČR	Technology Grant Agency of the Czech Republic

TFEU	Treaty on Functioning of the European Union
UK	United Kingdom
UKRI	UK Research and Innovation
UNICEF	United Nations Children's Fund
WHO	World Health Organisation
ZIG	Centre for International Health Protection

1. Infectious diseases are back on the global stage?

Regardless of scientific advancements, infectious diseases are still listed among the top causes of death compiled by the World Health Organisation (WHO), and an even more prominent position is occupied by infectious diseases in statistics applicable to low-income countries.[1]

The fight against infectious diseases has frequently outreached national borders and provided a platform for deepening of international cooperation as well as for the formation of global governance in the field of medicine. In particular, the successful campaign for eradication of small-pox (variola) in the years 1959-1977, coordinated by the WHO, has been considered as a clear demonstration of technocratic optimism regarding the ability of the international community to cope (despite the Cold War political environment) with global challenges. [2]

The inherent evolutionary character of infectious diseases and changing political and societal environment have created new challenges in the fight against epidemic diseases. The most prominent examples include: outbreaks of new epidemics (SARS, Ebola, avian flu, swine flu, Zika), the continuation of older "low-level" epidemic diseases (malaria, AIDS), the return of almost eradicated infectious diseases to developed states (measles, tuberculosis) as well as the public health consequences of new migration patterns, erosion of governance structures in many low income countries, increase in antibiotic resistance and last but not least shift in the vaccination paradigm in developed countries.

The reaction of the EU and its Member States to the afore-mentioned challenges provides for a significant space for an interplay between diplomacy, research coordination and management of public health affairs, both in the forms of science in diplomacy and diplomacy in science, as framed in the S4D4C project. The focus of this case study is the 2015-2016 Zika epidemic due to its timing (Zika is the most recent outbreak of a global epidemic), location (Brazil as a relatively developed state) and the attention it attracted due to its proximity to the 2016 Olympic Games. However, any analysis of the Zika epidemic cannot be isolated from other recent outbreaks of epidemics since, as another Zika-focused article stated:

> *"According to Tolstoy, happy families were all alike, whereas unhappy families were each unhappy in their individual ways. So it is with the emergence of new virus infections. Each new virus epidemic brings misery to affected human populations in unique ways."* [3]

Therefore, this study will also tackle transfer of knowledge and best (or worst) practices among individual outbreaks of epidemics in the last decades, continuity and discontinuity of the institutional patterns of the EU and national responses to epidemic crises and even the emergence of a competition between the political and scientific attention attracted by different infectious diseases. Regarding actorness, the study focuses primarily on the EU, the United Kingdom, Germany and the Czech Republic, with necessary inclusion of other actors.

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[1] Three infectious diseases (lower respiratory diseases, infectious diarrheal diseases and tuberculosis) were ranked in the top ten causes of death worldwide in 2016 by the World Health Organization. In the low-income countries, infectious diseases (lower respiratory diseases, infectious diarrheal diseases, tuberculosis, HIV/AIDS and malaria) occupied half of the top ten list.

[2] Less known is the successful eradication of rinderpest (cattle plague) by a campaign coordinated by FAO and the World Organisation for Animal Health within the Global Rinderpest Eradication Programme in the years 1994-2010.

[3] Zambon, M. (2016): Zika virus, the new kid on the block. Euro Surveill. 2016;21(23):pii=30255. https://doi.org/10.2807/1560-7917.ES.2016.21.23.30255

Disease	Year	Location	Distribution channels
SARS (Severe acute respiratory syndrome)	2003	China, Canada (then spread to over 30 countries)	Aerial
Swine flu (H1N1 influenza virus)	2009	(Mexico, USA)	Aerial
Ebola	2013-2016 (but a total of 24 outbreaks during 1976-2013)	Western Africa (primarily Liberia, Sierra Leone, Guinea)	Direct contact (with body fluids)
MERS (Middle East Respiratory Syndrome)	2014	Arabic peninsula	Aerial/direct contact
Zika	2015-2016	Brazil	Mosquito bite

Table 1: Most recent epidemics

2. Institutional and legal patterns

A relatively robust institutional framework for global governance of public health issues has already been established through the World Health Organisation and Global Health Security Initiative. The WHO membership more or less corresponds to the membership of the United Nations and the organisations' areas of interest, and its agenda covers a variety of health issues, albeit infectious diseases occupy a prominent role there. In contrast, the Global Health Security Initiative (GHSI) is a much less formalised joint project of G7 states, Mexico and the EU, with the WHO acting as a scientific and technical advisor. The global struggle with pandemic influenza (together with the fights against biological, chemical, and radio-nuclear terrorism) are major priorities of the GHSI.

Even a brief overview of global institutional design for infectious diseases would not be complete without mentioning the Global Research Collaboration for Infectious Disease Preparedness (GloPID-R) which coordinates the activities of key funding and research-performing bodies from all continents, including the European Commission's DG for Research and Innovation and research institutes from the UK, France, Germany, Italy, Spain, the Netherlands (WHO and the Coalition for Epidemic Preparedness Innovations/CEPI have observer status). Concerning the Zika epidemic, it is also important that three research institutes based in Brazil (Instituto Fiocruz, Sao Paulo Research Foundation/FAPESP and Instituto Butantan) are members of the GloPID-R network.

The actorness of the EU in global governance in the public health sphere corresponds to the general institutional and legal features of European integration. A reaction to a significant epidemic threat can be discussed within the European Council (details below), while the Council of the EU (sometimes in cooperation with the European Parliament) is entitled to adopt respective legislative acts or individualised decisions. The European Commission acts with its formal monopoly for drafting legally binding EU legal acts and has the largest administrative apparatus among all EU institutions. Central responsibility for public health issues is vested in the Directorate General for Health and Food Safety (DG

SANCO) within the European Commission (in particular its directorates B and C responsible for the agendas of "health systems, medical products and innovation" and of "public health, country knowledge, crisis management" respectively), but there are significant policy overlaps with other departments within the Commission.

The health policy of the EU also follows two other broader trends of European policy-making delegation of activity to specialised EU agencies and creation of flexible advisory platforms. After the outbreak of SARS in 2003, the Council established the European Centre for Disease Prevention and Control (ECDC)[4] charged with the task of collecting, analysing and monitoring data concerning over 50 infectious/communicable diseases. Further, the Council of ministers of health is advised by the European Union Health Security Committee which is a relatively informal body composed of representatives of national executives, usually nominated by national health ministries or other key national public health authorities.

Analogously to other policy areas, the EU's activity in health policy, including the European Union's science diplomacy in this field, is bound by the principle of conferred powers. The Treaty on Functioning of the European Union (TFEU) enumerates *"common safety concerns in public health matters, for the aspects defined in this Treaty"* among the shared competencies of the EU where the Member States have transferred some of their competencies to the EU level. Harmonisation of national legislation by the EU law is, in principle, possible but Member States are still permitted to *"exercise their competence to the extent that the Union has not exercised its competence"* (Article 2 TFEU). The other aspects of EU health policy (i.e. those outside common safety concerns) are enumerated in the Lisbon Treaty within the residual category of the EU's competencies where the EU is authorised to *"carry out actions to support, coordinate or supplement the actions of the Member States"* but without "hard" harmonisation of national legislation. Details of EU public health policy are specified by Article 168 TFEU whose section three provides a basis for the global reach of EU policies, declaring that *"the Union and the Member States shall foster cooperation with third countries and the competent international organisations in the sphere of public health."*

However, the competence question of the EU is complicated by two additional factors. Firstly, the science diplomacy element can be formally performed under the umbrella of other EU policies, such as European policy for research, development policy or even the European Common Foreign and Security Policy. The respective policy framework modifies not only the material core of the science diplomatic activity but also the applicable procedural and institutional rules, including the rules determining the external dimension of the activity. Secondly, even a scenario can emerge when the EU and its institutions provide only a negotiation and socialisation platform for Member States which ultimately act formally outside the EU framework, thus avoiding the constraints of the EU institutional and legal design.

In Germany, the institutional responsibility for global health policy lies with the Ministry of Health, which also represents Germany at the WHO. However, the research and development activities on neglected tropical diseases and poverty-related diseases are quite fragmented. They are distributed across the Ministry of Education and Research (BMBF), the Ministry for Economic Cooperation and Development, and the Ministry of Health (and its specialised institutes such as the Robert Koch Institute). In 2015, global health-related research activities were still managed in the Federal Ministry of Education and Research´s "Health Research" division. With more and more globally relevant infectious diseases and related international coordination and/or negotiations happening, a new division within the ministry named "Global Health" was established after the last

[4] European Parliament and the Council of the European Union (2004): Regulation (EC) No 851/2004 of the European Parliament and of the Council of 21 April 2004 establishing a European Centre for Disease Prevention and Control.

federal election (2018). BMBF is also responsible for German representation in GLOPID-R (Global Research Collaboration for Infectious Disease Preparedness).[5] Traditionally, the general coordination of German foreign policy, including the network of German embassies around the world, is vested in the Federal Ministry of Foreign Affairs.

The key legislative framework in Germany is provided by the Infection Protection Act adopted in 2000 and most recently amended in 2017.[6] In July 2013, the German government issued a national strategy paper for global health policy[7] after a 2-year consultation process. The Strategy was formally adopted under the auspices of the whole German government but was mainly written and coordinated by the Federal Ministry of Health. Chapter 4 of the Strategy focuses on health research and particularly highlights a few European and German initiatives related to infectious diseases, like the European and Developing Countries Clinical Trials Partnership (EDCTP), product development partnerships (PDPs) and research networks for health innovation in sub-Saharan Africa. It also states that it promotes research on poverty-related and neglected diseases to a substantial extent through institutionally supported German research facilities.[8]

To address coordination and policy coherence, in 2014, the Ministry of Education and Research presented a list of measures for how to improve cooperation with African countries in health research and education (the Africa-Strategy), in particular with universities, universities of applied sciences and non-university research institutes as well as in the field of professional and advanced vocational training.[9] Germany´s "Strategy for the Internationalization of Education, Science and Research"[10], which was published by the Federal Ministry of Education and Research in 2016[11], does not put global health as such into focus, but subsumes it under the concept of tackling global challenges through the internationalization of education, research and innovation. In this respect, it contains three traits of cooperation in this context: bilateral cooperation, EU-driven cooperation and multilateral (mostly G7/G20) oriented support and cooperation.

[5] Representation by a ministry in the GLOPID-R is a relative exception to more frequent representation by key national institutions performing research. However, originally the GLOPID-R was designed as a consortium where research funding organisations were supposed to be represented (as it still is in the case of Germany) but most countries opted for sending organisations performing research.

[6] Bundesgesetzblatt (2017): Gesetz zur Modernisierung der epidemologischen Überwachung übertragbarer Krankheiten. Retrieved from: https://www.bgbl.de/xaver/bgbl/start.xav?startbk=Bundesanzeiger_BGBl#__bgbl__%2F%2F*%5B%40attr_id%3D%27bgbl117s2615.pdf%27%5D__1555578170900

[7] Federal Ministry of Health (2013): Shaping Global Health Taking Joint Action Embracing Responsibility.

[8] Federal Ministry of Health (2013): Shaping Global Health Taking Joint Action Embracing Responsibility. pp. 33-34.

[9] Federal Ministry of Education and Research (2014): The Africa Strategy 2014–2018: Africa as a partner in education and research. Retrieved from: https://www.bmbf.de/pub/Afrika_Strategie_eng.pdf

[10] Federal Ministry of Education and Research (2016): Strategy for the Internationalization of Education, Science and Research.

[11] Germany approved its first internationalization strategy in 2008. With the emergence of new global trends and challenges it was updated in 2016.

Actor	Type	Relation to diplomacy	Responsibilities
Federal Ministry of Health	Ministry	Actor (health diplomacy)	National health system; global health policy; represents Germany at WHO; research and development activities on neglected tropical diseases and poverty-related diseases
Federal Ministry of Education and Research	Ministry	Actor (science diplomacy)	Research and development activities on neglected tropical diseases and poverty-related diseases
Federal Ministry of Foreign Affairs	Ministry	Actor (all aspects of diplomacy)	Humanitarian assistance; was the coordinating body for all the activities of the German government in its response to the Ebola crisis
Federal Ministry for Economic Cooperation and Development	Ministry	Actor (health diplomacy)	Cooperation with the World Bank, the Global Fund to Fight AIDS, Tuberculosis and Malaria, UNICEF, and the United Nations Population Fund; research and development activities on neglected tropical diseases and poverty-related diseases
PT-DLR	Research funding organization and consulting body to the Federal Ministry of Education and Research	Supporting and advising actor	Research funding (programmes of the Federal Ministry of Education and Research, e.g. neglected tropical diseases and poverty-related diseases)
Robert-Koch-Institute (RKI) // Centre for International Health Protection (ZIG)	National research organisation	Supporting and advising actor	Government's central scientific institution in biomedicine research and one of the most important bodies for the safeguarding of public health in Germany
Paul Ehrlich Institute	National research organisation	Supporting and advising actor	Federal Institute for Vaccines and Biomedicines. It is the senior federal authority for medicinal products, providing services in public health
German Center for Infection Research (DZIF)	Public research organisation	Supporting and advising actor	Research on malaria, tuberculosis, AIDS, and emerging infections. It was

			established in 2012 to align translational infection research with the development of new diagnostic, preventive, and therapeutic methods
Deutsche Akademie der Naturforscher Leopoldina	German National Academy of Sciences	Advising body to German Government and G7/G20	Represents the German scientific community in international committees and assumes a nonpartisan scientific position on social and political issues. Interdisciplinary groups of experts are formed by the Leopoldina and other German, European and international academies to develop and publish official statements on issues of current interest.

Table 2: List of selected German government (and government-related) actors for global health[12]

In the Czech Republic, the institutional framework for science diplomacy and public health is formed primarily by the Ministry of Health (Ministerstvo zdravotnictví) and the Ministry of Foreign Affairs (Ministerstvo zahraničních věcí). The Ministry of Health is the key coordinating body for, among others, protection of public health, scientific research in the medical field and the medical information system.[13] The Ministry of Health is also the institution with responsibility for international cooperation in the field of public health, including the WHO.[14] Further, the Ministry of Health directly supervises a network of regional public health stations (krajské hygienické stanice) and the National Institute of Public Health (Státní zdravotnický ústav) whose objective is *"creation of the basis for national public health policy, health promotion and protection, providing methodical reference activities and monitoring related to public health, researching the environmental impact on human health, international collaboration, post-graduate education in the medical field and health-related education of the general public."*[15] The chief public health officer of the Czech Republic (hlavní hygienik České republiky) also holds the rank of deputy minister of health. Within the Ministry of Health, the administrative responsibility for global public health issues is divided primarily between the unit for international affairs and the EU (with sub-units for bilateral cooperation and international organisations and for the EU) with responsibility for procedural aspects of European and international cooperation, and the unit for epidemiology (institutionally located within the section for public health protection), with responsibility for a substantial epidemiology agenda. Regarding the ECDC, the Ministry of Health is represented in the ECDC Management Board by the deputy minister of health (with alternate membership by the head of the epidemiology unit) and by experts from the National Institute of Public Health. The interconnection with the European dimension of public health policy is further strengthened by the fact that the incumbent (2019) deputy minister responsible for public health (and Czech representative in the ECDC), Eva Gottwaldová, previously acted as the attaché/counsellor for health issues

[12] Source: DLR Project Management Agency

[13] Act. No. 2/1969 Coll. on establishment of ministries and other central institutions of the civil service (as amended), section 10 par. 1.

[14] Act. No. 258/2000 Coll. on protection of public health, sec. 80.1.d.

[15] Act. No. 258/2000 Coll., sec. 86.

at the Delegation of the Czech Republic to the EU (however, this is more a coincidence, not a usual career path).

The Ministry of Foreign Affairs is responsible for general coordination of Czech foreign policy, including direct management of the network of Czech embassies. The Ministry is also responsible for promotion of Czech personnel in international organisations, for general coordination of science diplomacy of the Czech Republic and for the respective science attachés allocated at the embassies in Washington and Tel Aviv. Global health policy, however, is not included within the key priorities of Czech science diplomacy. Neither are the two incumbent science attachés located in states with recent outbreaks of significant epidemics.[16] Within the Ministry of Foreign Affairs, the responsibility for health aspects of science diplomacy are distributed among the policy analysis unit (with the formal task of elaborating science policy in general), regional units (such as the unit for sub-Saharan Africa concerning Ebola and the unit for Latin America concerning Zika or swine flu) and the unit for multilateral cooperation.

No Czech ministry is vested with general coordination of research. Instead, the Council for Research, Development and Innovations (Rada pro výzkum, vývoj a inovace) has been established as strategic advisor for the government. The Council operates under the auspices of the Office of the Government but without a particularly robust administrative apparatus. The Council is composed primarily of independent experts but chaired by a member of the cabinet (by the prime minister in 2019). The Council`s recommendations concern the distribution of public finances to research in general policy areas and establishment of governmental research priorities, while allocation of grants to individual projects is relatively decentralised, with the dominant position of the Grant Agency of the Czech Republic and the Technology Grant Agency of the Czech Republic.

Regarding the legislative framework, the most important Czech legislation regulating science diplomacy linked with infectious diseases is act No. 258/2000 Coll. on protection of public health (regulates measures in case of an epidemic outbreak) and act no. 130/2002 Coll. on support of research, experimental development and innovations (the key document for the advanced research framework). Concerning epidemic outbreaks, the key operational framework is contained in the National Action Plan of the Czech Republic (2011), the Pandemic Plan of the Czech Republic (2011), and their elaboration in specific instructions (směrnice) for treatment of highly infectious diseases adopted by the Ministry of Health. The Pandemic Plan and instructions regulate both the distribution of competencies between Czech institutions and inter-institutional coordination as well as the outline of major operational measures, such as entrance control, vaccination plans, modernisation of laboratories and the communication strategy.

[16] At present, Czech science attachés operate only in Washington and Tel Aviv.

Actor	Type	Relation to diplomacy	Responsibilities
Ministry of Health	Ministry	Actor (health diplomacy)	National health system; global health policy; research; communication with the WHO.
Ministry of Foreign Affairs	Ministry	Actor (all aspects of diplomacy)	Coordination of bilateral and diplomatic relations. Representation to the Foreign Affairs Council. Direct management of embassies, including science attachés.
Office of the Government (Úřad vlády)	De facto ministry	Actor (European diplomacy, science diplomacy)	General coordination of Czech-EU relations. Representation to the European Council and General Affairs Council. Key platform for debate of security issues (Bezpecnostni rada statu). The Office of the Government also hosts the Council for Research, Development and Innovation.
Council for Research, Development and Innovation (Rada pro výzkum, vývoj a inovace)	Expert platform presided over by a minister	Supporting and advisory body	Recommendation on general research priorities and general principles. Distribution of public funds to research. Platform for general debate on science diplomacy.
National Institute of Public Health (Státní zdravotnický ústav)	Regulatory agency under the auspices of the Ministry of Health	Supporting and advisory actor	Methodical reference activities and monitoring related to public health; researching the environmental impact on human health; post-graduate education in the medical field and health-related education of the general public. Operational cooperation with the WHO, including data collection concerning Zika.
Czech Health Research Council (Agentura pro zdravotnický výzkum)	Research funding organization under the auspices of the Ministry of Health	Supporting and advisory actor	Support for applied research in the medical field.
Czech Academy of Sciences (Akademie věd CR)	Research platform	Supporting and advising actor	Umbrella (but not exclusive) organisation for research, including research institutes focused on public health, such as the Centre for Biology (Biologické centrum AV) and

			the Institute of Parasitology (Ústav parazitologie AV). Provides a platform for a nonpartisan scientific position on social and political issues.
Grant Agency of the Czech Republic (GAČR), Technology Grant Agency of the Czech Republic (TAČR)	Grant agencies	Funding	Allocation of grants to individual research projects. In particular, the TAČR funding is closely linked with the policy priorities of individual ministries

Table 3: List of selected Czech government (and government-related) actors for global health[17]

Regarding the United Kingdom, in addition to the UK governmental institutional triangle primarily responsible for public health and science diplomacy consisting of the Department of Health, Department for International Development and the Cabinet Office, the Government Chief Scientific Advisor (GCSA) is worth mentioning. The GCSA's role is to provide scientific advice to the prime minister and members of cabinet, to advise the government on aspects of policies on science and technology and to ensure and improve the quality and use of scientific evidence and advice in government. GCSA also coordinates exchange of information between specialised chief scientific advisors (located within individual governmental departments) and within the Science and Innovation Network (SIN) of science attachés. The Scientific Advisory Group for Emergencies (SAGE) then provides, as far as possible, scientific and technical advice to support government decision makers during emergencies.[18]

SAGE provides a platform for communication and consultation between the scientific and political (including diplomatic) community, thus enabling translation of the scientific advice into practical reaction to an epidemic or emergency. Hence, this mechanism has the potential to strengthen and calibrate the “science” element in diplomacy. SAGE also provides a platform for communication between scientists from different fields, thus having the potential to strengthen the multidisciplinary character of the UK response to global epidemics.

[17] Source: Compiled by authors

[18] At the local level, SAGE is supplemented by Scientific and Technical Advisory Cells (STACs) which provide advice to local Strategic Coordinating Groups (SCGs). and Recovery Coordinating Groups (RCGs) which respond to the local consequences and manage local recovery efforts.

Actor	Type	Relation to diplomacy	Responsibilities
Department of Health (including the UK Vaccine Network)	Government department	Actor (health diplomacy)	National health system; global health policy; represents the UK at WHO; research and development activities on neglected tropical diseases and poverty-related diseases. Support of the initial development of vaccines to tackle epidemics.
Department for International Development (including the Global Health Oversight Group)	Government department	Actor (science diplomacy)	Research and development activities on neglected tropical diseases and poverty-related diseases
Cabinet Office	Ministry	Actor (all aspects of diplomacy)	The Cabinet Office plays a coordinating role during new outbreaks and health crises. The Cabinet Office coordinated the government response to the Ebola crisis and the subsequent lesson-learning process. The Cabinet Office's Civil Contingencies Secretariat is responsible for emergency planning, which supports the government's emergency response committee. In 2017, the secretariat established the International Health Risks Network, with cross-departmental representation, to help determine the UK's response to new international disease outbreaks.
Public Health England	Organisation	Actor (health diplomacy)	Central to the UK aid effort because of its internationally recognised public health expertise.
Philanthropic Trusts Wellcome Trust/ Bill and Melinda Gates	Research funding organization and consulting body to the Federal Ministry of Education and Research	Supporting and advising actor	Research funding i.e. Glo-PID-R Network (Global Research Collaboration for Infectious Disease Preparedness)

Research Funders UK Research and Innovation (UKRI), Medical Research Council (MRC).	National research organisation	Supporting and advising actor	UK Research and Innovation and its councils alongside Innovate UK form the main UK funders for research and innovation. The MRC had a leading role in response to Zika in terms of funding and strategy.
Government Office for Science and Chief Scientist led Scientific Advisory Group for Emergencies (SAGE)	Ministry	Actor (science diplomacy)	SAGE provides scientific and technical advice to support government decision makers during emergencies. Chaired by the chief scientific advisor, in 2016, a precautionary SAGE (Pre-SAGE) was activated to advise on the Zika virus outbreak.[19]
Department for Business, Energy and Industrial Strategy	Ministry	Supporting and advising actor	Oversees the Newton Fund and the Global Challenges Research Fund (GCRF), through which Official Development Assistance funding for research on global health threats is channelled.
Department for Environment, Food and Rural Affairs	Ministry	Supporting and advising actor	(Particularly its Veterinary Medicines Directorate) provides advice on zoonoses and antimicrobial resistance, from the perspective of how human, animal and environmental health interact (‘One Health’). The department also supports the UK’s international influencing activity on drug resistance.
UK Public Health Rapid Support Team (partnership between Public Health England and the London School of Hygiene and Tropical Medicine)	Network to support outbreaks, research organization	Actor (and supporting) (health and science diplomacy)	UK Public Health Rapid Support Team is a specialist team ready to respond to disease outbreaks around the world before they develop into emergencies. The team also conducts rigorous operational research to improve epidemic preparedness.

Table 4: List of selected UK government (and government-related) actors for global health and Zika[20]

[19] UK Gov. (2016): Scientific Advisory Group for Emergencies (SAGE). Retrieved from: https://www.gov.uk/government/groups/scientific-advisory-group-for-emergencies-sage

[20] Source: Independent Commission for Aid Impact (2018): Report: The UK aid response to global health threats. Retrieved from: https://icai.independent.gov.uk/html-report/global-health-threats/

3. Reaction to Zika epidemic

The reaction to the 2015/2016 Zika epidemic and the role of science diplomacy in it could be analysed through many potential filters. This case study choses four of them: a) political reaction and prioritization of science diplomacy, b) data collection and data sharing, c) internalisation of research and new funding and d) operational response to the crisis.

3.1. Political reaction and prioritization of science diplomacy, science advice

In particular, the "diplomatic" element of science diplomacy cannot properly function without clear support from the political level. Therefore, the issue of political communication and prioritisation of science diplomacy concerning global health was an essential element of the reaction to the Zika epidemic.

The European Council has frequently expressed the "commitment" of the EU to combat issues of global health as well as provided political support for more specific actions (e.g. establishment of the Global Fund to fights HIV/AIDS, support of international donor conferences) and institutional novelties (establishment of the European Centre for Disease Prevention and Control, appointment of an EU Ebola coordinator). Since 2003, the conclusions of the European Council have mentioned HIV/AIDS, tuberculosis, and malaria the most frequently, followed by Ebola. Even more frequently, global health issues are mentioned in the documents of the Employment, Social Policy, Health and Consumer Affairs Council (ESPHC Council) which mention, among others influenza preparedness (2006, 2007, 2008), AIDS (2006, 2007, 2010, 2017), Ebola (2014, 2015), MERS (2013), anti-microbe resistance (2016, 2017) as well as vaccination issues (2011, 2016, 2018). The Zika outbreak was addressed in May 2016 by the Council conclusions (albeit only in the "any other business section") which contained a call for "coordinated response efforts" covering an unsurprising mix of measures including "*reinforced research, regular risk assessments and risk management measures, such as the control of the mosquito transmitting the virus, as well as information to travellers and to healthcare providers."* From an institutional perspective, the central role was vested in the Council and (without detailed allocation of roles to individual institutions) in the European Commission, the European Centre for Disease Prevention and Control and the European Medicines Agency.

The British Prime Minister Theresa May explicitly supported the need to protect people from Zika in 2017[21] and to use both governmental (the government's Global Challenges Fund and Rapid Response Initiative) and European (Horizon 2020 Research and Innovation Programme) resources to tackle the global dimension of Zika epidemic. The Scientific Advisory Group for Emergencies (SAGE) was activated to advise on the Zika virus outbreak. The SAGE network advises the government and the governmental chief scientific advisers on all aspects of policy on science and technology, including the implementation of policies on science, technology, engineering and mathematics (STEM) and exchange of good practices in the area of global health. As part of the Government Office for Science (GO Science), Chris Whitty (Chief Scientific Adviser, Department of Health and Social Care) who was greatly involved in the Zika virus issue, and Charlotte Watts (Chief Scientific Adviser, Department for International Development), formed a SAGE to respond to the Zika virus. Indirectly, the Zika epidemic was addressed also by the British Parliament when the House of Commons' report '*Science in emergencies: UK lessons from Ebola'* outlined measures that the UK could instigate to improve the capacity to withstand global disease outbreaks,

[21] Merrick, Rob (2017): Zika virus project hailed by Theresa May on Scottish visit was funded by EU scheme which could be lost after Brexit. Independent, March 27, 2017, Retrieved from: https://www.independent.co.uk/news/uk/politics/zika-virus-theresa-may-eu-funding-brexit-european-union-research-project-scotland-university-glasgow-a7652466.html

emphasizing the importance of disease surveillance and early diagnosis in controlling the outbreak of diseases.[22]

The German government stressed the connection between the domestic and global dimensions of public health in declarations at the G20 and G7 summits in Hamburg (2017) and Elmau (2015). Germany endorsed a goal to make a strategic contribution to strengthening health sustainably in international contexts. In order to achieve this goal, the Federal Ministry of Health set up a "Centre for International Health Protection (ZIG)" at the Robert Koch Institute.[23] Among the main tasks of the ZIG is information management, the development of evidence-based methods as well as providing support for the implementation of projects on international health protection. Germany also amended its domestic legislation (Infection Protection Act) in order to reflect new tasks in the area of international health protection.

The Zika epidemic and global health in general had a less prominent position within the Czech political class. Global health policy is not listed among the priorities of Czech science diplomacy and comments of Czech politicians were limited to an operational response (providing information, monitoring, observation) concerning Czech citizens and the territory of the Czech Republic. However, former chief public health officer of the Czech Republic (hlavní hygienik CR) Vladimír Valenta mentioned the effective response to the Ebola, MERS and Zika epidemics among the most prominent successes of his agency. Indeed, during his term of office, Czech legislation and inter-institutional coordination for dealing with epidemic outbreaks was modernised and internationalised, but crucial operational activities of his office dealt with other agendas than epidemics.

3.2. Data collection and data sharing

Effective collection of data relevant for Zika epidemic and their further distribution was one of the key challenges of the European and national reactions to the outbreak of the epidemic.

The robust EU mechanism for data collection was activated in years 2015-2017. The European Centre for Disease Prevention and Control (ECDC) organised an epidemiological surveillance of Zika infection in the EU/EEA. In 2016, the European Union Health Security Committee approved an interim case definition for surveillance of Zika infection and the EU/EEA Member States reported in total 2,133 confirmed cases of Zika virus infection to ECDC, during the period of June 2015 to February 2017. The reported cases included 2,090 imported cases, 21 locally acquired non-vector borne cases and 22 cases with importation status reported as unknown.[24] Standard institutional channels between the national and European levels were used, such as data collection by the National Institute of Public Health in the Czech Republic.

What was more interesting was the debate on "ownership" of the data collected and the limits of their further distribution. Here, a clash between the concept of "pure" scientific data which should benefit from open access to the whole global scientific community and more blurred rules on data protection and intellectual property emerged. The WHO issued (after broad consultations) a statement supporting the establishment of global norms for data sharing during health emergencies which claimed *"that timely and transparent pre-*

[22] House of Commons Science and Technology Committee (2016): Science in emergencies: UK lessons from Ebola. Second Report of Session 2015-16, Retrieved from: https://publications.parliament.uk/pa/cm201516/cmselect/cmsctech/469/469.pdf

[23] Robert Koch Institut (2019): Centre for International Health Protection (ZIG). Retrieved from: https://www.rki.de/EN/Content/Institute/DepartmentsUnits/ZIG/ZIG_node.html

[24] Spiteri, G., B. Sudre, A. Septfons, J. Beauté, on behalf of the European Zika Surveillance Network (2017): Surveillance of Zika virus infection in the EU/EEA, June 2015 to January 2017. Euro Surveill. 22(41):pii=17-00254. https://doi.org/10.2807/1560-7917.ES.2017.22.41.17-00254

publication sharing of data and results during public health emergencies must be the global norm"[25]*.* However, it seems that this position has caused a certain level of uneasiness in the British academic sector. While the Wellcome Trust and many other British stakeholders (academic journals, NGOs, funders, and research institutes) have issued a commitment to data sharing in public health emergencies, including research content concerning Zika epidemic,[26] academics also occasionally expressed concerns regarding the vagueness of the respective legislative framework as well as the impact of a broadly interpreted data-sharing regime on their individual academic careers.[27] The whole ownership debate was complicated even more by the involvement of Brazilian researchers who tended to emphasise their specific "ownership" of data and samples (albeit not automatically excluding data-sharing) due to their geographical location at the core of the Zika epidemic.

In reaction to the data sharing controversy, the Global Research Collaboration for Infectious Disease Preparedness (GLoPID-R) set out an action plan to design a system for sharing data in public health emergencies (PHE), which includes mapping of the regulatory environment, developing a policy and framework for data sharing for PHE and a focus on implementation of data sharing policy and practice. This work focused on case studies, learning from past PHEs, such as Ebola, to test on potential future PHEs.

3.3. Internationalisation of research and new funding

Unsurprisingly, the Zika outbreak triggered new research on Zika treatment and prevention. From the perspective of science diplomacy, two aspects of the research are of particular interest: new funding schemes combined with internationalisation and multidisciplinarity of research.

While only little research on Zika was performed before the outbreak of the epidemic in the UK, the traditional actors, such as the Wellcome Trust, the Medical Research Council and the Newton Fund, along with the UK government fast tracked funding in response to the crisis.[28] Overall, it is estimated that there has been a GBP 14.4 m investment in Zika virus research. One of the UK's main funders, the Wellcome Trust claims that "*research is an essential part of being ready for and responding to public health emergencies*".[29] In connection with the issue of data collection and sharing it is important that new funding also supported new platforms for data sharing, such as a data-sharing platform for images of foetal and new-born heads and improved diagnosis for Zika virus infection through shared laboratory partnerships. Regarding funding, the UK stakeholders emphasised the rapidity of the funding allocation as a key feature of the British response to Zika and to global health threats in general.[30] Further, there was a "lesson learned" from the Ebola outbreak for funders` reaction to the Zika epidemic. As one of the stakeholders stated:

> *"At the time of the Ebola outbreak it was recognised that we needed a more robust way of evaluating the way to respond to an outbreak occurring …Work on vaccines led to the establishment of a government response bringing*

[25] WHO (2015): Developing global norms for sharing data and results during public health emergencies. Retrieved from: http://www.emro.who.int/rpc/rpc-events/global-norms-for-sharing-data-and-results-public-health-emergencies.html

[26] Wellcome Trust (2016): Sharing data during Zika and other global health emergencies. Retrieved from: https://wellcome.ac.uk/news/sharing-data-during-zika-and-other-global-health-emergencies

[27] One respondent remarked: "One of the concerns academics may have is that they are concerned that if they release the data elsewhere then they might not be able to publish."

[28] UK Gov. (2016): Government to fast track funding for research into Zika. Retrieved from: https://www.gov.uk/government/news/government-to-fast-track-funding-for-research-into-zika

[29] Wellcome Trust (2016): Data sharing in public health emergencies. Retrieved from: https://wellcome.ac.uk/what-we-do/our-work/data-sharing-public-health-emergencies

[30] Wellcome Trust (2016): 26 Zika projects receive £3.2m funding boost. Retrieved from: https://wellcome.ac.uk/news/26-zika-projects-receive-%C2%A332m-funding-boost

together a range of funders to identify a series of priority pathogens - that prioritisation activity was being undertaken by a number of organisations globally and nationally which tended to overlap, but understanding why they might be different was also very helpful."[31]

In contrast, neither Germany nor the Czech Republic seemed to allocate extra funding for Zika research. The German Federal Ministry of Education and Research did not specifically increase Zika-related research after the outbreak. Instead, the ministry used existing funding schemes for health research that did not have a thematic focus at the time to cover Zika-related research.[32] Similarly, in the Czech Republic, only one project with direct relevance for Zika was financed by standard research funding schemes during the 2016-2019 period. Even this project, with a budget over CZK 9 mil.(approx. 360,000 Eur) was focused primarily on the potential internal European dimension of the Zika infection (readiness for introduction of an exotic disease transferred by mosquitos).[33]

Internationalisation and the strengthening of multidisciplinary approaches to research were other common features of the reaction both to the Zika epidemic and to broader global health protection policies. Efficiency of the reaction to an epidemic is strengthened when the medical intervention is (at least partially) performed in the proximity of the centre of the epidemic's outbreak. At the same time, the EU and European states were confronted with the necessity to balance between the advantages of local medical intervention (e.g. in Brazil) compared with the benefits of medical measures performed within medical facilities (laboratories, hospitals, research institutions) in Europe. A similar internationalisation argument is applicable to management of the mobility of persons: how to combine unilateral measures for identification and control of individuals representing a medical hazard with coordinated measures between the European States, the EU and the countries of the original epidemic outbreak. Last but not least, the measures should be communicated to the external (state) partners and the risk of incompatibility with non-European regulatory regimes must be minimised.

In Germany, the Federal Ministry of Health launched a Global Health Protection Programme (GHPP) to improve international health.[34] The main focus is to support partner countries in developing steps to prevent epidemics, but the involvement of research is also addressed, e.g. by supporting research cooperation and promotion of young researchers. Currently (2019), 28 research projects cooperate with 38 partner countries in Africa, Asia and South Eastern Europe.[35] The Federal Ministry of Education and Research has also created incentives for German universities and researchers to become more interdisciplinary in their research of global health issues.[36] The Robert Koch Institute supports the programme in various fields, e.g. in building capacities for tackling outbreak situations, strengthening primary healthcare systems, implementing the international health regulations and combatting antimicrobial resistance. Apart from the Robert Koch Institute, the Federal Institute for Drugs and Medical Devices, the Bernhard-Nocht-Institute for Tropical Medicine, and the Paul-Ehrlich-Institute participate in this programme.[37]

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[31] Interview, UK Funding Council X, 29 April 2019.

[32] In particular, the EU-LAC Foundation; EU-LAC. Retrieved from: https://eulacfoundation.org/en/about-us

[33] Připravenost na introudkci exotických nákaz přenášených komáry – přístup One Health.

[34] Robert Koch Institut (2019): Bundesgesundheitsminister Spahn: Globale Gesundheitsgefahren erkennen und abwehren – Neues Zentrum für Internationalen Gesundheitsschutz im Robert Koch-Institut. Retrieved from: https://www.rki.de/DE/Content/Service/Presse/Pressemitteilungen/2019/01_2019.html

[35] Federal Ministry of Health (2019): The Federal Ministry of Health's Global Health Protection Programme. Retrieved from: https://ghpp.de/en/about-ghpp/

[36] Napoli, I., D. Böcking (2016): Global health education in the focus of research. Berlin: Federal Ministry of Education and Research.

[37] Robert Koch Institut (2019): The German Federal Ministry of Health's Global Protection Programme. Retrieved from: https://www.rki.de/EN/Content/Institute/International/GHPP/GHPP_node.html

The importance of multi-disciplinary research, including the interaction between medical research and the social sciences, was also emphasised in the UK strategic documents and its new research funding structure (UK Research and Innovation - UKRI)[38] as well as by the WHO that explicitly acknowledges that social science is an essential part of effective risk communication and community engagement for responding effectively to the ongoing Zika outbreak (as well as to any other epidemic or pandemic). A concept of science diplomacy is not explicitly mentioned by UKRI but experts interviewed stressed that the idea of science diplomacy significantly framed the preparatory work on the document.

The importance of partnership (in contrast to the simple "export" of science and medical expertise) in research has been emphasised in the Zika-related research more frequently than in connection with Ebola research. The emphasis on a collaboration principle was also reflected in the general policy declarations framing the whole process as well as the respective funding schemes (the Zika Rapid Response Initiative, the Wellcome Trust, MRC and Newton). Last but not least, the existence of an extensive scientific community and research structure in Brazil contributed to the collaborative approach in Zika research, particularly in comparison with Ebola-focused research.

3.4. Operational response to the crisis

The science diplomacy element was present both in the long-term ("strategic") reaction to Zika epidemic and in the immediate operational ("tactical") reaction. In particular, the operational reaction included rapid exchange of information on Zika prevention and treatment, treatment of own citizens suffering from Zika and management of travel routes between the EU and Latin America.

In Germany, the Zika outbreak of 2015 led to a wave of national requests and inquiries to the Federal Ministry of Education and Research as well as the Federal Ministry for Health. It seems that it did not have the same impact in actions and responses as the Ebola outbreak did. One interviewee indicated that jurisdiction for all Zika and infectious disease-related research questions and activities was handed to the Federal Ministry of Education and Research. In the Czech Republic, the information role was distributed (not necessarily coordinated) between the Ministry of Health and the Ministry of Foreign Affairs. For instance, the Czech embassy in Brasilia communicated primarily with the Ministry of Foreign Affairs. The low intensity of operational response to Zika contrasted with a significantly more intensive reaction during the Ebola outbreak several years earlier when, for instance, an emergency centre with a medical centre operating 24/7 was established at the major international airport in Prague (regardless of the fact that no direct flights between Prague and Ebola-affected African countries were operated) and the Czech Delegation to the EU in Brussels hosted a presentation of Czech medical products designed for biological protection during epidemics.[39]

[38] UKRI (UKRI. Retrieved from: https://www.ukri.org/) brings together the Arts and Humanities Research Council; Biotechnology and Biological Sciences Research Council; Engineering and Physical Sciences Research Council; Economic and Social Research Council; Medical Research Council; Natural Environment Research Council; Research England; and Science and Technology Facilities Council with Innovate UK.

[39] Ministry of Foreign Affairs (2014): Český příspěvek k boji s virem Ebola. Retrieved from: https://www.mzv.cz/brussels/cz/obchodne_ekonomicky_usek/ekonomicke_a_obchodni_aktuality/brusel_ceska_prezentace_prispevek_k_boji.html

4. Conclusions

Our case study identified four general issues of the European and national reactions to the Zika epidemic relevant for science diplomacy:

1. Zika has not been a game changer
2. Geography matters
3. National foreign policy narratives matter
4. The "Union method" matters

4.1. Zika has not been a game changer

The Zika outbreak has not caused a fundamental change in the European or national reaction to global health issues. Instead, the reaction to Zika has built upon already existing institutional platforms and narratives. If there was an epidemic which caused substantial institutional changes, it was Ebola.[40]

According to German stakeholders, Zika contrasted with Ebola in terms of perception. It was perceived that Germany (as well as other EU Member States) responded to the Ebola outbreak very late but then was able to mobilise its capacities to form an efficient global response to the Ebola outbreak. The reaction also had an institutional dimension because Germany appointed a special ambassador to coordinate the German government's response,[41] and later the position of Coordinator for the Foreign Policy Dimension of Global Health Issues in the Ministry of Foreign Affairs was created. The strengthening of cooperation with Africa had also been one priority in the international cooperation activities of the Federal Ministry of Education and Research. All the above-mentioned changes had the potential to increase the role of science diplomacy in reaction to global epidemics in general and provided a platform for science diplomacy after the Zika outbreak.

Czech stakeholders share the opinion that the impact of the Zika epidemic on the national approach to science diplomacy has been significantly weaker than the impact of the Ebola outbreak. In the Ebola case, new coordination mechanisms were tested, including establishment of a crisis centre at Ruzyně International Airport and cooperation with laboratories at the Robert Koch Institute in Germany in testing samples collected by Czech authorities. Several years later, the Czech reaction to Zika epidemic was less intensive both in its operative part and regarding innovativeness of actions taken.

4.2. Geography matters

Regardless of the global impact of the Zika epidemic, geographical position and the intensity of bilateral relations with Latin America have influenced the form of reaction to the Zika outbreak. For instance, the relatively low profile of the Czech reaction to the Zika epidemic (compared to the German and British reactions) was at least partially caused by the relatively low intensity of bilateral relation between the Czech Republic and Latin American countries. Among others, the fact that no direct flights operated between Brazil and the Czech Republic during the outbreak, further enhanced the Czech perception that the effects of the Zika epidemic could be significantly "filtered" by other EU Member States with direct communication routes with Brazil.

[40] The prevalence of the Ebola impact was also (indirectly) confirmed by the fact that Ebola attracted the attention of the European Council while Zika is mentioned "only" in the documents of the Council (i.e. the ministerial level).

[41] Kickbusch, I. et al. (2017): Germany's expanding role in global health. In: The Lancet, 03 July 2017, p.901, Retrieved from: https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(17)31460-5/fulltext

4.3. National foreign policy narratives matter

Science diplomacy cannot escape the influence of the general national diplomatic narrative of a country, regardless of how obscured the narrative could be. Hence, mapping a connection between Zika and the national diplomatic narrative can be helpful for the identification of deeper and more permanent trends and structural features of the science diplomacy of the states researched.

In this context the Zika experience of Germany seems to correspond to a trend of using its domestic scientific expertise (research facilities, professional associations, science associations and an active innovative health industry) as a tool for enhancing and expanding the German diplomatic profile in global governance. The medical aspect of science diplomacy is perceived as another tool of "soft" German power and an expression of German responsibility for global challenges. In other words, one can interpret the German use of science diplomacy also as an attempt to globalise German scientific excellence, combined with some altruistic motives.

A similar narrative is present within the UK case, with a possible difference that the UK uses its scientific diplomacy within a broader catalogue of diplomatic tools. Science diplomacy is perceived as a confirmation of an already existing and expanding "Global Britain" which is able to adapt to the new global environment and its challenges, including formation of partnerships between government and the private sector.

Science diplomacy is a concept generally used and promoted both by diplomats and scientists in the UK. the Parliamentary Office of Science and Technology (POST) published a document (POST note) stressing the role of science in maintaining and further cultivating the external relationships of the UK in the post-Brexit period. At the same time, the brief declares that diplomacy is recognised by the UK government as "both driver and by-product of international science". The science diplomacy element has an increasing role in the assessment of the "research impact" of research projects and individual scientists within the UK science system.[42]

In Germany, while the science diplomacy concept has its place in the diplomatic and scientific narrative, it seems to be used less intensively and intuitively in the public health policy domain than in the UK. The science diplomacy concept tends to be understood as excessively vague and terms such as "health diplomacy" and "scientific policy advice" are frequently used instead by stakeholders. In other words, the science diplomacy concept is in the phase of being developed in Germany with different stakeholders searching for their role in it.

The Czech case, in contrast, demonstrates the reaction of a smaller country with limited resources[43] and aspirations. Therefore, the Czech reaction focused on addressing direct elements of the Zika threat to Czech citizens and territory and additional activities were either triggered by direct requests from other institutions (data collection for the ECDC) or by ad hoc research projects. The space for use of the science diplomacy concept is further reduced by a perception that Czech citizens are still underrepresented in the EU and the international institutions responsible for global health issues.

This does not mean that science diplomacy does not have a place in the Czech diplomatic narrative. However, the Zika epidemic does not occupy a priority position in Czech science diplomacy either from a topical perspective (for instance, health aspects linked with migration or water management issues receive more attention) or a geographical one (the

[42] Grimes, R., J. Maxton, R. Williams (2017): Providing International Science Advice: Challenges and Checklists. In: Science & Diplomacy, 24 September 2017.

[43] For instance, the Czech diplomatic mission in Brasilia during the Zika epidemic was composed of two diplomats and one consul (and an additional consulate was located in Sao Paulo). Therefore, no Czech diplomat in Brazil was vested exclusively with health and/or the scientific agenda. Instead the health and science agendas were managed together with other "soft" agendas, such as economic relations, education or culture.

location of Czech science diplomats in Washington D.C. and Tel Aviv, the focus on the health dimension of migration from Eastern and South Eastern Europe).

At the same time, the Czech narrative is open to international cooperation and inspiration (Czech stakeholders in the area of public health mentioned the UK system in particular) or even outsourcing, such as the agreement with the Robert Koch Institute (based on explicit authorisation in the National Action Plan to conclude an agreement with a laboratory in another EU Member State on testing small-pox (variola), Ebola, Marburg, Lassa, Nipah and Hendra viruses). Additionally, the National Action Plan and the Pandemic Plan explicitly stated that their adoption (and the replacement of the older regulatory regime) was triggered by the necessity to implement the obligations of the Czech Republic under international and EU legal instruments. However, the use of the term "science diplomacy" does not appear to be integrated into the vocabulary of stakeholders within the Czech institutions responsible for public health issues. Instead, the "science diplomacy" terminology is used by the diplomatic and science community.

4.4. The "Union method" matters

Despite differences between the experience of the three countries analysed, there are at least two features shared in their reaction to Zika:

The first one is securitisation. Zika (as well as Ebola) was perceived not as an external event but as a security threat to the European continent.[44] However, the debate on the security element of infectious diseases remained on a relatively non-confrontational level, without significant frictions with other aspects of European or national policies. A more substantive debate on the security dimension of European science diplomacy would emerge in a situation when an epidemic event collides with a core internal element of European integration, such as reintroduction of internal border controls or even the mobility regime for EU citizens.

The second common element of national reactions is an institutional mix. During their reactions to the Zika epidemic, the science diplomatic efforts of the UK, Germany and the Czech Republic used national channels, the EU framework as well and other institutional platforms when available (such as the G7 and G20 by Germany and the UK). A preferential institutional pattern cannot be identified. Instead, the reaction resembles an evolving nebulous structure or the "Union Method" of governance mentioned by Angela Merkel in her Bruges speech in 2010[45], expanded by the global institutional dimension and, ideally, bound together by the principle of loyal cooperation, as defined in Article 4 (3) TFEU.

[44] Chancellor Merkel described the threat posed by the Ebola virus along the same lines as global issues such as terrorism and forced migration, and she spoke about the extent to which foreign and security policy impacts matters concerning the internal politics of societies.
Merkel, A. (2015): Speech by Federal Chancellor Angela Merkel on the occasion of the 51st Munich Security Conference. 07 February 2015, Retrieved from:
https://www.bundesregierung.de/Content/EN/Reden/2015/2015-02-07-merkel-sicherheitskonferenz_en.html?nn=393812

[45] Merkel, A. (2010): Speech by Federal Chancellor Angela Merkel at the opening ceremony of the 61st academic year of the College of Europe. Bruges, 02 November 2010, Retrieved from:
https://archiv.bundesregierung.de/archiv-en/articles/speech-by-federal-chancellor-angela-merkel-at-theopening-ceremony-of-the-61st-academic-year-of-the-college-of-europe-804002

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Merkel, A. (2015): Speech by Federal Chancellor Angela Merkel on the occasion of the 51st Munich Security Conference. 07 February 2015, Retrieved from: https://www.bundesregierung.de/Content/EN/Reden/2015/2015-02-07-merkel-sicherheitskonferenz_en.html?nn=393812

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2. Water Diplomacy and its Future in the National, Regional, European and Global Environments

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List of Acronyms

BEIS	Department for Business, Energy and Industrial Strategy
BV	Dutch abbreviation for a private limited liability company
CAS	Czech Academy of Sciences
CZELO	Czech Liaison Office for Research, Development and Innovation
Defra	Department for Environment, Food and Rural Affairs (in the UK)
DFID	Department for International Development (in the UK)
DG	Directorate General (e.g. of the European Commission)
DG RTD	Directorate General for Research and Innovation
DIT	Department for International Trade (in the UK)
EEAS	European External Action Service
FCO	Foreign and Commonwealth Office (in the UK)
GIZ	Gesellschaft für Internationale Zusammenarbeit
IWaSP	International Water Stewardship Programme
JPI	Joint Programming Initiative
MDGs	Millennium Development Goals
NGO	Non-governmental organizations
NWP	Netherlands Water Partnership
OECD	Organisation for Economic Co-operation and Development
S.A.W.E.R. system	Solar Air Water Earth Resource
TFEU	Treaty on the Functioning of the European Union
UK	United Kingdom
UNECE	United Nations Economic Commission for Europe
UNESCO	United Nations Educational, Scientific and Cultural Organization
WFD	Water Framework Directive

1. Introduction

Water diplomacy is a new field of diplomacy that combines the methods of science diplomacy (focusing on close ties between the worlds of science and diplomacy) with traditional diplomatic instruments. It is defined by its emphasis on water-related topics: access to drinking water, water sanitation, water scarcity, flooding, etc. All these categories are included in the broader category of international water management.

Water management is a multifarious responsibility that extends to agriculture, national security, public health and other areas. A diplomacy that promotes efficient water management requires the involvement of different actors who need to understand and take into account the 'water dimension' of a specific diplomatic situation. As needed, it can employ the tools of pre-emptive diplomacy, designed to head off critical international problems, and crisis management. That is why the cooperation of government officials with the scientific community (including experts in the hard sciences, technical disciplines, the social sciences and the humanities) is crucial to successful water diplomacy. The case of water management is very well suited for a study of the practice of science diplomacy.

The internal structure of this case study reflects the different approaches to water management and water diplomacy in three EU Member States: the Czech Republic, the Netherlands and the United Kingdom. The subcase of each country offers us insight into the governance arrangements, the stakeholder landscape, and the processes and procedures applied in the water policy agenda in each country. The entire case study is complemented by an analysis of water diplomacy at the EU level, mainly focusing on the role of the EEAS and the relevant Directorate Generals (DGs), as they step into a more important role in water diplomacy—a new ambition of the European Union as pointed out by relevant stakeholders.

This case study is an example of a foreign policy driven analysis, as it focuses mainly on actors, topics and instruments that contribute to the achievement of foreign policy goals as mentioned in main conceptual documents of the three countries and the EU. It mainly studies the science for diplomacy category – methods and instruments that contribute to an effective cooperation and communication between the scientific and diplomatic communities and follow diplomatic objectives.

2. Water Management in the Netherlands and Dutch Water Diplomacy

Dutch engineers have used invention, science and technology to fend off sea water for centuries. Since the Dutch people began to settle in areas threatened by flooding, they have successively protected themselves with mounds, seawalls, concrete-and-metal structures and recently with sand nourishment. In the process, they have reclaimed large areas of land from the sea. During the middle ages, Dutch engineers were already travelling to Northern Germany to advise on flood control construction[1]. Nevertheless, systematic, large-scale flood protection only developed in the twentieth century, when the means for large-scale monitoring of conditions as well as improved institutional organization became available. Improvements in flood management were always linked to critical events such as large floods. In the first half of the twentieth century, such events inspired a more integrated approach to flood management involving all the governmental institutions in the Netherlands dedicated to water issues. Naturally, the systemic transformations of the Netherlands' approach to flood management were coupled with a growing body of

[1] Pye, Michael (2015): The Edge of the World. How the North Sea Made Us Who We Are. London: Penguin UK.; Mauelshagen, Franz (2007): Flood Disasters and Political Culture at the German North Sea Coast: A Long-Term Historical Perspective. In: Historical Social Research 32, no. 3.

knowledge about flood control. While Dutch flood management experts have always travelled and worked abroad, their value is now even greater in a more and more globalized world. Since the second half of the nineteenth century, the Netherlands' governmental water management was staffed by civil engineers[2]. In the 1970s, the engineers were joined by ecologists, which led the government to take a more complex approach to water management[3]. At the same time, Dutch companies, which were often contracted to implement the government's water management plans, grew in expertise. They are now some of the world's most renowned business' experts in the sector. Dutch water management scientists played a significant role in formulating flood risk reduction plans for post-Hurricane Katrina New Orleans and for New York City after Hurricane Sandy. The Dutch government has advised on water management plans for low-lying countries in river deltas like Bangladesh[4].

2.1. Water legislation and policy

Since 2009, water management in the Netherlands has been regulated by one law: the **Water Act**. That law replaced and integrated eight other laws related to different aspects of water management[5]. Except for its definition of transboundary water basins, the Water Act does not explicitly mention any international aspects of water management. However, it does task the Dutch government (and by inference the minister responsible for water management) to develop a **National Water Plan** and a **Delta Programme**, which provide for international cooperation and take into account other foreign aspects of water management. The National Water Plan[6] outlines the overarching objectives of Dutch national water policy. In principle, it is to be revised every six years. The Delta Programme contributes to the National Water Plan in the areas of flood safety and provision of drinking water. It contains all the concrete measures to be taken to ensure adequate water supplies as well as water quality[7]. According to the Water Act, the Delta Programme may also have 'ambitions in other policy domains', but does not specify which other domains. In other words, the National Water Plan is the Netherlands' strategic policy document, while the Delta Programme sets out the tactics to be used on the operational level for achieving the objectives of the National Water Plan. Besides national objectives, the Plan and the Programme often mention some international objectives. The Delta Programme acknowledges the international, transboundary character of flood protection efforts. The international theme most often mentioned in the Programme is the benefit to Dutch businesses of exporting flood management expertise and exchanging knowledge, technology and experiences with countries in similar low-lying delta regions, such as Bangladesh and Indonesia. An occasional topic is the need for cooperation with the European Commission and the OECD.[8] In 2016, the Dutch government produced an

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[2] Disco, Cornelis (2002): Remaking "Nature": The Ecological Turn in Dutch Water Management. In: Science, Technology, & Human Values 27, no. 2.

[3] Ibid.

[4] Ministerie van Infrastructuur en Milieu and Ministerie van Economische Zaken Landbouw en Innovatie (2016): Deltaprogramma 2017: Voortgang Kennisagenda. The Hague: MinIenM.

[5] Arnold, Geo et al. (2011): Water Management in the Netherlands. Utrecht: Rijkswaterstaat, Centre for Water Management.

[6] Ministerie van Infrastructuur en Milieu and Ministerie van Economische Zaken (2015): Nationaal Waterplan 2016-2021. Den Haag: MinIenM.

[7] Ministerie van Infrastructuur en Milieu and Ministerie van Economische Zaken Landbouw en Innovatie (2017): Deltaprogramma 2018: Doorwerken Aan Een Duurzame En Veilige Delta. The Hague: MinIenM.

[8] Ministerie van Infrastructuur en Milieu and Ministerie van Economische Zaken Landbouw en Innovatie (2016): Deltaprogramma 2017: Voortgang Kennisagenda. The Hague: MinIenM.; Ministerie van Infrastructuur en Milieu and Ministerie van Economische Zaken Landbouw en Innovatie (2017): Deltaprogramma 2018: Doorwerken Aan Een Duurzame En Veilige Delta. The Hague: MinIenM.

internationally-oriented **International Water Ambition.**[9] It was issued in cooperation between the Minister for Infrastructure and the Environment, the Minister of Foreign Trade and Development Cooperation, and the Minister of Economic Affairs. Given the inter-ministerial cooperation that produced the 'ambition', the integrated definition of water safety and security it contains may not come as a surprise. The Netherlands' International Water Ambition can be seen as an informal statement of Dutch foreign policy in the domain of water management and climate change. Its objectives are reflected in a broad range of 'water instruments' outlined in the document, including funding, partnerships and disaster assistance. In addition, according to the International Water Ambition, the Netherlands aims to become a global 'centre of excellence' in the domain of water safety and security.

2.2. Governance mode

In terms of its mode of governance, the Dutch water management system is a **mixture** of hierarchical, network and market elements. Given the importance of flood protection to the country, the **central government has a clear duty of oversight** of the water management system and its activities. Lower-level authorities are often assigned to carry out water management projects, but monitoring and inspection responsibilities remain with the central government. There is a large number of actors in the system (see below) with different expertise in terms of water supply, water quality and project management. That means that once projects are started, they are seldom implemented by one governmental organization but rely on the **cooperation of many stakeholders**, such as the public works agency, provincial governments, water boards, municipalities, consulting and water management companies, and sometimes citizens and civic organizations. Finally, in some construction projects there are **tenders or market-based mechanisms** to find the most suitable bidder to participate in the project.

2.3. Stakeholder landscape

The various institutions and organizations that influence water management are set out below. The relevant stakeholders are identified in bold text.

The Netherlands' geographic location has propelled water management to high importance in Dutch policy making, which applies to all levels of government and stretches out into civil society and the knowledge sector. Policy-making crosses national boundaries. The Dutch government collaborates with other states as well as international stakeholders. The Netherlands is a leader of a network of stakeholders, promoting best practices and sharing its water management knowledge. Improving social welfare and commercial opportunities are the main drivers of its policies. Water management is an opportunity for the Netherlands and Dutch companies to conquer a unique position in the global market for flood management technology and mitigation of the effects of climate change.

2.3.1. Actors in Dutch foreign policy

Two ministries constitute the core of Dutch foreign policy as it relates to water management activities. The **Ministry of Infrastructure and Water Management** is nominally in charge. Together with the **Ministry of Economic Affairs and Climate Policy**, the Ministry of Infrastructure and Water Management implements the **Delta Programme**, which establishes an annual focus and planned activities, mainly for Dutch national water management but also for its international activities. Since 2014, the **Ministry of Foreign**

[9] Ministerie van Infrastructuur en Milieu (2016): Synergos Communicatie, Internationale Waterambitie. Den Haag: Ministerie van Infrastructuur en Milieu.

Affairs has leveraged its cooperation in the framework of the Delta Programme to draw foreign attention to the Netherlands' water management knowledge and expertise[10]. Both of the core ministries collaborate on preparing and implementing the National Water Plan, the International Water Ambition and the National Climate Adaptation Strategy. The Ministry of Infrastructure and Water Management has appointed two responsible employees: the **Delta Commissioner** and the **Water Envoy**. The Commissioner has quasi-ministerial rank and is charged with specific tasks in the implementation of the Delta Programmes, for which Dutch law defines a position that is unique in the world. The Delta Commissioner maintains contact with organizations and international working groups interested in river basin management. He or she makes policy recommendations to the EU via the relevant Dutch government ministries. Such recommendations may relate to river basin management and adaptive delta/coastal management. The Water Envoy is a function that is unique to the Dutch government. Although 'special envoys' have often been appointed by the Netherlands and other countries[11], the efforts of the Dutch Water Envoy are dedicated to water in all its facets. The position is unique in the world. The naming of a Water Envoy in 2015 created a thematic ambassadorship that is helping to reinforce the Dutch national Water Ambition and contributes to international marketing of Dutch knowledge and expertise.

2.3.2. System of advisory councils

Several advisory councils and institutions of knowledge contribute expertise to the Dutch government and its national and foreign strategies for science, technology and innovation. The **Advisory Council on International Affairs** (*Adviesraad Internationale Vraagstukken*) has not given advice on water management topics, rather on typical foreign policy topic such as security; The **Advisory Council for Science, Technology and Innovation** (*Adviesraad voor wetenschap, technologie en innovatie*) has published an advice on STI diplomacy in 2017 which does not mention water management. The **Royal Netherlands Academy of Arts** and Sciences (Koninklijke Nederlandse Akademie van Wetenschappen) has published reports on scientific cooperation in general and attractiveness of NL for scientists. The **Netherlands Scientific Council for Government Policy** (*Wetenschappelijke Raad voor het Regeringsbeleid*) does not focus on water specifically. Some advices on technology or foreign policy use water management as case study. It has not provided an advice relevant for water management since 2010.

These advisory councils influence a large share of Dutch policy making, including its foreign policy and its Science, Technology & Innovation Policy, as well as the general direction of policy overall. However, none of these advisory councils is focused exclusively on water management. An exception was a dedicated **Water Governance Centre**, which was set up as a platform devoted to all matters relating to water management. The Centre has since been closed down, but before it closed, it commissioned a report on water diplomacy[12]. Several Dutch universities advise the government and are well-known for their approaches to water management. Among them, TU Delft and the University of Twente take a civil engineering approach, while Wageningen University upholds a tradition that focuses on ecological systems. The Netherlands also has set up a **Risk Reduction Team**, which is a team of experts tasked with making a quick response to disasters worldwide.

[10] The Ministry of Foreign Affairs houses the ministers of foreign affairs as well as of foreign trade and development cooperation. Besides the cooperation on the Delta Programme, its water management activities are unknown.

[11] Among others, the Ministry of Foreign Affairs has/has had Envoys for the Sustainable Development Goals, the climate or rare earths.

[12] Genderen, Ruben Van, Jan Rood (2011): Water Diplomacy: A Niche for the Netherlands? The Hague: Netherlands Institute of International Relations 'Clingendael'.

2.3.3. Collaboration between the public and private sectors

As mentioned above, Dutch expertise and skills in water management has gained a global reputation and is in high demand. The Dutch government encourages that demand to grow through active promotion and networking activities. It now cooperates directly with several countries and with international platforms for sharing relevant knowledge and experience. The Dutch approach to adaptive Delta management has been applied in Bangladesh and Vietnam. The Netherlands assisted in the development of the *Bangladesh Delta Plan 2100*. Dutch institutes of knowledge collaborated with Bangladeshi authorities on a long-term, adaptive strategy and corresponding funding scheme. In Vietnam, a Delta Plan was developed for the Mekong Delta and was presented at the end of 2013. In Colombia, the Netherlands has contributed to finding natural solutions to drainage problems and an early warning system for floods. In addition, the Netherlands has identified countries such as Egypt, India, Indonesia and Mozambique as potential partners in the long term. On top of all this, the Netherlands led the formation of a **Delta Coalition** in 2016, which has twelve member states[13]. The Coalition has the aim of (a) making deltas more resilient, (b) preventing global water problems, (c) agenda-setting, (d) sharing knowledge, and (e) promoting practical solutions to water management issues. The Netherlands considers China and the United States[14] to be its peers in the field of water management, with which it seeks to build productive relationships. Dutch water management expertise has piqued the interest of the **OECD** and the **World Bank**, which is a member of the **Water Mondiaal program**[15]. The OECD has established a Water Governance Initiative, to which the Dutch Delta Programme contributes. In the domain of **non-governmental organisations** (NGOs), there are several Dutch **environmental consultancies**, **water technology companies**, and **non-profit organisations** that operate transnationally. Two of them are the **Water, Sanitation and Hygiene (WASH) alliance** and the **Netherlands Water Partnership (NWP)**. WASH aims to bring sustainability to foreign water and sanitation programs. It is carrying out a variety of projects in Africa and Asia, including capacity building and knowledge transfer projects. The NWP does not run water projects itself, but rather facilitates networking. It is the first port of call for those seeking Dutch water expertise. The organization is composed of groups of experts categorised by topics and regions. These experts direct inquirers to Dutch companies, NGO’s, government agencies, and knowledge institutes in the water sector and their foreign counterparts. The NWP's connecting and match-making encompasses a range of networking activities, including attending international events, fielding direct requests from members, and organizing incoming and outgoing missions. Its ambition to be open and connective requires agility and eagerness to seek out opportunities on the part of its experts. While the NWP does work with scientists and diplomats, its relationship with them is mainly as a facilitator of contacts. The NWP's areas of concentration are aligned with the policy agenda put forward by the Dutch government. Its synergy with the national government gives the Netherlands a much stronger and more supported position in the international field of water management, both bilaterally and in the framework of international organizations.

[13] Member states are: Bangladesh, Colombia, Egypt, France, Myanmar, Indonesia, Japan, Mozambique, Philippines, South-Korea, Vietnam, and Netherlands.

[14] Since hurricane Sandy in 2012, intensive contacts have been established with a Memorandum of Understanding between US department of Housing and Urban Development and then Dutch Ministry of Infrastructure and Environment as a result.

[15] There are some other international networks dealing with water, such as the Delta Alliance, Partners for Water, European Partnership for Innovation in Water and the Netherlands Water Partnership.

2.4. De-facto governance practices

Various Dutch organizations address a **large range of water issues** in foreign countries. These include water quality, water quantity, sanitation, irrigation, and mitigation of and adaptation to the effects of climate change. Of course, the ability to export knowledge of such a diversity of issues requires wide-ranging expertise, a national interest in supporting such exports, a strong economic sector and ambition to set policy internationally. Over the years, the Dutch water management sector is (or at least perceives itself as) a jack-of-all-trades as regards water management issues, **not only in terms of the content of its knowledge, but also in terms of process and procedures**. Dutch organizations provide services for capacity-building, training, technology transfer, policy making, consultancy and research. Such versatility allows for approaches tailored to the target country's requests, requirements and opportunities.

Based on conversations with practitioners of science diplomacy, **expressed rules of conduct** for their work are rare. Rules for their conduct are tacit and adapt dynamically whenever situations change. Practitioners of water diplomacy, just as science diplomats, need to know what could be called the 'typical' diplomatic rules and procedures. Such typical rules of conduct involve knowing a host country's culture, and how people there think, talk, and work. Familiarity with the cultural context is paramount to effective interaction with organisations from a foreign country. Cultural rules must be learned from experience and socialisation. Diplomats who increase their work experience in the foreign context increase their chances of successfully pursuing effective science diplomacy.

Cultural idiosyncrasies are a potential point of leverage for **greater involvement in water diplomacy by the EU**. Of course, there are abundant situations in which a clear **division of labour** between the EU and its Member States would be desirable, especially in countries where Member States already have deployed diplomats involved in the field of water management. However, even there, the EU can play a useful supporting role in situations where non-governmental actors, be they civil society organisations or commercial firms, encounter the **vicissitudes of unpredictable or unstable domestic governance**.

International exchanges of water management knowledge and expertise occur **in various ways**. Both government and non-governmental diplomats attend **trade fairs** or organise and join **trade missions**. They set up **personal meetings** for scientists and foreign policy makers, sometimes based on requests for information or match-making, sometimes based on their own noticing of an opportunity. Such networking facilitates the exchange of resources**, including contacts, knowledge and prospects for government funding**.

2.4.1. The cultural context

A set of broader societal developments in the Netherlands has influenced concepts of water management and how it is executed. These developments include an increase in the number of scientific and other disciplines (professions, fields) that take an interest in the subject, raising public concern about climate change, and the Netherlands' increasing self-perception as a welfare state that takes international responsibility and offers support to other countries.

First, concern about the water environment have been increasing in **many different scientific disciplines**, such as hydrology, physics, engineering, ecology, and even the social sciences.[16] This greater interest in the subject has led researchers to discover and

[16] Disco, Cornelis (2002): Remaking "Nature": The Ecological Turn in Dutch Water Management. In: Science, Technology, & Human Values 27, no. 2.; Verduijn, Simon H., Sander V. Meijerink, Pieter Leroy (2012): How the Second Delta Committee Set the Agenda for Climate Adaptation Policy: A Dutch Case Study on Framing Strategies for Policy Change. In: Water Alternatives 5, no. 2.

employ more and more sophisticated and technology-intensive research methods. It has also resulted in more integrated, increasingly interdisciplinary approaches to water management, river basin management, integrated coastal zone management and adaptive water management[17].Second, certainly there is a is rising concern about **climate change** and problems it can cause, such as a rise in sea level, droughts, and changes in the biome. Climate change is putting water systems under pressure, requiring well-organized water management systems. The Netherlands' Delta Programme, coastal maintenance programme and other initiatives result from an upward trend in the learning curve with respect to water management.

Finally, the Netherlands has a long tradition of supporting other countries in their water management efforts by making its expertise and knowledge widely available[18]. The Delta Programme documents state:"The efforts for water safety and freshwater supply the Netherlands has undertaken in the past decades have laid the foundations for a prosperous country. The Netherlands is home to the safest delta in the world. It has to stay that way. This requires substantial effort and the commitment of all the innovative power that public and private parties possess. This immediately generates a wonderful product for export[19]."This business model attitude is mirrored in the field of water management, where the Netherlands is not just seeking to promote the interests of Dutch businesses, but also to render real assistance to countries in need of water management expertise and technology, as well as immediate relief in the wake of water-related disasters. In this effort, the Netherlands intends to 'link its national approach with the international market, making the country a testing ground and showcase for innovative, iconic projects and increasing the level of knowledge'[20]. In addition, supporting countries abroad provides opportunities for increasing knowledge of extreme environmental conditions and situations.

2.4.2. International aspects of governance

In addition to the above-mentioned policy documents, an advisory report to the Dutch Ministry of Foreign Affairs has been published on **water diplomacy**. The report suggests that the Ministry is well-positioned to act as a **broker, a central hub and an enabler** as well as a **norm entrepreneur** in the field of water diplomacy.

The Netherlands' presence in the world as a source of expertise in water management emerges from **different narratives** as its starting points. On the one hand, there is the **developmental perspective,** which focuses on grand challenges and puts the Sustainable Development Goals front and centre. One official interviewed by the authors told us:

> *"The world needs to become a better place, i.e. the Sustainable Development Goals, and the Netherlands will contribute to this. […] First comes help and then trade. So, the mechanism is not that the Netherlands has to be better off and then let's see how the world fares. No, the world needs to be better off and the assumption is that, because this task is so large and the Netherlands has relevant expertise, we will also benefit."* (personal communication)

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[17] Huntjens, Patrick, et al. (2011): Adaptive Water Management and Policy Learning in a Changing Climate: A Formal Comparative Analysis of Eight Water Management Regimes in Europe, Africa and Asia. In: Environmental Policy and Governance 21, no. 3.

[18] Ministerie van Verkeer en Waterstaat, Ministerie van Volkshuisvesting Ruimtelijke Ordening en Milieubeheer, and Ministerie van Landbouw Natuur en Voedselkwaliteit (2009): Nationaal Waterplan 2009-2015. Den Haag: MinVenW.; Ministerie van Infrastructuur en Milieu and Ministerie van Economische Zaken Landbouw en Innovatie (2017): Deltaprogramma 2018: Doorwerken Aan Een Duurzame En Veilige Delta. The Hague: MinIenM.

[19] Ministerie van Infrastructuur en Milieu (2012): Deltaprogramma 2013: Werk Aan De Delta. De Weg Naar Deltabeslissingen. The Hague: MinIenM.

[20] Ministerie van Infrastructuur en Milieu (2016): Synergos Communicatie, Internationale Waterambitie. Den Haag: Ministerie van Infrastructuur en Milieu, p. 9.

This narrative is most apparent in the inter-ministerially produced International Water Ambition, which aims for the Netherlands to take an active, preventive approach towards water security. Of course, Dutch businesses may in the end profit from the government's efforts to promote more integrated water management approaches at home and abroad, but they are not the priority in this narrative. There is a second, different narrative, in which **contributing to the Dutch economy** is the prime objective. An expression that appears in this context is 'BV Nederland'. 'BV' is the Dutch abbreviation for a private limited liability company. Framing the Netherlands as 'the Netherlands, Ltd.' emphasizes what technological leadership can bring to economic growth. Focusing on benefits to society at home and abroad is seen as just a different way of doing the same thing, i.e. it is window-dressing for the real goal. The Dutch approach to transferring its water management knowledge internationally is therefore marked by a dialectic between achieving global sustainable development objectives and supporting the national economy. One of our interviewees said:

> *"It is good that societal challenges are included in economic policy, […] because money is not a remedy for everything and it does not always bring happiness. Conversely, it should be allowed to earn money with the solutions to environmental problems we find: circular economy, smart cities, etc. Netherlands Ltd., the knowledge economy of the Netherlands should surely profit from that."* (personal communication)

In practice, the above two narratives are not as clear-cut as we present them here. For example, the Netherlands' Water Envoy's work is sometimes characterized as 'economic diplomacy'[21], even though it epitomises the strong focus on international development of the first narrative. Both narratives about the reasons for the Dutch presence in world water management are reflected in practice. The developmental perspective is the most common approach taken by the media and is the basis of the work of the Dutch special Water Envoy (see below). Travelling the world and advising governments worldwide, the Envoy aims to contribute to putting the Sustainable Development Goals into practice in order to achieve 'the necessary transformation towards a world that is sustainable, inclusive and climate-proof'[22]. That is the objective of the Netherlands' **strategic agenda** for water management, as described in *The Geography of Future Water Challenges*[23]*.* The Netherlands assistance to Bangladesh in the development of a plan for the Ganges River delta, the "Bangladesh Deltaplan 2100" illustrates the developmental approach[24]. The second narrative is reflected in the work of various attachés from Dutch ministries, including attachés from the Ministry for Infrastructure and Water Management, development cooperation specialists and the **innovation attachés** of the Ministry of Economic Affairs. One of the latter ministry's tasks is connecting Dutch companies with foreign companies.

3. UK Water Management and Water Diplomacy

Unlike countries that suffer from water scarcity or that are faced with the challenge of sharing their water resources, the UK is relatively autonomous in terms of its water environment and its governance. The UK's island geography means that it does not share

[21] Ministerie van Binnenlandse Zaken en Koninkrijksrelaties (2015): Henk Ovink benoemd tot Nederlands eerste Watergezant. Retrieved from: https://www.algemenebestuursdienst.nl/actueel/nieuws/2015/03/12/henk-ovink-watergezant as accessed 4 July 2019.

[22] Ligtvoet, Willem, et al. (2018): The Geography of Future Water Challenges. The Hague: PBL Netherlands Environmental Assessment Agency, p. 7.

[23] Ibid.

[24] Ministerie van Infrastructuur en Milieu and Ministerie van Economische Zaken (2016): Deltaprogramma 2017: Werk Aan De Delta. Opgaven Verbinden, Samen Op Koers. The Hague: MinIenM.

any freshwater resources with other countries, except along its border with the Republic of Ireland. The UK does, however, have a rich history of water management as a domestic concern. Its interest in international water management issues is growing as a part of its commitment to international development and foreign affairs. Moreover, the UK is not immune to the growing threats and challenges to water management brought about by climate change and thus rising sea levels as well as increased urbanisation.

3.1. Governance and the background of the case

3.1.1. Water management as a domestic issue

As in most countries, effective management of water is an important concern in the UK. Water management is generally understood as a domestic concern and includes the management of water resources for environmental, agricultural and industrial uses, the control of flooding, the supply of water and the treatment of sewage. The history of domestic water management in the UK largely mirrors changes in government and governance more generally[25].Briefly summarised, UK water management was a heavily decentralised and ad-hoc activity before and during World War II[26]. There followed a period of national consolidation and enactment of legislation including a series of 'Water Acts' that defined relationships and responsibilities with regard to water. Regulations were issued to control pollution and consumer prices. Eventually the supplying of water was privatised in the 1980s[27]. At that time, a number of private water companies took over responsibility for all provision of services and a government agency—now called the **Environment Agency**—was established to regulate the environmental impact of the water supply industry[28].Water management in the UK is still decentralised. Policies are different in England, Scotland, Wales and Northern Ireland. This report focuses on the details of domestic water management in England only. The most recent government policy document on water management focuses on enhancing competition, improving conservation, and ensuring that water companies are more efficient and customer-focused[29]. The UK's planned departure from the EU means that the UK will no longer be subject to EU directives on water management. There is therefore a lot of uncertainty about the future development of water management in the UK.

3.1.2. Water management as a foreign policy issue

The UK is an island nation. It therefore avoids many of the disputes that can arise from shared water systems, such as boundary rivers and lakes[30]. However, water management is still a foreign policy issue for the UK in a number of respects. First, the UK has been party to the EU treaties and has therefore had a role in negotiating and implementing EU

[25] Royal Geographical Society (with IBG) (2012): Water policy in the UK: The challenges. RGS-IBG Policy Briefing, p 13, Retrieved from: https://www.rgs.org/getattachment/Professionals/Policy/RGSIBGPolicyDocumentWater_732pp.pdf/?lang=en-GB

[26] HM Government (2006): The development of the water industry in England and Wales. Ofwat and Defra. Retrieved from: https://www.ofwat.gov.uk/wp-content/uploads/2015/11/rpt_com_devwatindust270106.pdf

[27] Ibid.

[28] Ibid.

[29] Royal Geographical Society (with IBG) (2012): Water policy in the UK: The challenges. RGS-IBG Policy Briefing, p 13, Retrieved from: https://www.rgs.org/getattachment/Professionals/Policy/RGSIBGPolicyDocumentWater_732pp.pdf/?lang=en-GB

[30] Susskind, Lawrence, Shafiqul Islam (2012): Water Diplomacy: Creating Value and Building Trust in Transboundary Water Negotiations. In: Science & Diplomacy. 1, no. 3, Retrieved from: http://www.sciencediplomacy.org/perspective/2012/water-diplomacy

directives related to water. Since its membership of the European Community in the 1970s, the UK has been involved in the development and implementation of a growing body of water management standards across the continent[31]. Second, the UK gains from the exchange of experience and expertise in water management through collaborative research and commercial partnerships with other countries. Third, the UK has made commitments and contributions to water management in other countries as part of its programs of international development and overseas aid. The UK government sees water security and sanitation initiatives as a valuable way to contribute to global security and development. Water issues are also being viewed in a 'nexus' of issues along with food and energy issues, which has been described by the former UK chief scientist as a 'perfect storm of global events'[32]. Fourth, the UK cannot avoid the impacts of transnational issues such as the impact of climate change on water management. Such global issues can have domestic consequences, such as shifting rain patterns, but often require international collaborations to respond to them.

Finally, the sustainable development agenda is raising important questions about equity in the distribution of resources.

3.1.3. Water Science and the UK

The importance of science to the issue of water management is abundantly clear. In the UK, increased scientific understanding of water management issues is a key priority for investment into research[33]. The UK's vision of the future is that it will 'be a key contributor in providing integrated solutions in water security and sustainability'[34] not only in its domestic market but also on international markets, making use of the full potential of UK companies and public bodies in water research and innovation[35]. The contributions of the UK can also include the social, political and economic expertise that the UK has in water management, in particular the management of flood risk. The scientific knowledge that can be considered relevant for science diplomacy in the area of water management extends beyond the biophysical and the technical sciences, similar to the Netherlands. Scholars of social, economic and political science are becoming involved in the production of evidence reviews on issues related to water management, such as flood resilience[36] and flood risk[37].

3.2. Stakeholder landscape

3.2.1. National domestic policies

In the UK, government policy is set out by periodic white papers, which are government documents that define the future direction that the government would like to take on

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[31] HM Government (2006): The development of the water industry in England and Wales. Ofwat and Defra. Retrieved from: https://www.ofwat.gov.uk/wp-content/uploads/2015/11/rpt_com_devwatindust270106.pdf

[32] Beddington, John (2009): Food, energy, water and the climate: A perfect storm of global events? HM Government. Retrieved from: https://webarchive.nationalarchives.gov.uk/20121206120858/http://www.bis.gov.uk/assets/goscience/docs/p/perfect-storm-paper.pdf

[33] NERC (2019): Water. Retrieved from: https://nerc.ukri.org/innovation/activities/infrastructure/water/

[34] NERC (2010): Taking Responsibility for Water: United Kingdom Water Research and Innovation Framework 2011 – 2030. Retrieved from: https://nerc.ukri.org/research/partnerships/ride/lwec/ukwrip/

[35] Ibid, p. 34.

[36] HM Government (2016): National Flood Resilience Review. Retrieved from: https://www.gov.uk/government/publications/national-flood-resilience-review

[37] HM Government (2018): Research and analysis: Science Advisory Council: Communicating risk report. Retrieved from: https://www.gov.uk/government/publications/science-advisory-council-communicating-risk-report

issues. National strategies for water management were recently set out in a white paper entitled *Water for Life*[38], and a white paper prepared under a Labour government entitled *Future Water — The Government's water strategy for England*[39]. The governments of Scotland, Wales and Northern Ireland each generate and implement their own policy agendas[40]. Over time, the **UK Government** has legislated the policy through acts of Parliament, secondary legislation and guidance that it provides to water regulators. **Water regulators** are independent bodies established to regulate the activities of the water industry. They include the Environment Agency, the Drinking Water Inspectorate and the Office of Water Services[41]. The **water industry** has played a central role in defining the direction for development of UK water management. In addition to government white papers, a manifesto published by the water industry in 2018 set out their vision for the UK water sector into the 2020s[42]. The legal system, including the **UK courts**, are responsible for enforcing government policy. A number of **UK non-governmental organisations,** e.g., the Rivers Trust, the Wildlife Trust, and the Freshwater Habitats Trust, also have a role in the governance of water management[43].

3.2.2. UK foreign policies

The UK government has a number of departments that deal with foreign policy issues. Each of them plays a different role in foreign policy related to water management. Water management is not listed as a core part of UK Foreign and Commonwealth Office (FCO) policy in its 'single departmental plan.'[44] However, the FCO does contribute to water-related activities through the government's broader international development work, which focuses on promoting sustainable global growth, human rights, mitigation of the effects of climate change and prevention of conflicts[45]. Disputes over water resources are well recognised by the UK government as a source of conflict. This recognition has underpinned investment by the **UK Department for International Development** (DFID) in activities for improving water quality and quantity in other countries. Its most recent policy paper on water and sanitation in developing countries was prepared in 2013.[46] This paper described the UK government's response to water and sanitation as part of its commitment to the Millennium Development Goals (MDGs). DFID funds a range of activities, including

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[38] HM Government (2011): Water for life. Retrieved from: https://www.gov.uk/government/publications/water-for-life

[39] HM Government (2008): Future Water: The Government's water strategy for England. Retrieved from: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/69346/pb13562-future-water-080204.pdf

[40] Scottish Government (2019): Water. Retrieved from: https://www.gov.scot/policies/water/; Natural Resources Wales (2019): Water resources management planning. Retrieved from: https://naturalresources.wales/about-us/what-we-do/water/water-resource-management-planning/?lang=en as accessed March 2019.

[41] HM Government (2006): The development of the water industry in England and Wales. Ofwat and Defra. Retrieved from: https://www.ofwat.gov.uk/wp-content/uploads/2015/11/rpt_com_devwatindust270106.pdf

[42] Water UK (2018): A Manifesto for Water. Retrieved from: http://www.water.org.uk/publication/a-manifesto-for-water/

[43] Waterwise: What we do. Retrieved from: https://www.waterwise.org.uk/what-we-do/ as accessed March 2019.

[44] HM Government (2018): Foreign and Commonwealth Office single departmental plan. Retrieved from: https://www.gov.uk/government/publications/foreign-and-commonwealth-office-single-departmental-plan/foreign-and-commonwealth-office-single-departmental-plan-may-2018

[45] HM Government: Foreign and Commonwealth Office. Retrieved from: https://www.gov.uk/government/organisations/foreign-commonwealth-office as accessed July 2019.

[46] HM Government (2015): 2010 to 2015 government policy: water and sanitation in developing countries. Retrieved from: https://www.gov.uk/government/publications/2010-to-2015-government-policy-water-and-sanitation-in-developing-countries/2010-to-2015-government-policy-water-and-sanitation-in-developing-countries

initiatives by research organisations, civil society organisations, and other bodies such as the **World Bank.** These projects also support the international development objectives of the UK government. In 2012, for example, DFID made a commitment to assist 60 million people through its water, sanitation and hygiene (WASH) programmes by December 2015[47]. Investment in such projects is ongoing.[48] The **Department for International Trade** (DIT) has the role of helping UK-based companies succeed in the global economy[49] and take advantage of the commercial opportunities in international water management. As recently as 2015, the DIT identified the UK's offering of expertise in water management as a potential priority for support[50].

The FCO collaborates with the **Department for Business, Energy and Industrial Strategy** (BEIS) to build partnerships and cooperation in science and innovation through its **UK Science and Innovation Network**. This network employs 110 officers in over 40 countries who work in a set of priority areas.[51] Water management does not feature as a formal priority for the network, but it is still recognised informally as an important issue worthy of attention. For example, the Science and Innovation Network co-organised a conference in South Africa in 2015 called 'Emerging Frontiers for Sustainable Water — A Trilateral Partnership: Africa-India-UK', which focused on sharing lessons learned in the science and policy of water management.[52]

3.2.3. Public and private sector collaborations

One important governance arrangement for water management in the UK is partnerships between public bodies and private organisations. The **UK Water Partnership**[53] is an example, where private industry, government agencies and research organisations collaborate to develop solutions and provide advisory services for managing water-related issues. Private companies participate in designing and implementing strategies for water management, often in collaboration with other industrial partners, public bodies, and local communities. Similar governance organisations are also found at the European level, such as the **European Water Partnership.**[54] These organisations add another dimension of private interest to the foreign policy goals of countries as related to water management. They also illustrate how the technical and economic expertise of scientists can contribute to issues of water management.

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[47] HM Government (2015): DFID Annual Report and Accounts 2014-15 Results: Water, sanitation and hygiene sector. Retrieved from: https://www.gov.uk/government/publications/dfid-annual-report-and-accounts-2014-15-results-achieved-by-sector-water-sanitation-and-hygiene/dfid-annual-report-and-accounts-2014-15-results-water-sanitation-and-hygiene-sector

[48] In December 2018, for example, DFID made a contribution of up to £18 million to a World Bank initiative to support the Palestinian Authority to implement priority activities in the water and energy sectors. See World Bank (2018): United Kingdom Contributes Up to US$23 Million Through the World Bank for Palestinian Water and Energy Projects. Retrieved from: https://www.worldbank.org/en/news/press-release/2018/12/10/united-kingdom-joins-the-palestinian-partnership-for-infrastructure-development-a-contribution-of-up-to-us-23-million-for-improving-water-and-energy-services

[49] HM Government (2015): Water and treated water. Retrieved from: https://www.gov.uk/government/publications/water-and-treated-water/water-and-treated-water

[50] Ibid.

[51] HM Government: UK Science and Innovation Network. Retrieved from: https://www.gov.uk/world/organisations/uk-science-and-innovation-network as accessed March 2019.

[52] Sunil Kumar (2015): Innovations for a clean water. In: UK Foreign and Commonwealth Office Blogs. Retrieved from: https://blogs.fco.gov.uk/sunilkumar/2015/08/31/innovations-for-a-clean-water/

[53] UK Water Partnership: Members. Retrieved from: https://www.theukwaterpartnership.org/members/ as accessed March 2019.

[54] European Water Partnership: Home. Retrieved from: https://www.ewp.eu as accessed March 2019.

3.2.4. Research collaboration

As regards water-related technologies and management, the UK is an active participant in **international research programmes**, which include scientific collaborations across borders. One example is the International Water Stewardship Programme (IWaSP), which is co-funded by DFID in association with the German Gesellschaft für Internationale Zusammenarbeit (GIZ). IWaSP is a water security programme operating in Africa, Asia and the Caribbean. It establishes partnerships between the public sector, the private sector and civil society in order to build local capacities for water management.[55]

In addition to its commercial potential and its ability to contribute to international development agendas, UK water science contributes to the development and implementation of policy in the UK and at the EU level. UK scientists have provided **scientific advice and support** to the implementation of the EU's Water Framework Directive (WFD,)[56] for example, through the Working Group on Ecological Status (Ecostat) mandated by the WFD's Common Implementation Strategy[57]. UK water science is also contributing to scientific collaboration in the European Research Area through EU joint programming initiatives, such as "Water Challenges for a Changing World" (JPI Water). JPI Water involves the UK, the Netherlands, the Czech Republic, and other EU Member States, as well as international partners such as Brazil and South Africa.[58]

3.2.5. Informal inter-state relations

In addition to its formal foreign policy activities in the area of water management, the UK also has many informal inter-state relations. A particularly notable example is the relationship between the UK and the Netherlands in the area of water management infrastructure and expertise. Policymakers in the UK have an active interest in the work of the Netherlands in the field because of the Netherlands' recognised achievements in managing challenges similar to those faced by the UK in terms of the risks and impacts of flooding and coastal erosion. In 2016, for example, a number of **members of the UK Parliament** visited the Netherlands in order to meet with the Delta Programme Commissioner and better understand the work that office is doing in water management.[59] The UK's Environment Agency has also forged active links with the Netherlands in order to share expertise and learn from its experience with coastal and flood risk management.[60] The Netherlands is also a common standard of reference for UK scientific research and advice with regards to water management. A recent review of flood management in the UK by the Cabinet Office, the **Department for Environment, Food and Rural Affairs** (Defra), the Environment Agency, the **Met Office**, and the government's **Chief Scientist,** entitled the *National Flood Resilience Review*[61], made 60 references to the Netherlands

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[55] IWaSP: Who we are. Retrieved from: http://www.iwasp.org/who-we-are as accessed March 2019.

[56] European Union (2000): Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy. Retrieved from: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32000L0060

[57] European Commission (2015): Water Framework Directive scientific and technical support related to ecological status - summary report of JRC activities in 2015. Retrieved from: https://ec.europa.eu/jrc/en/publication/water-framework-directive-scientific-and-technical-support-related-ecological-status-summary-report

[58] Water JPI: About Water JPI. Retrieved from: http://www.waterjpi.eu/about-us as accessed March 2019.

[59] Delta Programme Commissioner (2016): United Kingdom interested in Dutch approach to water. Retrieved from: https://english.deltacommissaris.nl/news/news/2016/06/09/united-kingdom-interested-in-dutch-approach-to-water

[60] Boyd, Emma Howard (2017): The Netherlands and why partnership matters in flood risk management. In: Gov.UK Blog. Retrieved from: https://environmentagency.blog.gov.uk/2017/08/07/the-netherlands-and-why-partnership-matters-in-flood-risk-management/

[61] HM Government (2016): National Flood Resilience Review. Retrieved from: https://www.gov.uk/government/publications/national-flood-resilience-review

throughout. Despite its active interest in developments in other countries, the UK has its own environmental dynamic and political culture that drive its water management policies. These can be understood by examining its de-facto governance practices.

3.3. De-facto governance practices

As the above outline of the stakeholder landscape illustrates, water management in the UK is managed with reference to a diverse set of governance arrangements. There is no single 'top down', 'bottom up' or 'market-based' governance framework for water management, either domestically or as a foreign policy issue. Indeed, the domestic, foreign, and scientific dimensions of water management reflect the how complex modern governance is in any national setting. While the UK government has a role in setting priorities and creating the overall policy environment, businesses, civil society and the changing environment itself also have decisive influences on the UK's system of governance for water management.

The scientific dimension influences the entire governance system. In some cases, such as establishing and monitoring standards to be mandated by EU directives, the role of science is clear. Scientific expertise significantly contributes to cooperation between public and private sector bodies as well.

For the purposes of this report, it is important to discuss the nature of diplomacy with respect to water governance. The 'tools of water diplomacy' are described by Maruf Oladotun Orewole as negotiation, co-operation, conventions, treaties, agreements, and scientific and technical knowledge[62].

In contrast to countries with significant transboundary water systems, where **negotiation** is a very important tool of water diplomacy,[63] the UK's international negotiations in the area of water management is mostly limited to its work as a member state of the European Union and as a signer of the other international conventions related to water management.

Despite its lack of transboundary waters, the UK has invested significantly in international development and scientific research pursuant to programs such as IWaSP. Similarly, the UK has been active in the development and implementation of relevant **conventions, treaties and agreements**. These instruments have directly shaped UK domestic policy in the form of EU directives, but have also been important to defining the UK's foreign assistance goals as implemented by DFID and other agencies.

Diffusing scientific and technical knowledge is one of the major focuses of the UK's water diplomacy. The UK is an active participant in many international science projects. It contributes scientific advice to the EU Commission on monitoring water standards and works with its partners abroad to improve water security. It donates and sells scientific and technical experience and expertise across borders in the service of UK policy priorities. The UK's scientific and technical knowledge plays a hugely important role in improving water management beyond its national jurisdiction.

In addition to the previously mentioned tools of water diplomacy, the case of the UK highlights two other pertinent ways the UK engages in water diplomacy: 'adaptation' and 'relation'.

Adaptation refers to the adaptation of scientific knowledge, technical solutions, people and problem solving to different social and political cultures. For example, the scientific

[62] Orewole, Maruf Oladotun (2018): Water diplomacy: Solving the equations of conflict, economic growth, social well-being and ecosystem demand. In: IM. Mujtaba, T. Majozi, MK. Amosa (eds.) Water Management: Social and Technological Perspectives. 1st ed. Boca Raton: CRC Press.

[63] Susskind, Lawrence, Shafiqul Islam (2012): Water Diplomacy: Creating Value and Building Trust in Transboundary Water Negotiations. In: Science & Diplomacy. 1, no. 3, Retrieved from: http://www.sciencediplomacy.org/perspective/2012/water-diplomacy

and technological tools developed in the Netherlands must be adapted before they can be applied in the UK.

The translation of scientific knowledge, technical solutions, people and problem framings from one country to another raises important issues with regards to governance. It is important to take into account, for example, the differing understanding of risk in between various national settings[64] and differences in fluvial environments[65]. Adaptation of science and technology, along with the other things, is a tool that should be employed in water-related diplomatic activities.

The UK case also highlights the value of **relations** as a resource for water governance. Of particular note is the relationship that has long existed between the Netherlands and the UK with regard to water management. The draining of the English Fens in the seventeenth century, for example, was a historical illustration of effective international collaboration and partnership. The Fens are low-lying marshlands in the east of England that historically were subject to seasonal flooding. The Fens supported a vibrant ecosystem and a traditional way of life[66]. In the early seventeenth century, technological developments and the economic advantages of draining this area for agriculture led to a series of major changes in the landscape. Drawing on the experience and expertise of the Dutch, major UK landholders — including King Charles I himself — invested in a major feat of engineering. They installed dikes, sluices, pumps and windmills, and thereby channelled excess water off the land and out to sea[67]. The process depended heavily on the international relationship between the Dutch and the English. Connections between the nobility in the two countries, well-developed trade in goods, and technical traditions[68] facilitated the transfer and acceptance of Dutch technologies. The trust and mutual respect between the two countries was essential to success of the project. That trust and respect continues today, as evidenced by a recent visit by a parliamentary delegation to observe the Delta Programme and by Dutch cooperation with the UK Environment Agency.

4. Water Management and Water Diplomacy in the Czech Republic

Due to its inland position, Czech water management efforts are focused on the quality and supply of fresh water. Lately there has been an increase in interest in water-related issues, especially drought prevention and mitigation of its effects, water sanitation (including control of hormones and pharmaceutics in waters), and precision farming.[69] This interest has been translated into specific research projects, marketing of excellence strategies, and new diplomatic tools that have been put in practice after 2000.

[64] Ale, Ben (2005): Tolerable or Acceptable: A Comparison of Risk Regulation in the United Kingdom and in the Netherlands. In: *Risk Analysis.* Vol. 25, no. 2, pp. 231-241, Retrieved from: https://onlinelibrary.wiley.com/doi/epdf/10.1111/j.1539-6924.2005.00585.x

[65] Ertsen, Maurits (2015): People, protection and parameters: Comparing flooding in the UK and the Netherlands. lecture delivered at Museum of London for Gresham College, London, 13 January 2015. Retrieved from: https://www.gresham.ac.uk/lectures-and-events/people-protection-and-parameters-comparing-flooding-in-the-uk-and-the

[66] Merchant, Carolyn (1983): Hydraulic technologies and the agricultural transformation of the English fens. In: Environmental Review*.* Vol. 7, no. 2, pp. 165-178.

[67] Ibid.

[68] Wilson, Charles (1946): Holland and Britain. London: Collins.; Jardine, Lisa (2008): Going Dutch: How England Plundered Holland's Glory. Harper Press.

[69] Interview 1, Czech University of Life Sciences Prague, Prague, December 2018.

4.1. Governance and water policy in the Czech Republic

The transition period in the 1990s after the fall of the Iron Curtain was crucial for Czech water management. With the assistance of experts from Western European countries such as the Netherlands, France and Germany, the Czech Republic's outdated water infrastructure was reconstructed to ensure adequate sanitation. The objective was to build a water supply and sanitation system that met international environmental standards. The biggest problem then identified in the Czech Republic was the lack of rational economic water management, which was a heritage of the communist era[70]. Waterworks and sewage companies were privatized and eleven state-owned companies were split into 40 associations controlled by municipalities and private companies[71]. In addition, during the 1990s a transboundary framework for shared water resources in Central Europe was developed, providing a basis for today's cooperation. During the 1990s and at the beginning of the 21st century, improving water sanitation and building up cross-border water cooperation dominated Czech governance activities in the field. After establishing a sustainable UNECE water framework and infrastructure for water supplies, Czech officials started to deal with other topics in the water agenda, such as flood control[72] and more recently with drought[73]. Their efforts are reflected in domestic legislation enacted to comply with the EU Water Framework Directive[74].

The main drawback of Czech water management and its water diplomacy is that its great potential in the scientific domain is not backed up or used by its diplomats to its full extent. If it were, it would serve the Czech Republic's foreign policy goals and help it to face global challenges. The scientific and foreign policy worlds are still two separate domains. Science diplomacy is a new element in Czech foreign policy and has many uncertainties about how to organise it and set priorities.

4.1.1. Water management as a domestic issue

The number one domestic issue related to water is drought, which is a threat to the domestic economy and agriculture. Fighting the effects of drought is an official priority of the current Minister of Environment, who has held the post since 2014. The Ministry of Environment, in cooperation with the T.G. Masaryk Water Research Institute, established a working group (DROUGHT) in 2014 that has since been joined with another working group (WATER) set up by the Ministry of Agriculture and the Research Institute for Soil and Water Conservation. The aim of the inter-department commission WATER-DROUGHT is to take the know-how of flood prevention and management that has resulted from flood control being the main topic of Czech water management for the last 20 years and apply it to a new challenge in the Czech Republic, the increasing water scarcity. The collaboration

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70 Ministry of Housing, Physical Planning and Environment of the Netherlands (1994): Water Supply and Sanitation in Bulgaria, the Czech Republic, Romania and the Slovak Republic. pp. 28-9, Retrieved from: https://www.ircwash.org/sites/default/files/821-EUREAST94-14809.pdf as accessed 10 May 2019.

71 Transparency International (2011): Privatizace vodárenství v České republice: Kam odtékají zisky. p. 5, Retrieved from: https://www.transparency.cz/wp-content/uploads/TIC_vodarenstvi_cz.pdf as accessed 10 May 2019.

72 E. g., Ministerstvo zemědělství ČR (2000): Strategie ochrany před povodněmi pro území České republiky. Retrieved from: http://eagri.cz/public/web/file/365715/Strategie_ochrany_pred_povodnemi.pdf as accessed 29 April 2019. ; Výzkumný ústav vodohospodářský T. G. Masaryka (2015): Strategie ochrany před negativními dopady povodní a erozními jevy přírodě blízkým opatřeními v České republice. Retrieved from: http://www.vodavkrajine.cz/sites/default/files/vystup/informace_o_vysledcich_projektu_a_jejich_vyuziti.pdf as accessed 9 May 2019.

73 Meziresortní komise VODA-SUCHO (2016): Koncepce ochrany před následky sucha pro území České republiky. Retrieved from: http://www.suchovkrajine.cz/sites/default/files/podklad/koncepce_sucho.pdf

74 European Union (2000): Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy. Retrieved from: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32000L0060

of the ministries, research institutions and NGOs[75] that are members of the commissions has led to the publication of documents proposing a range of measures for retaining water in the soil and developing water resources for agriculture. The main strategic document is called the *Conception of Protection against the Consequences of Drought for the Czech Republic*[76]. It was adopted by the Czech government in 2017[77]. However, few of the proposals in the document have so far been implemented[78].

Because most Czechs own country houses and grow vegetables and plants in their gardens, drought is not only a concern for government, agriculture, and industry, but is also a concern for almost every citizen. It has been used as an issue in political campaigns. Even though the list of water management topics that impact the Czech Republic is a long one, drought is the only issue perceived as a real problem for society by the media and the public. The other topics are reserved to experts, scientists and politicians.

4.1.2. Czech water diplomacy

One of the strengths of Czech science diplomacy is its use of public diplomacy. The Czech Republic is a small country and its international prestige is maximized by efficient use of branding strategies and public diplomacy instruments. Czech water diplomacy is not guided by a specific conceptual document (nor does the latest version of the main conceptual foreign policy document explicitly mention science or water diplomacy[79]). Still, Czech know-how in water-related research and innovation has become an integral feature of the part of many state PR campaigns. The government promotes the Czech Republic as the 'nano' country'[80], for instance, and will display its S.A.W.E.R. system for producing drinking water at the Czech pavilion at EXPO 2020 in Dubai[81].

The crucial task for Czech science diplomacy in general, and in its water diplomacy in particular, is shifting the perception of the Czech Republic from being a receiving country for technology transfer to that of a donor. The Czech Republic is a new member of the European Union and has been the receiving partner in many twinning projects. It has not structured its international technological strategy around an active approach to using its considerable technological expertise in the international context. There are many 'niches' in water management where the Czech Republic could contribute to high quality science diplomacy projects as a technological leader, projects that would better market its innovation, science and technology potential to the world. An example is the use of nanotechnology in water sanitation.

The Czech Republic is not especially active in international organizations (including UN organizations and agencies) that engage experts and scientists. For instance, the Czech

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[75] More information about members of the commission WATER-DROUGHTS are available at Meziresortní komise VODA-SUCHO: Seznam členů komise. Retrieved from: http://www.suchovkrajine.cz/sites/default/files/podklad/seznam_clenu_komise.pdf as accessed 14 May 2019.

[76] Meziresortní komise VODA-SUCHO: Koncepce ochrany před následky sucha pro území České republiky.

[77] Meziresortní komise VODA-SUCHO: O meziresortní komisi VODA-SUCHO. Retrieved from: http://www.suchovkrajine.cz/komise-voda-sucho/komise as accessed 14 May 2019.

[78] More information are available at Meziresortní komise VODA-SUCHO (2019): Poziční zpráva o pokroku při plnění koncepce ochrany před následky sucha pro území České republiky za rok 2018. Retrieved from: http://www.suchovkrajine.cz/sites/default/files/podklad/pozicni_zprava_2018.pdf

[79] Ministerstvo zahraniční věcí ČR (2015): Koncepce české zahraniční politiky. Retrieved from: https://www.mzv.cz/jnp/cz/zahranicni_vztahy/analyzy_a_koncepce/koncepce_zahranicni_politiky_cr.html

[80] See for instance Czech Invest: Nanotechnology & Advanced Materials. Retrieved from: https://www.czechinvest.org/en/Keysectors/Nanotechnology

[81] The technological element of the Czech national exhibition in Dubai 2020 is a joint project of the Czech Academy of Sciences and Czech Technical University (CTU), more details available at: Expo 2020: Water created by the S.A.W.E.R. system is drinkable. Retrieved from: https://www.czexpo.com/en/news/6/water-created-by-the-sawer-system-is-drinkable

Republic still perceives UNESCO only as a cultural organization[82]. This limited perspective, and a lack of involvement by Czech experts and officials in the organization, reduces the Czech Republic's opportunities to participate in international projects and lowers its national influence over debates and the international agenda in the field of water management.

For Czech diplomacy now, water management is important mostly in the context of managing transboundary waters. The Czech Republic is a riparian state that hosts a number of essential European rivers, such as the Elbe, Danube and Oder rivers and their basins. Cross-boundary water cooperation is based on joint international commissions that deal with the technical aspects of water protection, such as reducing water contamination, ensuring balance in the water ecosystem and protecting drinking water sources. This cooperation enhances compliance with the EU Water Framework Directive[83] and the UNECE Convention on the Protection and Use of Transboundary Watercourses and International Lakes[84]. Cooperation on management of river basins is a shared priority of the Visegrad Four countries (the Czech Republic, Slovakia, Hungary, and Poland). The Czech Republic's bilateral relations also play an important role in its international water cooperation. Apart from neighbouring states, with which the Czech Republic has numerous bilateral and multilateral agreements relating to shared water resources[85], Israel is the Czech Republic's main partner and source of inspiration for water management strategies[86].

Czech water diplomacy has a development policy aspect. The *Development Cooperation Strategy of the Czech Republic 2018-2030*[87] stresses water supply and water resource protection as two of its main targets for development aid. Czech scientists have transferred their knowledge about water sanitation, in particular about cleaning water contaminated by chemicals and heavy metals like chromium using nanotechnology, to partners abroad[88]. Moreover, the Czech Republic has been involved in educational activities for water treatment in developing countries. In that regard, Czech scientists have long been engaged in Nepal. Nevertheless, the sharing of Czech know-how with developing countries is based on individual research projects for which scientists must search for financial and diplomatic support on a case-by-case basis. Therefore, the range of Czech actors in development assistance, which includes the Czech Development Agency, the Ministry of Education, Youth and Sports, various NGOs, and private companies, is poorly integrated. There is a huge gap between the scientific and the foreign policy domains[89].

4.2. Stakeholder landscape

The stakeholder landscape in the area of water management and water diplomacy is very heterogeneous and unstable. The two areas can be described as 'evolving'. A common

[82] Interviews, UNESCO, Prague, December, 2019.

[83] European Union (2000): Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy. Retrieved from: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32000L0060

[84] Ministerstvo životního prostředí ČR (2013): Mezinárodní spolupráce České republiky v ochraně vod. Retrieved from: https://www.mzp.cz/C1257458002F0DC7/cz/mezinarodni_spoluprace/$FILE/OOV-brozura_mezinarodni_spoluprace-20131003.pdf

[85] Ibid.

[86] Siegel, Seth (2017): Budiž voda: Izraelská inspirace pro svět ohrožený nedostatkem vody. Praha: Aligier.

[87] Ministerstvo zahraničních věcí ČR (2017): Strategie rozvojové zahraniční spolupráce České republiky 2018-2030. Retrieved from: https://www.mzv.cz/file/2583329/strategie_mzv_2017_A4_09.pdf

[88] Rozvojovka (2013): Zázračná voda „z Česka" léčí, čistí i zvětšuje plody ovoce. Retrieved from: http://www.rozvojovka.cz/clanky/1317-zazracna-voda-z-ceska-leci-cisti-i-zvetsuje-plody-ovoce.htm as accessed 16 May 2019.; Akademie věd ČR (2012): Nanocentrum spojuje věd s praxí. In: Akademický bulletin. Retrieved from: http://abicko.avcr.cz/2012/10/06/nanocentrum.html as accessed 16 May 2019.

[89] Interview 1, Czech University of Life Sciences Prague, Prague, December 2018.

remark made by the numerous people we interviewed for purposes of this research was that there are no fixed priorities, processes, or strategies. They also saw no connection between domestic mechanisms for cooperation between Czech national and regional actors (in the fields of both science and administration) and the Czech Republic's foreign policy[90]. Foreign Ministry officials and representatives of the Office of the Government hesitate about where to place science diplomats (including those interested in water diplomacy) and what institution should be the one mainly responsible and the 'owner' of a project. At the same time, the Czech Republic's activities in the domain of science and water diplomacy show a high degree of personal involvement and enthusiasm flexibility and creativity.

The **national foreign policy actors** include several ministries (mainly the Ministry of Agriculture, Ministry of Environment, Ministry of Education and Ministry of Foreign Affairs)[91]. There is no central coordinating body that controls the goals and use of science diplomacy. There is no clear definition of science diplomacy at the national level or mechanism for sharing best practices. The Office of the Government has been given special competence in the Czech Republic's research and innovation agenda. It has formed the **Research, Development and Innovation Council (R&D&I Council)**, which is a professional and consulting body working in the field of research, experimental development and innovation[92]. The only conceptual document relative to the field of science diplomacy, the *Innovation Strategy of the Czech Republic 2019-2030*[93], was published by the Government, but it is more of a document setting the course of domestic policy than a foreign policy document.

Unlike the ever-changing internal mechanisms for coordinating the Czech Republic's science diplomacy, its international outposts involved in science diplomacy in general and water diplomacy in particular have a relatively stable position. They have two priorities. The first is representing the interests of Czech science and innovation and the second is promoting Czech science and innovation through direct contact with foreign audiences.

CZELO[94] (the Czech Liaison Office for Research, Development and Innovation) is a project of the Czech Technological Centre of the Czech Academy of Sciences (CAS). Its main purpose is to 'facilitate the integration of the Czech Republic into European cooperation in research, development and innovation'[95]. CZELO does not drive Czech foreign policy, but through its activities and networking practices it contributes to developing new mechanisms for cooperation between the worlds of diplomacy and science. However, its ambition does not extend to external EU activities. It is limited to internal EU projects.

Czech Centres are 'contributory organisation[s]' of the Ministry of Foreign Affairs of the Czech Republic, established to promote the Czech Republic abroad. The network of Czech Centres abroad is an active tool of the foreign policy of the Czech Republic in the area of public diplomacy'[96]. As of 2019, the network of Czech Centres includes 24 centres abroad based all over the world, plus the Czech House in Moscow. The Czech Centres are relevant to science diplomacy (and water diplomacy) because they are officially considered to be a tool of foreign policy and because they devote a large part of their public diplomacy activities to the promotion of Czech science, technologies and innovation. An example is

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[90] Interview, Ministry of Environment of the Czech Republic, Prague, September 2019.

[91] At the Czech Ministry of Foreign Affairs, the science diplomacy agenda falls into the domain of Economic diplomacy department and there are not special topic units at the moment (2019).

[92] More information available at Research, Development and Innovation Council: About us. Retrieved from: https://www.vyzkum.cz/Default.aspx?lang=en

[93] Research, Development and Innovation Council (2019): Innovation Strategy of the Czech Republic 2019-2030. Retrieved from: https://www.vyzkum.cz/FrontAktualita.aspx?aktualita=867990

[94] More information available at CZELO: Home. Retrieved from: https://www.czelo.cz/en

[95] Interview, CZELO, Brussels, November 2018.

[96] More information available at Czech Centres: About us. Retrieved from: http://www.czechcentres.cz/en/about-us/

the Czech Innovation Expo. There is no doubt at the central government level or the local level in the Czech Republic that the Czech Centres' promotion of science, and their work in close partnership with scientists, are integral parts of the Czech foreign policy strategy. The Science Café sessions that popularize Czech science organised by the Czech Centre in Brussels in cooperation with CZELO serve as an illustration. The Czech Centres are also a good example of balanced and open cooperation between the administrative and scientific communities of the Czech Republic.

4.3. De-facto governance practices

Government officials and diplomatic stakeholders are interconnected with scientific institutions in three dimensions: (1) calls for projects; (2) development aid; and (3) involvement in public diplomacy. Project calls are a direct link between state and scientific actors where academia is requested to fulfil certain requirements of the ministries. Their use has often been found to be problematic and projects are sometimes not realized. Project calls in the area of water management most commonly have requirements for addressing water scarcity and the retention of water in the landscape of Czech territory[97]. The WATER-DROUGHT Commission, whose members come from various ministries (although not from the Ministry of Foreign Affairs) as well as from research institutions and NGOs, is undertaking an exceptional effort to tackle water scarcity in the Czech Republic. This special case of the interconnection of scientists and politicians results from prioritization of that issue in the agenda of the Minister of Environment and from great public concern about drought.

Development aid activities have both a diplomatic and a scientific, dimension. Whereas diplomacy officially provides financial support for the Czech Republic's aid mission, experts guarantee the technical part of its activities.

Public diplomacy instruments promote Czech scientific research and facilities abroad in order to share the prestige of Czech academia. Czech research institutions and individual scientists use the Czech Centres, Czech Trade, Czech Invest and CZELO as platforms to search for international partners and economic support for their activities. Since communication among diplomatic and scientific actors in the Czech Republic is not facilitated by any official body, or by any strategic document, actors in scientific sphere use personal contacts and private channels for international cooperation and even for diplomacy. Consequently, ad hoc international cooperation is a common feature of Czech science diplomacy[98].

5. The EU – Between National and Global Governance in Water Diplomacy

5.1. Water legislation and policy

The history of the general legal framework of EU water law can be divided into three phases of European integration. Regulations first appeared during the period 1975–86 as directives were issued on diverse topics such as surface waters, bathing waters, discharges of hazardous substances in surface waters and groundwater, and particularly the quality of water for human consumption. The majority of the mentioned directives were revised in the 1990s. In addition, during the second period of time new water legislation was adopted,

[97] Interview 2, Czech University of Life Sciences, Prague, December 2018.

[98] Interview 1, Czech University of Life Sciences Prague, Prague, December 2018.; Interview, Technical University of Liberec, Prague-Liberec, December 2018.

e.g., directives on urban waste water treatment and nitrates pollution. In the third period, the 2000 Water Framework Directive (WFD)[99] was introduced in order to integrate all previous legislation related to water issues. This main water policy document was later included in the EU environmental policy defined by Articles 191-193 of the Treaty on the Functioning of the European Union (TFEU)[100] [101]. In 2007, EU water policy was broadened further by the Flood Directive[102]. The European Commission and Member State representatives have recently held a conversation about updating and reframing the EU Water Framework Directive[103].

5.2. EU water diplomacy

Apart from EU water legislation, there is a significant effort within the EU to create a complex framework for its water diplomacy. That effort started in 2013[104] when the first document dealing with the issue was published. In 2018, Council Conclusions on EU Water Diplomacy[105] were published. Other documents related the water agenda (e.g., water governance guidelines) are in preparation[106]. EU water diplomacy aims to be a pre-emptive diplomatic tool 'for peace, security and stability'[107] building upon the long-term, positive experience of water cooperation within the EU. In addition to the ambition of ensuring sustainable water supplies and water sanitation in regions of focus (e.g., Central Asia, Middle East, and Mediterranean region), EU water diplomacy is targeting one of grand challenges of the twenty-first century, water scarcity[108].

Generally, most EU Member States support the EU's ambition to become a global actor in water governance and to share best practices in water cooperation and management outside of the EU. The most active countries are those with advanced water management know-how and vast experience in water cooperation, such as the Netherlands, Finland and Slovenia[109]. Member States are also participating in platforms for sharing water management know-how with third countries, for example, Denmark, Estonia, Finland, France, the Netherlands and others are engaging in the EU-India Water Forum and the China-EU Water Platform. Member States' involvement with cooperation platforms depends not only on their expertise in water issues but also on historical ties they may have with a particular country[110].

In order to become a globally-recognised actor in water-related issues, the European Union needs to gain credibility in water governance. The EU is known for its high standards for

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[99] European Union (2000): Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy. Retrieved from: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32000L0060

[100] Ibid.

[101] European Commission: General Framework of EU Water Law: Legal basis for water policy. Retrieved from: https://www.era-comm.eu/EU_water_law/part_2/index.html as accessed 10 May 2019.

[102] European Union (2007): Directive 2007/60/EC of the European Parliament and of the Council of 23 October 2007 on the assessment and management of flood risks. Retrieved from: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32007L0060&from=EN

[103] Interview, Czech Permanent Representation to the EU, 2018.

[104] Council of the European Union (2013): Water Diplomacy – Council Conclusions. Retrieved from: http://www.europarl.europa.eu/meetdocs/2009_2014/documents/droi/dv/1407_councilconclusions_/1407_councilconclusions_en.pdf

[105] Council of the European Union (2018): Water Diplomacy – Council Conclusions. Retrieved from: http://data.consilium.europa.eu/doc/document/ST-13991-2018-INIT/en/pdf

[106] Interview, European External Action Service (EEAS), Brussels, February 2019.

[107] Council of the European Union (2018): Water Diplomacy – Council Conclusions, p. 3, Retrieved from: http://data.consilium.europa.eu/doc/document/ST-13991-2018-INIT/en/pdf

[108] Ibid.

[109] Interview, EEAS, 2019.

[110] Interview, Directorate-General for Environment (DG ENV), Brussels, February 2019.

water quality and its positive experience with cross-border cooperation within its borders, which supports its credibility and trustworthiness in the field. The European Union is preparing a revision of the Water Framework Directive in order to advance water management within the EU. The revision will include standards for recycling water and using it in agriculture. The EU Member States support advancing the EU's expertise in the water agenda[111].

5.3. Stakeholder landscape

From a science diplomacy perspective, there are two groups of stakeholders in the EU, the scientific actors and the diplomatic/political actors, who are engaged in framing EU water diplomacy. The European Union has several **platforms for water-related issues** (the Joint Programming Initiative for Water, the Water Supply and Sanitation Technology Platform (WSSTP), a European Technology Platform, and the European Innovation Partnership for Water). Diverse research institutions, universities, think tanks, private and public companies are members of these platforms. They are chosen by the European Commission, pay membership fees, and are consulted as needed. The **Directorate General for Research and Innovation** (DG RTD) communicates with experts and exchanges information with **sectoral DGs**. The communication channel between DG RTD and other DGs is hampered because the involvement of the DG RTD is seen as interference in internal sectoral political issues of the other DGs. Since sectoral DGs consult on their policies with the College of the **European Commission**, which sets priorities for EU domestic and foreign policy, and with the **European External Action Service (EEAS)**, this operational problem is one of the chief obstacles for EU water diplomacy, and its science diplomacy in general, to overcome[112].

EU Member States are also crucial players in EU water diplomacy because European water diplomacy documents were produced by the European Council. National experts play an important role in the consultation process for water issues[113]. As shown in the national subcases discussed above, Dutch professionals are well-known for their expertise in advanced technologies and their know-how in the field. However, other national experts are also involved, e.g., a Czech expert participated in the special committee that prepared the Nitrates Directive[114]. Member States engage in an EU water dialogue with third countries, e.g. with India, China, and Israel, where their bilateral relationship with a particular country can have a positive impact[115]. Last but not least, the EU builds on the best practices in water management and governance of its Member States.

5.4. De-facto governance practices

Official communication channels exist among the DGs dealing with the water agenda. These include regular meetings with desk officers that deal with water issues in specific regions that include their colleagues from other DGs and from the EEAS[116]. Science and politics interface in technical units of the DGs, which communicate with DG RTD. The technical units of DGs´ ambitions are (1) to support sectoral policies; (2) to stress the application and implementation of the outcomes of funded research projects; (3) to hire staff with policy and research backgrounds to mediate communication between the world of

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[111] Interview, Czech Permanent Representation to the EU, 2018.
[112] Interview, Directorate-General for Research, Technology and Development (DG RTD), Brussels, February 2019.
[113] Interview, Czech Permanent Representation to the EU, 2018.
[114] Interview, T. G. Masaryk Water Research Institute, Prague, December 2018.
[115] Interview, DG ENV, Brussels, 2019.
[116] Ibid.

diplomacy and the world of science; and (4) to address operational gaps inside the EU institutions[117]. The biggest barrier to realizing DG RTD's goals in practice is that the support of DG RTD for sectoral policies is often seen as interference in the affairs of other DGs. Therefore, communication between DG RTD and the technical units of other DGs could be improved in the future[118].

Among many other objectives, DG RTD is supposed to serve as a bridge between scientific and diplomatic bodies. For consulting with the scientific community, DG RTD takes advantage of researchers' participation in EU-funded research projects and on platforms such as the Joint Programming Initiative for Water (JPI Water), whose members come from various research institutes, universities, private and public companies, and think tanks. JPI Water also implements international cooperation activities, identifying priority countries to seek further collaboration and implements joint calls.[119] The scientific research projects produce outputs for the implementation by science diplomats. However EU science diplomacy for water-related issues needs a more effective interconnection between sectoral policy makers and experts[120].

An **example** for science diplomacy with the focus on water issues: **EU-Central Asia water science diplomacy platform**.

The European Commission explicitly aims to use scientific cooperation as an instrument to improve international relations (science for diplomacy) in this region and the term "Science Diplomacy" was explicitly used to describe a new Stakeholder Platform launched in 2018 focusing on water. The stakeholder platform aims to find novel solutions to address the regional water challenges founded on a scientific basis and sensitive to societal constraints. The instrument has the explicit aim to deploy scientific cooperation to help to overcome the divides and conflicts.

In Central Asia, water conflicts have a long history: Kyrgyzstan and Tajikistan, the upstream countries, depend on water for power generation during the cold season, Kazakhstan, Uzbekistan and Turkmenistan, the downstream countries need water for irrigation to grow crops. Thus, also water diplomacy was implemented, for example in terms of diagnoses of water problems, identification of intervention points, and proposals of solutions – ideally sensitive to the different points of views, competing needs and political uncertainty.[121]

The transfer of innovative technologies which have been successfully deployed in individual Central Asian countries or in European Union Member States can help to address the environmental challenges pressing all five countries: Strong population growth and an aging population, dominance of drylands and land degradation, close interdependence of water, energy production and food security, largely agricultural-based economies with low agricultural productivity, above-average effects of climate change in the region.

The EU Strategy for Central Asia, signed in 2007 and reviewed in 2015, also prioritizes the thematic fields of environment and water. With the objective to advance water policy reforms, so called National Policy Dialogues (NPDs) on water have been launched and the main operational EU instruments of the Water Initiative (EUWI) component for Eastern

[117] Interview, Directorate-General for Research, Technology and Development (DG RTD), Brussels, February 2019.
[118] Ibid.
[119] Water JPI: Cooperation beyond Europe. Retrieved from: http://www.waterjpi.eu/international-cooperation/cooperation-beyond-europe-1, as accessed 20 August 2019. Calls of Water JPI involved already Brazil, Canada, Egypt, South Africa, Taiwan, and Tunesia. Priority countries for further cooperation are Brazil, Canada, China, India, South Africa, the United States and Vietnam.
[120] Interview, DG RTD, Brussels, 2019.
[121] See International Crisis Group (2018): End the Weaponisation of Water in Central Asia. Retrieved from: https://www.crisisgroup.org/europe-central-asia/central-asia/kazakhstan/end-weaponisation-water-central-asia ; Water Diplomacy. Retrieved from: http://waterdiplomacy.org

Europe, the Caucasus and Central Asia (EECCA) have been implemented in all CA countries (except Uzbekistan) since 2006.[122] Water was highlighted in the Council Conclusions on the EU strategy for Central Asia adopted by the Council in 2017[123].

Financial support was provided through of cooperation and development projects supported by the EU's Development Cooperation Instrument (DCI) and the Framework Programmes for Research and Technological Development (or Research and Innovation respectively) and by several EU Member States.

At the meeting of EU-Central Asia Working Group on Environment and Climate Change in February 2017, the idea to establish the **Central Asian Regional Water Stakeholder's Platform (WASP)** was developed and reconfirmed in June 2018, when a Working Group discussed a possible extension of its scope to water issues.

The perceived need to re-engage the stakeholders around the new terminology of "science diplomacy" and a new way of framing (explicitly not in the format of "the governmental stakeholders speak and the scientific stakeholders listen" or conferences) but as an interactive platform that is complementary to the existing water platforms[124]. Several advantages can be observed: Due to its focus on the scientific aspects, it was possible to engage the target groups into multi-level governance dialogues. The emphasis on scientific evidence also set the long-term perspective needed for science diplomacy: The expectation is that more trans-boundary cooperation and regional integration between the Central Asian states ultimately contributes to conflict resolution. Thus, the aim was to establish reliable communication between decision makers and researchers with a focus on specific challenges such as data generation, management and exchange, low cooperation and mobility on the operational level of water management authorities and water-related researchers.

The stakeholder platform aims to support dialogue horizontally (transregional between stakeholders from similar groups) and vertically (between different groups) and includes the political and administrative level (e.g. regional political decision makers, European Commission DG Research, DEVCO and special representative for Central Asia, ministries, embassies), researchers, private sector and civil society (including for example chambers of commerce, donor platforms, etc.).

While there are already lots of dialogue fora, science diplomacy was highlighted as a means to cooperate concretely to identify successful initiatives from policy and scientific perspectives and to discuss the specific needs to improve the framework conditions.

Science diplomacy was offered at the launch event as a tool for the bi-regional policy dialogue and trans-boundary cooperation. Water is a politically charged topic in the region and there are many potential conflict lines (upstream/downstream; energy vs. agriculture)

[122] EUWI EECCA Working Group: Report on Implementation of the European Union Water Initiative National Policy Dialogues on Integrated Water Resources Management and on Water Supply and Sanitation. Retrieved from: https://www.oecd.org/environment/outreach/Progress%20report_OECD%20UNECE_ENG.pdf

[123] 'Council Conclusions on the EU strategy for Central Asia. Council document 10387/17, 19 June 2017, p 5.; Cf also EC Regional Strategy Paper for assistance to Central Asia for the period 2007-2013. Retrieved from: http://www.eeas.europa.eu/archives/docs/central_asia/rsp/07_13_en.pdf

[124] Including for example several international initiatives: International Fund for Saving the Aral Sea (IFAS): an International organization supported by the CA governments - http://ec-ifas.waterunites-ca.org/; Interstate Commission for Water Coordination of CA (ICWC): body comprising the five ministries of water resources - http://icwc-aral.uz/; Innovation and Scientific Research Cluster in the field of water management: joint initiative of the Regional Environmental Centre for CA (CAREC) and Tashkent Institute of Irrigation and Agricultural Mechanization Engineers https://carececo.org/en/main/news/CAIEF2018-cluster-opening/, International Water Management Institute, IWMI - http://centralasia.iwmi.cgiar.org; http://centralasia.iwmi.cgiar.org/show-projects/?C=851; as well as several national initiatives: Germany's Central Asian Water project - https://www.cawa-project.net/; Regional water management programme of the Swiss Agency for Development and Cooperation - https://www.eda.admin.ch/deza/en/home/countries/central-asia.html; USAid - https://www.usaid.gov/central-asia-regional .

but there is also a concretely expressed wish in the region to cooperate, to "make water a non-political issue". While water availability is one of the highly controversial topics in the region, a dialogue on *water quality* offers an easier avenue towards productive exchange and agreements. Based on interactive settings, the stakeholders highlighted specific technologies, exchanged general information on water research but also discussed topics such as gender or the inclusion of policy modules in curricula for water scientists.

This is thus an example of the shift from pure policy dialogue towards dialogues between policy, science and practitioners. It also shows a professionalization of science diplomacy: there is an increased awareness and capacity building to introduce policy thinking to scientists and to bring scientists into policy fora.

An aspect that is not yet adequately addressed in the EU-Central Asian science diplomacy initiative on water is the involvement of the EU Member States. A larger event is planned in 2020 where additional donors will be involved that might take up the results in their programming.

6. Conclusion

In this case study, we have illustrated the issue of water management as both a domestic and foreign policy issue in the Netherlands, the UK and the Czech Republic. In charting the stakeholder landscape and considering how de-facto governance arrangements take advantage of the tools of water diplomacy, the report provides an overview of where water-related science diplomacy stands today. Further research is needed to examine how science can be used strategically by the three countries to further their foreign policy ambitions with respect to water. There are areas where such research could be conducted, from seeking a more in-depth understanding of the negotiation and implementation of EU directives to analysis of the effectiveness of foreign aid for development projects in the area of water management. In addition, there is further potential to gain understanding of the market for water management expertise, which is being supported by government departments and research councils, as well as the involvement of private industry as a partner in water management projects in the three countries and abroad.

As the report shows, there is no single understanding of water science diplomacy at the national level in the three countries. The three subcases present some common features, such as acceptance that scientific expertise must be part of decision-making and foreign policy, but every country has its own specific approach and different de-facto governance practices. Dutch water management and water diplomacy is an example of a niche where the Netherlands is positioned as an expert. Its expertise is based on its long cultural, scientific and technical experience, and makes the Netherlands a reliable partner for water-related projects on all levels (regional, bilateral, EU and global). The UK case is characterized by complex governance methods and the importance of water diplomacy as a part of development aid and technical assistance. Czech water diplomacy is a new element of Czech foreign policy that is seeking to find a place in both traditional and public diplomacy. Its main focus is on bilateral and international transboundary waters cooperation.

The EU case is unique, with no relationship to national science diplomacy models, even though its practice does reflect the ambitions, areas of expertise and excellences of its Member States. EU water diplomacy deserves more attention in future research as a new thematic field of EU external action. It offers an insight into new management and organizational methods used by the EU for its diplomacy and for cooperation among its different actors and units. The EU experience is a perfect example of project management in diplomacy, applicable to both pre-emptive diplomacy and crisis management.

The UK case of water management illustrates that the kinds of ‘science’ that are relevant to foreign policy extend beyond the biophysical sciences, to incorporate the economic, social and political sciences. This enables the ‘adaptation’ and ‘relation’ that this report posits are essential tools of water diplomacy. The UK case also emphasises the complexity of governance systems involving many state and non-state actors, which is not conducive to a straightforward governance structure. Grand narratives and an over-arching foreign policy agenda for UK water governance do not exist. The most fruitful future scholarship in this area is therefore likely to be research that examines detailed case studies of individual elements of UK water management.

Czech water diplomacy is similar to Czech science diplomacy in general. It is still in transition, revealing uncertainties about the organizational and coordination centre for the country's foreign policy agenda. More importantly, it is evidence of the Czech Republic's difficult passage from the position of a receiver to that of a donor. Although we can find niches of excellence like nanotechnology, the Czech Republic still takes a quite passive approach to diplomacy, when it needs higher ambitions and more self-confidence. Unfortunately, Czech water diplomacy is suffering from a gap between academia and government ministries, a lack of vision, and working methods that do not unify science, expertise and policy making. As a result, Czech science diplomacy is more about individual scientific networking and cooperation, and less about the country's foreign policy ambitions on the EU and global levels.

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3. Cyber Security: Mapping the Role of Science Diplomacy in the Cyber Field

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List of Abbreviations

Czech Republic:	
MU	Masaryk University
MFA	Ministry of Foreign Affairs of the Czech Republic
NATO	North Atlantic Treaty Organisation
NCISA	National Cyber and Information Security Agency
NCSC	National Cyber Security Centre
NSA	National Security Authority
PROPED	Projects of economic diplomacy
TA ČR	Technology Agency of the Czech Republic
Germany:	
FOC	Freedom Online Coalition
France:	
ANSSI	National Cybersecurity Agency
CAPS	Centre for Analysis, Forecasting and Strategy
COMCYBER	Cyber military command
DGA	Weapons Directorate
FRS	Foundation for Strategic Research
GDRIS	International and Strategic Affairs Directorate
GGE	United Nations Group of Governmental Experts
IFRI	French Institute for International Relations
INRIA	National Research Institute for the Digital Sciences
IRIS	Institute for International and Strategic Affairs
IRSEM	Military School Institute for Strategic Research
MEAE	Ministry for European and Foreign Affairs
SGDSN	General Secretariat for Defence and National Security
European Union	
CFSP	Common Foreign and Security Policy
EEAS	European External Action Service
ENISA	EU Agency for Network and Information Security
EU	European Union
EU ISS	EU Institute for Security Studies
GMF	German Marshall Fund of the US

H2020	Horizon 2020
ICT	Information and telecommunication technologies
NIS Directive	Directive on Security of Network and Information Systems
SNV	Stiftung Neue Verantwortung
TCPRI	Transatlantic Cyber Policy Research Initiative
DG Home	Directorate General for Migration and Home Affairs
DG CNECT	Directorate General for Communications Networks, Content and Technology

1. Introduction

Cyber security topics have been part of national defence discourses for more or less the past thirty years. With a growing number of cyber attacks originating in one state and targeting another, cyber security has slowly entered the agenda of international community as well. The discussion has mainly been concerned with technology and technical solutions, but as the topic has gained greater attention, it is now being addressed by the world of international diplomacy. Nowadays, the role of cyber security in diplomacy has become so important that the term "cyber diplomacy" has come into global use, and countries are even deploying their own "cyber diplomats".

This report uses three important terms that must be explained at the beginning, especially if the reader is a newcomer to issues of cyber space. Firstly, the term "cyber security" is often used throughout this report. There is no single definition of the term. Each nation-state defines for itself what cyber security means. More than one definition of cyber security can be in use within a single state, because different national agencies and institutions may deal with different aspects of cyber security. Thus, the definition of the term in an organisation that focuses on industrial control systems is probably different from the one used by an organisation concerned with, for example, cloud security. Yet, if the organisations' individual definitions are studied closely, one will likely come to the conclusion that cyber security is the state of readiness of an organisation's services or systems, as well as its planning for recovery of functions if and when a breach of security occurs.

The second term which must be clarified is "cyber defence". Again, no commonly agreed definition of cyber defence exists, but certain common elements can be observed. Cyber defence covers a narrower spectrum of activities than cyber security. It refers to activities that protect a state from advanced hostile attacks undermining its integrity, sovereignty and national interests. These kinds of attacks are often conducted on a massive scale and can seriously threaten a state's ability to defend itself against external threats. Cyber defence enters the picture when cyber attacks cannot be handled by the traditional measures and tools of cyber security.

Finally, the third commonly used term is "cyber diplomacy". This term is probably the least controversial or confusing because it simply refers to applying traditional diplomatic tools and measures to international issues arising in the cyber domain. Of the three terms, cyber diplomacy is the newest concept. It is now recognised and employed by states around the world.

Given how new these terms are, the goal of this report is to map the landscape of cyber security and cyber diplomacy in the Czech Republic, Germany, France, and the EU and explore how those three states and the EU approach science diplomacy in the cyber realm. The cases briefly touch upon the historical background and explore the landscape of stakeholders. Later, they illustrate governance in practice, that is, how the optimal theoretical set of governance arrangements is reflected in practice. Finally, the report offers a meta-perspective of science diplomacy in the area of cyber security and identifies common features of the cases studied.

The research team worked with two main sources of information which were interviews and documents. Interviewees represented stakeholders from both government and academia. All the interviews were anonymous, citing only the interviewee's organization and time and place of the interview. Furthermore, the research team worked with various official documents ranging from government strategies and white papers to press releases and official statements as well as other texts such as active webpages of the discussed projects.

2. Czech Republic's Approach to Science Diplomacy in Cyber Space

2.1. Governance Arrangement

The history of cyber security in the Czech Republic dates back to 2011, when the Czech National Security Authority (NSA) was appointed as the national authority for the cyber agenda. A year later, the NSA published the first ever *Cyber Security Strategy of the Czech Republic for 2012 to 2015* which set the goal of creating the National Cyber Security Centre (NCSC) as part of the NSA. The NCSC was officially opened in May 2014. It is the main coordinating body for cyber security in the country. Since then, cyber security in the Czech Republic has progressed immensely. The proof of that is the latest National Cyber Security Strategy, for the period from 2015 to 2020, which sets forth the country's desire "to play a leading role in the cyber security field within its region and in Europe".[1] To fulfil such an ambitious goal, an independent National Cyber and Information Security Agency (NCISA) was created in August 2017. The NCISA replaced the NCSC, adopting the NCSC's agenda and boosting its capabilities and capacities.[2]

As part of that process, cyber diplomacy had to be strengthened, especially after January 2017, when the Czech Ministry of Foreign Affairs (MFA) detected a serious cyber campaign directed against its own computer networks.[3] The first and, so far, the greatest milestone in the development of Czech cyber diplomacy was the deployment of three Czech "cyber attachés" to Washington, D.C., Brussels and Tel Aviv in 2016. All three cyber attachés are employees seconded from the NCISA.

When it comes to science diplomacy, the Czech Republic has two science diplomats who are employees of the MFA, one in Washington, D.C. and one in Tel Aviv. In general, there is no specific, explicit strategy for the country's cyber diplomacy and science diplomacy. The only document that does touch upon cyber diplomacy and the ongoing research in the domain is the *National Cyber Security Strategy for the Period from 2015 to 2020*. Among its goals, the *Strategy* includes "active international cooperation" focused on engagement in international fora such as the EU and NATO, promotion of cyber security in Central Europe, and deepened bilateral cooperation with partners.[4] The crucial part of the document for science diplomacy is the goal of strengthening "research and development/consumer trust" which is to be achieved by participation in national and European research projects, appointment of a national cyber security coordinator as the main point of contact for research in the area of cyber security and encouragement of cooperation with academia and the private sector on research projects at the national, international, and transatlantic levels.[5]

Improvement of transborder cyber security through diplomacy and research is mentioned in the margins of some other strategic documents. One of them is the *Interdepartmental*

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[1] National Security Authority, National Cyber Security Centre (2015): National Cyber Security Strategy of the Czech Republic for the Period from 2015 to 2020. p.7, Retrieved from: https://www.govcert.cz/download/gov-cert/container-nodeid-1067/ncss-15-20-150216-en.pdf

[2] For more details on the history of development of cyber security in the Czech Republic, please, see Kadlecová, Lucie, Daniel Bagge, Michaela Semecká, Václav Borovička (2017): The Czech Republic: A Case of a Comprehensive Approach toward Cyberspace. Tallinn: NATO CCDCOE. Retrieved from: https://ccdcoe.org/library/publications/the-czech-republic-a-case-of-a-comprehensive-approach-toward-cyberspace/

[3] Interview, Ministry of Foreign Affairs of the Czech Republic, Prague, 5 December 2018.

[4] National Security Authority, National Cyber Security Centre (2015): National Cyber Security Strategy of the Czech Republic for the Period from 2015 to 2020. p. 17, Retrieved from: https://www.govcert.cz/download/gov-cert/container-nodeid-1067/ncss-15-20-150216-en.pdf

[5] National Security Authority, National Cyber Security Centre (2015): National Cyber Security Strategy of the Czech Republic for the Period from 2015 to 2020. p. 19, Retrieved from: https://www.govcert.cz/download/gov-cert/container-nodeid-1067/ncss-15-20-150216-en.pdf

Concept of Support for Security Research of the Czech Republic which was published by Ministry of Interior. It sets forth the national approach to security and innovation for 2017 through 2023, and mentions cyber security in that connection.[6] Furthermore, the document states an intention to prepare an action plan for use of economic and science diplomacy tools in order to develop better contacts with the main stakeholders in security research in the region (point C.3.2). However, it does not specify what those tools are. It prioritises the USA, Israel, the UK, Switzerland and the Scandinavian countries as the main partners for cooperation.[7] This is probably the first document that has mentioned a strategic framework for science diplomacy in the security domain.[8]

Another example of a document that addresses a need for strengthened international scientific cooperation is the *National Research, Development and Innovation Policy of the Czech Republic 2016–2020*. That policy was approved by the Czech Government in February 2016. It briefly mentions cyber security research.[9] To sum up, although there are strategic documents which suggest that the will exists on the part of Czech public authorities to develop science diplomacy for cyber security, the Czech Republic has no express, coherent cyber diplomacy or science diplomacy strategy at the time of writing this report in spring 2019.

2.2. Stakeholders

The key stakeholder in cyber security in the Czech Republic is the NCISA, which so far has most of the expertise and experience in cyber diplomacy (and possibly also overlapping into science diplomacy). The NCISA has by default been the country's key actor in cyber diplomacy and relations with academia, both because of its policy remit and also because there is no other entity capable of taking over responsibility for diplomatic relations in cyber security.[10] The NCISA is the agency that supplies Czech cyber attachés to the field. In 2016, three cyber attachés were posted to Tel Aviv, Washington, D.C., and Brussels. In the future, NCISA will decide on the distribution of funds received from the European cyber security competency centres and network.

Another actor that is gaining importance is the Ministry of Foreign Affairs. So far, the MFA has not been much involved in cyber diplomacy, but it has the intention of getting more active in the near future. That intention is reflected in its appointment of a Special Envoy for Cyber Space and the establishment of a Cyber Security Department. Ideally, the MFA and NCISA should complement each other—NCISA would articulate positions on cyber security-related issues which the MFA would then advocate abroad during diplomatic negotiations.[11] As it stands now, the MFA's capabilities are limited, which means that it is mainly NCISA that coordinates the Czech Republic's cyber diplomacy. However, as far as science in general is concerned, the MFA has posted two of its employees as science diplomats in Tel Aviv and Washington, D.C. Besides that, the MFA organises economic diplomacy projects (PROPED), which involve sending trade missions abroad. Although the MFA's primary goal is to support the business sector, there are also opportunities for it to get involved with academia. In the eyes of the MFA, science diplomacy, especially that

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[6] Ministry of the Interior of the Czech Republic (2017): Interdepartmental Concept of Support for Security Research of the Czech Republic. Retrieved from: https://www.mvcr.cz/vyzkum/clanek/koncepce-meziresortni-koncepce-podpory-bezpecnostniho-vyzkumu-cr.aspx

[7] Ministry of the Interior of the Czech Republic (2017): Interdepartmental Concept of Support for Security Research of the Czech Republic. Retrieved from: https://www.mvcr.cz/vyzkum/clanek/koncepce-meziresortni-koncepce-podpory-bezpecnostniho-vyzkumu-cr.aspx

[8] Interview 4, NCISA, Prague, 26 March 2019.

[9] Government of the Czech Republic (2016): National Research, Development and Innovation Policy of the Czech Republic 2016–2020. Retrieved from: https://www.vyzkum.cz/FrontClanek.aspx?idsekce=782691

[10] Interview 2, NCISA, Brno, 17 January 2019.

[11] Interview 2, NCISA, Brno, 17 January 2019.

related to cyber security, is considered closely related to or perhaps even an indispensable part of economic diplomacy.[12] An example was a PROPED mission to the UK, where an NCISA representative had an opportunity to establish contacts with universities in London.[13] In 2019, two PROPED missions focused on cyber security are planned for India and the USA.[14]

CzechInvest is another important stakeholder in science diplomacy and cyber security. It is the Czech business and investment development agency and is subordinate to the Ministry of Industry and Trade. It promotes both domestic and foreign investment into the Czech Republic. CzechInvest's role is unique because of its knowledge of the Czech academic environment and local practice in various disciplines. It applies that knowledge to organise missions abroad that are specialised in selected industries. For example, CzechInvest organised a mission to Canada in September 2018 with a special focus on artificial intelligence. Canada aims to be a showcase of artificial intelligence. The main goal of this particular mission was to promote Prague as a future knowledge hub for the industry that would be of great interest to Canadian firms.[15]

The other stakeholders involved in cyber security and research play a rather marginal role. The Technology Agency of the Czech Republic (TA ČR) is one of them. Although TA ČR is not primarily oriented toward foreign countries, an exception to the rule is its Delta Programme, which supports international cooperation in experiment-based development and applied research.[16] The Ministry of Interior is a stakeholder thanks to the research it is doing in the field of security. So is the Ministry of Industry and Trade, because its representatives in Czech embassies often participate in diplomatic activities oriented towards further developing Czech expertise and commerce in cyber security and other sciences.[17]

Finally, the academic community, including all major Czech universities such as Charles University, the Czech Technical University and the Technical University in Brno cannot be ignored. In particular, Masaryk University in Brno has an especially strong position in science diplomacy and cyber security because of its close cooperation with the NCISA. However, Masaryk University does not contribute much directly to international science diplomacy because the focus of its cooperation is on domestic issues.

Overall, the structures and activities of stakeholders in science diplomacy and cyber security in the Czech Republic are not well-defined and perhaps even downright confusing. It often happens that one stakeholder does not know about the activities and opportunities developed by another actor in the same area.[18] More intense cooperation between the ministries and other government bodies, which could potentially result in the creation of coordinated structures and strategies, is lacking.[19]

[12] Interview, CzechInvest, Prague, 29 November 2018.

[13] Interview 3, NCISA, Prague, 26 March 2019.

[14] Ministry of Foreign Affairs of the Czech Republic: Projects of Economic Diplomacy for 2019. Retrieved from: https://www.mzv.cz/ekonomika/cz/servis_exporterum/projekty_ekonomicke_diplomacie/projekty_ekonomicke_diplomacie_pro_rok.html

[15] Interview, CzechInvest, Prague, 29 November 2018.

[16] Technology Agency of the Czech Republic (2018): Programme Delta 2. Retrieved from: https://www.tacr.cz/index.php/en/26-programy/delta/1469-delta-delta-2-guidepost.html

[17] Interviews 3 & 4, NCISA, Prague, 26 March 2019.

[18] Interviews 3 & 4, NCISA, Prague, 26 March 2019.

[19] Interview 2, NCISA, Brno, 17 January 2019.

2.3. Governance Practice

So far, cyber security has played only a marginal role in the Czech Republic's science diplomacy. Therefore, there have been only a handful of projects and activities in this area. Such activities as there have been were organized on a rather random basis, to take advantage of one-off opportunities. One of the first activities in the area was an application by NCISA to participate in the NATO Science for Peace and Security programme in 2016/2017. NCISA offered to organise a workshop on monitoring computer network operations, in cooperation with Israeli partners in government and academia. Although the application was unsuccessful, it was an important first test of NCISA's ability to cooperate with the Czech Republic's science diplomat and cyber attaché in Tel Aviv.[20]

Another project, in which NCISA gained its first experience with science diplomacy in the cyber sphere was the NATO Multinational Cyber Defence Education and Training project, which ran from 2014 to May 2019. The goal of the training project was to tap into the knowledge held by NATO members in order to devise new initiatives for NATO and its members in the areas of cyber defence training and education. Among those initiatives were new courses on cyber intelligence, development of cyber defence capabilities and Master's degree programmes on cyber defence and cyber security law.[21] Besides NCISA, Masaryk University was also invited to contribute to development of the curricula for the courses. Although the project had great ambitions, both of the Czech participants agree that the project was rather unsuccessful due to the lack of strong management by the project's leadership.[22] On the other hand, the project demonstrated smooth cooperation between NCISA and Czech academia.[23]

Other projects similar to those realized by NCISA include the activities of Masaryk University (MU). For example, representatives of its Institute of Law and Technology serve as observers to the UN Commission on International Trade Law and the UN Office on Drugs and Crime. They were requested to participate in the trade law meetings by the Czech Ministry of Industry and Trade and in the latter meetings by the UN Office on Drugs and Crime itself. Both sets of meetings dealt with elements of cyber security. The Czech academic observers contributed input to policy documents.[24]

Another promising form of science diplomacy that involves a cyber element is possible future cooperation between MU and Georgetown University. Georgetown has developed a programme for supporting research and cooperation on cyber issues, which MU would like to launch in the Czech Republic. This is still in the negotiation and preparation phase, but the Czech science diplomat based in Washington has played a key role in facilitating contacts between MU and Georgetown.[25]

In sum, Czech activities in the areas of science diplomacy and cyber security have taken place on a random or ad hoc basis so far, without any overall strategic plan.

Before the Czech Republic deployed its science diplomats and cyber attachés, diplomacy related to cyber issues was governed by the personal interests of individual diplomats, again, without any strategic framework. The first and so far the last effort to establish a formal basis for Czech science diplomacy was that of Pavel Bělobrádek, who became Deputy Prime Minister for Science, Research and Innovation in January 2014. During his almost three years in the office, he initiated the posting of two science diplomats—one to Israel in autumn 2015 and another to the United States in spring 2017. He had planned to

[20] Interview 3, NCISA, Prague, 26 March 2019.

[21] MN CD ET: Project. Retrieved from: https://mncdet.wixsite.com/mncdet-nato as accessed 12 April 2019.

[22] Interview 3, NCISA, Prague, 26 March 2019.; Interview, Masaryk University, Brno, 19 March 2019.

[23] Interview, Masaryk University, Brno, 19 March 2019.

[24] Interview, Masaryk University, Brno, 19 March 2019.

[25] Interview, Masaryk University, Brno, 19 March 2019.

deploy a third such diplomat to the Far East.[26] However, this promising start was derailed when Bělobrádek resigned in December 2017. No other politician continued Bělobrádek's plan to build up a network of science diplomats and formulate a strategic framework for their work in the area. Thus, although there is a clear need for more science diplomats, the Czech Republic continues to have only two of them, whose work lacks clear leadership and sustained political support. The overall situation of Czech science diplomacy continues to be based on unsystematic decision making and the individual interests of diplomats.[27]

The disorder in Czech science diplomacy also influences relations between the two science diplomats and NCISA's cyber attachés, particularly those who are posted to Washington and Tel Aviv. For example, one of the four stated priorities in the work of the science diplomat in Washington is cyber security. Thus, there are two diplomats at the same embassy dealing with the very specific topic of cyber security, which might confuse foreign partners. Moreover, the competencies of the two diplomats have not been clearly defined by their leadership. Instead, their work overlaps and coordination is ad hoc, depending on their individual agreement on the spot to cooperate on particular issues.[28] Although it might be agreed that the science diplomat should have the lead on cooperation with the academic sector in cyber security, sooner or later the cyber attaché will come across new contacts in that domain. It then becomes a question whether it would not be better to create a "thematic" division of work that would put the cyber attaché in charge of science diplomacy for cyber security issues.[29]

Another disharmony in the Czech Republic's science diplomacy is the absence of a common understanding within the government of what science diplomacy actually is. The MFA and other government bodies continue to ask themselves what kind of activities can be considered science diplomacy.[30] If they could definitively answer that question, preferably by producing a strategy for science diplomacy, the government would know better how to approach such issues. Hopefully, science diplomacy would then receive its deserved share of attention and would not be closely so linked to economic diplomacy (as for instance through PROPED missions) as it is.[31]

Similarly, there is a certain level of disagreement about who is suitable to be a science diplomat with a focus on cyber security. The selection of career diplomats with no scientific or academic experience in the field to be the first Czech science diplomats evoked criticism.[32] Some argue that a science diplomat does not need to possess a scientific background. Such a person need only to be a socially skilled manager because what is needed is only a mediator who does not choose the scientific fields to emphasise or determine the content of policy.[33] Others argue that although a science diplomat should be an MFA employee, he or she should have rich experience in the sphere of science, preferably having accomplished academic projects on both the national and international levels. Only that way will a diplomat gain the respect of his partners and be considered a

[26] Government of the Czech Republic: Deputy Prime Minister Bělobrádek Officially Introduced the Second Science Diplomat. Retrieved from: https://www.vyzkum.cz/FrontAktualita.aspx?aktualita=807455 as accessed 12 April 2019.

[27] Interview, CzechInvest, Prague, 29 November 2018.; Interview 1, NCISA, Brno, 17 January 2019.; Interview, Ministry of Foreign Affairs of the Czech Republic, Prague, 5 December 2018.

[28] Interview 3, NCISA, Prague, 26 March 2019.

[29] Interviews 3 & 4, NCISA, Prague, 26 March 2019.

[30] Interview 1, NCISA, Brno, 17 January 2019.; Interview 4, NCISA, Prague, 26 March 2019.; Interview, Masaryk University, Brno, 19 March 2019.; Interview, CzechInvest, Prague, 29 November 2018.

[31] Interview 1, NCISA, Brno, 17 January 2019.

[32] Majer, Vladimír (2017): Science Diplomacy according to Czech Republic. In: Česká pozice. Retrieved from: http://ceskapozice.lidovky.cz/vedecka-diplomacie-po-cesku-dfz-/tema.aspx?c=A170720_232214_pozice-tema_lube ; Interview 1, NCISA, Brno, 17 January 2019.

[33] Interview, Ministry of Foreign Affairs of the Czech Republic, Prague, 5 December 2018.

peer. Such a person does not need to be a career diplomat.[34] Hypothetically, another idea would be to appoint a plenipotentiary science diplomat to focus on cyber security who would not be posted to one country or region but would rather travel the world based on actual need.[35] In contrast to the MFA and its career science diplomats, NCISA has understood the need to send out representatives who are experts in the field they are expected to promote abroad. The NCISA's cyber attachés in Washington, Brussels and Tel Aviv are in fact experts on cyber security who promote the Czech national interest in that domain with clear guidance and express purpose.

The unsystematic nature of science diplomacy in respect of cyber security is also reflected in the various platforms used for communication by diplomats and scientists, which have been developed independently by different stakeholders. The PROPED missions organized by the MFA and CzechInvest's missions abroad have already been mentioned. Another way interested parties can obtain information is the web portals of CzechInvest[36] and NCISA[37]. The former portal is an information gateway which offers a complex overview of Czech research and development to foreign partners and investors. The latter provides details on research and development in the area of protecting classified information and cyber security in the Czech Republic and internationally. However, the portals are rather exceptional. Experts agree that communication and cooperation between Czech diplomats and scientists often occurs on an ad hoc, personalized basis.[38]

Although the state of the art of Czech science diplomacy seems very disorganized, the future of diplomatic efforts in the area of cyber security science appears brighter. At the time of writing this report in spring 2019, NCISA is finishing a document which will define the framework for research in cyber security for the upcoming years. This document, which will probably be published in summer 2019, will, among other things, articulate several areas of interest that should be prioritized by Czech diplomats.[39] Furthermore, NCISA is also planning to organize its own research missions abroad, which would copy the structure of PROPED missions. The intention is to invite Czech research institutions to introduce their work abroad, opening up new opportunities for collaboration with foreign counterparts. This kind of mission will take place two or three times a year, beginning in 2020.[40]

3. Germany's Approach to Science Diplomacy in Cyber Space

3.1 Governance Arrangement and Stakeholders

In the past ten or twelve years, cyber and information security has become an important societal question for Germany, not only an issue for national intelligence agencies. Before, it was seen as a purely governmental topic. Citizens and industries were not understood to be the targets of cyber attack.

[34] Interview 1, NCISA, Brno, 17 January 2019.; Interviews 3 & 4, NCISA, Prague, 26 March 2019.

[35] Interview, CzechInvest, Prague, 29 November 2018.

[36] CzechInvest: Research and Development in the Czech Republic. Retrieved from: http://www.czech-research.com/ as accessed 14 April 2019.

[37] NCISA: Research. Retrieved from: https://nukib.cz/cs/informacni-servis/vyzkum-nukib/ as accessed 14 April 2019.

[38] Interview, CzechInvest, Prague, 29 November 2018.; Interview, Masaryk University, Brno, 19 March 2019.

[39] Interview 3, NCISA, Prague, 26 March 2019.

[40] Interviews 3 & 4, NCISA, Prague, 26 March 2019.

3.1.1. The Institutional Dimension

Now, cyber security is considered a whole-of-government task, which means that different ministries are involved in dealing with it from different angles. Currently, three ministries share cyber security responsibilities:

- Federal Ministry of the Interior
- Federal Ministry of Defence
- Federal Foreign Office

Responsibilities on the governmental level are more or less clearly divided and assigned. The Federal Ministry of the Interior is responsible for the technical means of cyber protection and measures against criminal cyber activities. It is the main body regulating the national architecture of Germany's cyber security activities and procedures. The Federal Ministry of Defence is responsible for cyber defence activities, by which is meant measures against cyber attack, mainly from abroad. The Federal Foreign Office is responsible for foreign policy related to cyber issues and is the main actor for cyber diplomacy. In 2011, the Federal Foreign Office created a special unit, the Cyber Policy Coordination Staff, which works with other ministries and actors to ensure a free, open, secure and stable cyberspace. In its organisational structure there are two main entities dealing with cyber security. The Cyber Foreign Policy and Cyber Security Coordination Staff is the coordinating entity within the Ministry. It deals with all issues of cyber-related foreign policy. In case of an incident or crisis, it creates task forces that include employees of other divisions of the Ministry. In addition, the Foreign Office has a dedicated Director for the United Nations, International Cyberpolicy and Counterterrorism (since 2015 this has been Ambassador Thomas Fitschen).

The Federal Foreign Office has also assigned about 20 cyber attachés to German embassies across the world (including China, Korea, and Israel).[41] The Ministry also has a network of science attachés[42] in 30 embassies around the world (who are not referred to as science diplomats). Some of them are not trained diplomats but are civil servants seconded from the Federal Ministry of Education and Research.[43]

To execute policy in the cyber area, a number of institutions have been created over the years, some with extensive responsibilities:

- The German National Office for Information Security
- The National Cyberdefence Centre
- The German National Cyber Security Council
- The Cyber and Information Domain Service

The German National Office for Information Security, which was founded in 1991, is the national cyber security authority and is linked to the Federal Ministry of the Interior. It shapes security policy for digitalisation through prevention, detection and reaction of incidents for the government, business and society. Its objective is to promote overall IT security in Germany and is the central provider of IT security services to the federal government. It also offers services to the IT industry as well as to other private and commercial IT users and providers.

The German National Cyber Security Council was established in 2011. Its objective is to strengthen cooperation within the government and between the government and the

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[41] Interview 3, a representative of German public sector, Bonn/Berlin, 5 April 2019.

[42] In Germany they are called "Wissenschaftsreferenten". The term science diplomat (or in German "Wissenschaftsdiplomat") is not used by the official governmental bodies in this context.

[43] Federal Foreign Office, Außen- und Europapolitik: Internationale Wissenschaftlich-Technologische Zusammenarbeit. Retrieved from: https://www.auswaertiges-amt.de/de/aussenpolitik/themen/aussenwirtschaft/forschungtechnologie/wissenschaftlichtechnologischezusammenarbeit-node as accessed 23 May 2019.

private sector, and to provide recommendations to high officials on strategic issues. The Council falls under the responsibility of the Federal Government's Commissioner for Information Technology. It is comprised of representatives from the Federal Chancellery and State Secretaries from the Foreign Office, the Ministries of the Interior, Defence, Economics and Technology, Justice, Finance, Education and Research, and representatives of the federal Länder (regions).[44] It is thus the most important consultation and exchange forum for cyber security on the national level.

Also in 2011, the National Cyberdefence Centre was established in order to respond to attacks on government computers in Germany. The centre pools the cyber defence resources of many German cyber and intelligence services.[45] It is an advisory body to the German National Cyber Security Council and reports directly to it.

Another new body is the Cyber and Information Domain Service, which is the youngest branch of Germany's military, the Bundeswehr. It is directly responsible to the Federal Ministry of Defence and started operations in 2017. All the competences and capabilities relevant to the cyber and information domains, which were formerly distributed among several Bundeswehr facilities, are located in this new service as of spring 2019.[46] It is the military auxiliary to the National Cyberdefence Centre.

In addition, there are at least two important actors from the private sector that play a key role in national discussions:

- German Telekom
- BITKOM e.V.

German Telekom is the largest telecommunications provider in Europe by revenue and has more than 200,000 employees worldwide (as of 2017).[47] BITKOM is Germany's digital trade association. Founded in 1999, it represents more than 2,600 companies active in the digital economy.[48] German Telekom is a member of BITKOM.

3.1.2. The Link between International Cyber Security Policy and Science

None of the institutions mentioned above are clearly focused on science themselves. However, there are some institutional and operational connections that are worth mentioning. Two governmental bodies already have or are about to institutionalize cooperation with scientific experts.

The Cyber and Information Domain Service already works closely with the University of the Bundeswehr on cyber security-related issues.[49] The University has a research unit on cyber defence and smart data (established in 2013) whose purpose is bringing together researchers, economic actors and government officials. In 2017, a new institute for

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[44] The IT Law Wiki, wikia: National Cyber Security Council. Retrieved from: https://itlaw.wikia.org/wiki/National_Cyber_Security_Council as accessed 2 May 2019.

[45] Such as the Federal Office for Information Security, the Federal Office for the Protection of the Constitution, the Federal Intelligence Service, the Federal Police, the Customs Criminal Investigation Office, the German Military, the Federal Office of Civil Protection and Disaster Assistance, and the Federal Criminal Police Office.

[46] Cyber and Information Domain Service Headquarters, Press and Information Centre: Cyber and Information Domain. Retrieved from: http://cir.bundeswehr.de/resource/resource/YjR0QzY3aWZvTE4yUHd5Vk55eFhUZFo5dGh3aGZlRTE1VnNvSDFHRnNjUFVxa1l1S3hITWlWRFlRM3ZUSUVjM0NxYXNjck1BVG1RdFBZdWlqNTZ2d3lVY2N0TzRuOE9zakR5STNzcklUTWs9/Flyer_CIR_engl.pdf as accessed 2 May 2019.

[47] Deutsche Telekom: Geschäftsbericht 2017. Mitarbeiterstatistik. Retrieved from: https://www.geschaeftsbericht.telekom.com/site0218/lagebericht/mitarbeiter/mitarbeiterstatistik.html as accessed 2 May 2019.

[48] BITKOM: About. Retrieved from: https://www.bitkom.org/EN/About-us/About-us.html as accessed 2 May 2019.

[49] Interview 2, a representative of German public sector, Bonn, 22 February 2019.

information technology was created by the university.[50] In the near future it intends to fund new professorships.[51] The Service has also worked with some of the Fraunhofer Institutes on a case by case basis.

At the time of this report the Federal Foreign Office is setting up a new research institution, the German Institute for International Cyber Security.[52] The establishment of this institute is mentioned in the national cyber strategy.[53] It will be a virtual institute composed of different German research institutions. Its objectives will be creating scientific output on cyber security issues and providing networking opportunities to domestic and international researchers. It is intended to anticipate trends in cyber security in order to provide up to date, evidence-based advice and guidance for the German government. The institute will be in operation by 2020.

In its new strategy for artificial intelligence, which was just adopted in 2018, the German government announced the creation of a German-French virtual research and innovation network.[54] The strategy does not say whether cyber security will be one of the network's thematic focuses and preparations have not yet moved very far.[55] Given that developments in the field of artificial intelligence will be very interesting to cyber security experts, one can expect that this complex field of research will be one of the key topics for the new network.

The German National Office for Information Security subcontracts research and studies on a case-by-case basis with the aim of providing a knowledge base to decision makers. It has no standing structure or formalized procedures (e.g. working groups) for the Office that organizes cooperation with researchers.[56]

German Telekom interacts with international science from different angles. One example is the Telekom Innovation Laboratories (T-Labs). T-Labs is German Telekom's research and development unit, set up in close partnership with the Technische Universität Berlin. It has sites in Berlin, Darmstadt, Beer Sheva, Budapest and Vienna.[57]

3.1.3. The Strategic Dimension

The Federal Foreign Office is the lead government agency for cyber diplomacy. It uses the term "international cyber policy" to describe its activities.[58] International cyber policy is a cross cutting task impacting virtually all areas of foreign policy. The goal is to ensure that German interests and ideas concerning cyber security are coordinated and pursued in international organizations, such as the United Nations, the OSCE, the Council of Europe, the OECD, and NATO. The priorities for the work of the Federal Foreign Office in those fora include agreement on standards for good governance, the application of international law, and the development of confidence-building measures that enhance international cyber security.[59]

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[50] Ibid.

[51] Interview 1, a representative of German public sector, Bonn, 9 February 2019.

[52] Interview 3, a representative of German public sector, Bonn/Berlin, 5 April 2019.

[53] Federal Ministry of the Interior (2016): National Cyber Security Strategy for Germany. p.6.

[54] Federal Ministry for Economic Affairs and Energy (2018): Strategie Künstliche Intelligenz der Bundesregierung. p.6.

[55] Interview 4, a representative of German public sector, Bonn/Berlin, 2 April 2019.

[56] Interview 1, a representative of German public sector, Bonn, 9 February 2019.

[57] Deutsche Telekom, T-Labs: Über uns https://laboratories.telekom.com/ as accessed 2 May 2019.

[58] In German "Cyber-Außenpolitik," see also Federal Foreign Office, Foreign and European Policy (2017): International Cyber Policy. Retrieved from: https://www.auswaertiges-amt.de/en/aussenpolitik/themen/cyber-aussenpolitik

[59] Federal Foreign Office, Foreign and European Policy (2017): International Cyber Policy. Retrieved from: https://www.auswaertiges-amt.de/en/aussenpolitik/themen/cyber-aussenpolitik as accessed 23 May 2019.

There are a number of relevant national regulations, strategies and framework documents that relate to cyber diplomacy. The most important are the following:

The German Federal Office for Information Security issues national regulations on protection of cyber security. An Act to Strengthen the Security of Federal Information Technology was passed in 2009 and has been amended regularly since then. The last amendment was in January 2017.[60] It provides a legal framework for all information technology-related issues. Its main focus is on domestic aspects of IT.

A very important document is the German National Cyber Security Strategy, issued in 2016 by the Federal Ministry of the Interior.[61] All government stakeholders were involved in the process of generating that document. The strategy was also notably supported by stakeholders from scientific disciplines, as is stated in the preamble.[62]

That same year, a *White Paper on Security Policy and the Future of the Bundeswehr* was issued by the Federal Ministry of Defence.[63] It underlines Germany's ambition to play an active, substantial role in international security policy and is Germany's key document on its security policy. Cyber security is one of many topics of the white paper. It clearly presents the tasks to be carried out in this context in a specific Cyber Security Strategy.[64]

The Federal Ministry of Education and Research has issued a framework programme on Research for Civil Security from 2018-2023, which provides the main theoretical framework and funding mechanism for all German civil security-related research.[65] Cyber security is mentioned in the Minister's preface to the programme, but is not a specific topic in the body of the paper. It is in fact mentioned as follows: "to ensure that good use is made of the many opportunities and potentials related to digital change. In this context it is important to take account of both the requirements for using digital technologies and applications, and the risks involved".[66] International cooperation is one of the cross-cutting issues of the programme. The Ministry wants to foster international cooperation in civil security research, primarily with Austria, France, India, Israel and the United States.[67]

In summary, the term cyber diplomacy has not been clearly defined by a strategy of any kind that has so far been published in Germany. It is not mentioned under the umbrella of science diplomacy either. The term the government uses, "international cyber policy," suggests that the many actions that might be categorized under that concept are simply considered to be one part of Germany's general diplomatic efforts.

3.2. Governance Practice

Government practice is diverse and is executed by different governmental bodies. Depending on the content and thematic focus of the issue at hand, actors meet in variable geometries.

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[60] German National Office for Information Security, BSI: Act to Strengthen the Security of Federal Information Technology. Retrieved from: https://www.bsi.bund.de/EN/TheBSI/BSIAct/bsiact_node.html as accessed 2 May 2019.

[61] Federal Ministry of the Interior (2016): National Cyber Security Strategy for Germany.

[62] Ibid, p.17.

[63] Federal Ministry of Defence (2016): The White Paper on Security Policy and the Future of the Bundeswehr.

[64] Ibid, p.38.

[65] This framework programme is a follow-up of the initial framework programme Research for Civil Security from 2012-2017.

[66] Federal Ministry of Education and Research (2018): Research for Civil Security 2018–2023 – A Federal Government Framework Programme. p.4.

[67] BMBF issued joint funding programmes with Austria, France, India, Israel and signed a bilateral agreement with the US Department of State to promote science and technology cooperation on Homeland/Civil Security Matters.

For example, since 2013, Germany has been an active Partner in the Freedom Online Coalition (FOC), a partnership of 30 governments working to advance Internet freedom, and has provided it with financial support. The Federal Foreign Office also plays an active role in the FOC's core group, the Friends of the Chair.

The Ministry of Foreign Affairs has recently established bilateral cyber dialogues with quite a number of countries, among them Brazil, Canada, India, Israel, Japan, Russia, South Korea, and the United States. In May 2017, Germany and Singapore signed a Joint Declaration on strengthening their cyber security cooperation.[68] The declaration promotes cyber security cooperation in key areas, including regular information exchanges, joint training and research programs, and sharing best practices to promote innovation in cyber security. All cyber-related dialogues with EU Member States take place in the Horizontal Working Party on Cyber Issues that was established by the EU in 2016.[69]

European and international cooperation is also a key part of the Research for Civil Security framework programme of the Federal Ministry of Education and Research. Parallel to expanded research collaboration on the European level, the Ministry has set up bilateral funding mechanisms for research with France and Israel. Austria, India and the US are also close partners for cooperation in the field. All these cooperation schemes are based on bilateral agreements.[70]

In the area of cyber defence[71], Germany adheres strictly to the framework of EU and NATO procedures, which are highly formalized. The Federal Ministry of Foreign Affairs has primary responsibility, but the Cyber and Information Domain Service of the Bundeswehr is also deeply involved.

In the area of cyber security, Germany seeks to form coalitions with countries and regions that are like-minded as regards democratic values.[72] It is an obvious pattern and was confirmed in three of the five interviews we conducted.[73] This applies in multinational fora like EU and NATO and also extends to the practice of building bilateral ties. France, Israel and India are examples of states with which Germany has created cyber dialogues. Some bilateral research schemes have also been put into place.

All our interviews hinted that Germany's practices are being formalized, especially those of the Federal Ministry of Foreign Affairs and the Bundeswehr. Official consultations among the responsible ministries are the main instruments of exchange in the cyber security sphere. Intergovernmental consultations take place only among ministries; subordinate agencies are not usually involved, although they can be in particular cases. Power

[68] Cyber Security Agency of Singapore: Singapore Signs Joint Declaration of Intent on Cybersecurity Cooperation with Germany. Retrieved from: https://www.csa.gov.sg/news/press-releases/singapore-signs-joint-declaration-of-intent-on-cybersecurity-cooperation-with-germany as accessed 2 May 2019. Germany has also other bilateral declarations on cyber security, e.g. with Israel and India. The one with Singapore is the most recent one.

[69] European Council, Preparatory Bodies: Horizontal Working Party on Cyber Issues (HWP). Retrieved from: https://www.consilium.europa.eu/en/council-eu/preparatory-bodies/horizontal-working-party-on-cyber-issues/ as accessed 2 May 2019.

[70] Federal Ministry of Education and Research, Sicherheitsforschung: Bilateral Cooperation in Civil Security Research. Retrieved from: https://www.sifo.de/en/bilateral-cooperation-in-civil-security-research-2219.html as accessed 23 May 2019.

[71] In the German context term cyber defence describes mostly measures taken against cyber attacks mainly from abroad, while cyber security is used as a general term that subsumes cyber protection, cyber defence, cyber security policy and cyber foreign policy (Federal Ministry of Defence (2016): The White Paper on Security Policy and the Future of the Bundeswehr. p.38).

[72] This was expressed independently by different interviewees: Interview 1, a representative of German public sector, Bonn, 9 February 2019.; Interview 3, a representative of German public sector, Bonn/Berlin, 5 April 2019.; Interview 5, a representative of the German private sector, Bonn, 1 February 2019.

[73] Interview 2, a representative of German public sector, Bonn, 22 February 2019.; Interview 3, a representative of German public sector, Bonn/Berlin, 5 April 2019.; Interview 5, a representative of the German private sector, 1 February 2019.

relationships are very clear and are organized from the top down. All the officials we interviewed stated that cooperation is quite good, fruitful, and driven by content. Disagreements are handled in a formal manner.

3.2.1. On the Limits of Science Cyber Diplomacy

Germany has no overall strategic approach that links science, cyber security and science diplomacy. There are institutionalized connections between some institutions of cyber security or cyber defence and scientific institutions (as there are between the University of the Bundeswehr and the Cyber and Information Domain Service). In general, government institutions have addressed scientific issues on a case-by-case basis. This might change when the new German Institute for International Cyber Security begins to operate. Its main purpose will be to inform the government about future trends.

Because Germany has assigned quite a large number of cyber diplomats and science diplomats to its embassies around the world, one might think that cooperation between colleagues working in the two fields would be natural, since both types of diplomats work in the same embassy. An interview with a representative of the public sector suggests the opposite: the science and cyber attachés usually stick to their clearly defined responsibilities and there are no formal schemes for cooperation or interfaces between the two positions.[74] For instance, the science attaché in Tel Aviv does not participate in the bilateral cyber dialogue between Germany and Israel. The same is true for most of Germany's other bilateral cyber dialogues. Who participates depends on the people in charge and the degree to which they are interested in linking both spheres of diplomatic activity.

All our interviews showed that the concept of science diplomacy is not well understood in the cyber security world. All the interviewees were very interested in it, however. They said there would be added value in learning more about it as a first step toward exploiting its merits for improving cyber security. As there are no formalised structures for exchanges between science diplomats and cyber diplomats, even within the Ministry of Foreign Affairs, there is clearly room for a more formalized, strategic approach to linking the two "worlds" in the future.

Because the Ministry of Foreign Affairs and the Federal Ministry of Education and Research have only recently started to develop the concept of science diplomacy, which remains at a very general level, it will be interesting to see whether they continue down that path and how they organise and formalise their science diplomacy efforts.

4. France's Approach to Science Diplomacy in Cyber Space

4.1 Governance Arrangement

Since about 2010, technological changes (cloud computing, big data, artificial intelligence, etc.), rising awareness of the vulnerability of computer systems, and the technological gap between the United States and Europe revealed by the Snowden case have boosted investment in cyber security. The challenges now cut across fields in information technology, involving companies, universities, laboratories, governmental agencies, and interdepartmental government services. All of those actors have contributed to development of an official French document that addresses cyber strategy, cyber defence, and cyber diplomacy. In 2015, digital security became an express national priority. In 2017, France adopted an international digital strategy, which encompasses cyber security

[74] Interview 3, a representative of the public sector, Bonn/Berlin, 5 April 2019.

policies. First conceived mainly as a technical issue, cyber security has become more of a diplomatic issue for governments and policymakers.

The French cyber doctrine milestones (listed with French acronyms of the agencies that have produced them) are:

- SGDSN, Livre Blanc sur la Défense et la Sécurité Nationale (2008)
- ANSSI, Défense et sécurité des systèmes d'information - Stratégie de la France (2011)
- SGDSN, Livre Blanc sur la Défense et la Sécurité Nationale (2013)
- ANSSI, Stratégie Nationale pour la sécurité du numérique (2015)
- Ministère des Armées, Revue stratégique de défense et de sécurité nationale (2017)
- MEAE, Stratégie internationale de la France pour le numérique (2017)
- SGDSN, Revue stratégique de Cyberdéfense (2018)

The lead government agency responsible for cyber security issues is the French National Cybersecurity Agency (ANSSI), attached to the General Secretariat for Defence and National Security (SGDSN), which reports directly to the Prime Minister. Created in 2009, ANSSI employs over 500 people and provides expertise and assistance to government departments and other institutions, and for international negotiations.

The Ministry of Home Affairs' mandate is defending against all kinds of cyber criminality, whether it targets government agencies, businesses, or private individuals. The Ministry of the Armed Forces (MinArm) has two concerns: protecting its own computer networks from attack and integrating digital combat into military operations. In addition to the Weapons Directorate (DGA) and the International and Strategic Affairs Directorate (DGRIS), the Ministry of the Armed Forces created a military command (COMCYBER) in 2017 tasked with developing a cyber defence strategy.

The Ministry for European and Foreign Affairs (MEAE) coordinates cyber diplomacy and acts as France's representative to the United Nations Groups of Governmental Experts (GGE), where international rules for behaviour in cyber space are discussed. Its representatives, together with those of the other authorities with competencies in cyber security (MinArm and ANSSI), are implementing the Cyber Defence Pledge adopted by NATO in June 2016. They are also promoting adoption of standards for responsible behaviour in cyber space, and are taking action within the OSCE to implement confidence-building measures.[75]

Until 2017, the MEAE devoted only half of one of its posts to cyber issues: it now has assigned two full-time equivalent employees to the Strategic Affairs Directorate, plus a cyber counsellor in the French Permanent Representation in Brussels. Last but not least, France named a digital ambassador in 2017, who is attached to the MEAE. He has gradually expanded his portfolio (data policy, electronic proof, etc.). The ambassador participates in international negotiations in NATO and was notably involved in the preparation of the Paris Call for Action in November 2018.

The importance of cyber security issues increases the usefulness of several scientific disciplines in creating policy tools and attracts scientists from various disciplines to government services. Computer sciences, cryptography, international law, political sciences or geo-strategy have all had an impact on political decisions and are valued for that. The Director General of ANSSI has said that "cybersecurity is a fascinating and highly scientific field spanning a range of disciplines and involving a wealth of organisations and actors, from both the public sector and the business world, within France and internationally".[76] The MEAE's international digital strategy paper stresses that it must:

[75] MEAE: La France et la cybersécurité. Updated May 2019. Retrieved from: https://www.diplomatie.gouv.fr/fr/politique-etrangere-de-la-france/defense-et-securite/cybersecurite/

[76] ANSSI: A Word from the Director General. Retrieved from: https://www.ssi.gouv.fr/en/mission/word-from-director-general/

…contribute to the development of French strategic thinking on cybersecurity issues. It seems imperative to continue to acquire, particularly at the national level, skills and knowledge in terms of foresight, research and multidisciplinary expertise…. It is important that the MEAE continues to promote specialized, interdisciplinary centres of excellence that capture the major transformations (not only in the security field) in the digital age. The MEAE is also committed to cooperating with leading French think tanks and research groups to help them develop real expertise on these topics.[77]

The sciences are strongly connected to policy areas. The increasing importance of cyber issues has contributed to development of a complex framework associating different types of actors in both government administration and academia.

4.2 Stakeholders and Governance Practice

Broadly speaking, France has four strategies for making science-related policies. The first is internalising scientific expertise. ANSSI has its own in-house science department, which consists of five laboratories, mainly in the computer sciences field. Most of its senior officers are engineers or hold a PhD in computer science. Employees of its five laboratories are working on doctoral theses. MinArm's DGA and DGRIS provide funding for PhD researchers in the hard sciences and in strategic analysis. The Ministry has its own research department. It also created the Military School Institute for Strategic Research (IRSEM) in 2010. As well as conducting their own scientific research, its members regularly submit prospective strategic studies to the Ministry. Founded in 1973, the Centre for Analysis, Forecasting and Strategy (CAPS) is an advisory body for the MEAE.[78] IRSEM and CAPS have cyber divisions staffed with their own researchers. One researcher from CAPS is dedicated solely to providing the MEAE and France's digital ambassador with expertise.

The second strategy is outsourcing. Historically, the French ministries have had their own privileged advisory channels. The MEAE, for example, regularly consults with experts from three think tanks: the French Institute for International Relations (IFRI), the Institute for International and Strategic Affairs (IRIS), and the Foundation for Strategic Research (FRS), all of which are dedicated to studying geopolitical and strategic issues and regularly publish studies of cyber issues. Furthermore, the Ministry of the Armed Forces subcontracts studies to researchers in the framework of a three-year renewable contract. CEIS is an important think tank that is very active with regard to strategic analysis. It is one of the main contractors with the French government and has a team of 15-20 in-house experts along with support from outside academic researchers.

A third, similar strategy is partnership. It is hard to describe the entire range of more or less formalized collaborations among scientific institutions (like the French National Research Institute for the Digital Sciences (INRIA)), individuals, and political decision-makers. One of ANSSI's current objectives is strengthening its links with academia. ANSSI created a Scientific Council in 2018 to facilitate its scientific cooperation with external researchers. In addition to several partnerships with research centres, ANSSI also participates in international scientific initiatives — for example, through the EU's Strategic Programs for Advanced Research and Technology in Europe (SPARTA) competence network.[79] ANSSI organises special events at French embassies abroad as part of its

[77] MEAE (2017): Stratégie internationale de la France pour le numérique. p. 30, Retrieved from: https://www.diplomatie.gouv.fr/fr/politique-etrangere-de-la-france/diplomatie-numerique/strategie-internationale-de-la-france-pour-le-numerique/

[78] From that point of view, science in diplomacy is traditionally ingrained in French foreign policy.

[79] See the EU part of the cyber security report for more details.

program of cooperation with foreign countries. These dialogues involve Embassy representatives and cyber scientists from their host countries.[80]

The fourth strategy involves ad hoc interfaces between government and experts. Emerging challenges related to cyber issues have actually redesigned the playing field and have promoted the creation of common spaces that gather together different types of actors. Two initiatives were often mentioned during our interviews. The Castex Chair was created in 2010 as a research institution specialising in the analysis of the geopolitics of cyber space, and is closely linked to both MinArm and the MEAE. The Castex Chair does not claim to "influence" but rather to "enlighten" decision makers, by organising seminars that bring together experts, academics, business actors and civil servants. The AMNECYS project (for Alpine Multidisciplinary NEtwork on CYber-security Studies) also brings together scientists from different fields and laboratories and in-house researchers who are engaged in various policy and diplomatic arenas.

Turning now to two specific sets of activities, we can make the links between science and diplomacy in France clearer. The first set is the activities of the French National Research Institute for the Digital Sciences (INRIA), which involve both science for diplomacy and diplomacy for science. INRIA is one of the main French research centres involved in cyber issues. It underwrites 25% of France's academic research in the area of cyber security and has 200 full-time employees working on that priority.[81] Together with other research teams, INRIA takes part in several bilateral projects of cooperation, particularly with Germany and Japan.

INRIA actively supports Franco-German bilateral cooperation on cyber issues. As a matter of fact, cyber security is one of the fields covered by the Sixth Forum on Franco-German Research Cooperation. A strategic initiative to establish a joint Cybersecurity Roadmap was approved by both countries' Ministers for Research in June 2018 with the goal of promoting synergy between France and Germany. According to the German Ministry, "[c]ooperation in cybersecurity can serve to study and test key enabling technologies in the field of digital sovereignty and to apply these technologies in association with industrial partners in both countries".[82] Prepared under the aegis of INRIA and Fraunhofer AISEC/TU, the scientific roadmap encompasses topics and instruments that include research events and projects, new facilities, support for scholars' international mobility, and joint education.

The second set of activities is INRIA's participation in collaboration between France and Japan on cyber security research, which has been ongoing since 2015. Annual workshops gather together researchers from both countries. They take advantage of "each country's specificities and excellence in the domain and a shared vision of geo-strategy and privacy concerns".[83] The workshops receive financial support from the French embassy in Japan. Interestingly, the embassy counsellors are given a chance to voice their opinions on the topics under discussion. The researchers focus on industrial and political issues (the spread of disinformation, development of 5G services, etc.). As one interviewee noted: "we also use the academic dimension in order to tackle other, political, issues".[84] In that sense, the French-Japanese initiative is not only about international scientific cooperation (diplomacy for science) but also about sharing a common understanding of political issues (science for diplomacy).

[80] See, for example, the partnership between France and Japan on cyber security research, involving INRIA researchers (INRIA: Joint collaboration between France and Japan on Cybersecurity Research. Retrieved from: https://project.inria.fr/FranceJapanICST/)

[81] INRIA (2019): Cybersecurity. Current challenges and Inria's research directions. White Book 3.

[82] Federal Ministry of Education and Research (2018): Cybersecurity Research – Proposal to develop the synergy between France and Germany. Position paper by the expert group.

[83] INRIA: Joint collaboration between France and Japan on Cybersecurity Research. Updated March 2019. Retrieved from: https://project.inria.fr/FranceJapanICST/

[84] Interview, INRIA, 6 February 2019.

Another interesting initiative is related to science in diplomacy. Inaugurated in 2011, attached to the Institute of Higher Defence Studies, the Castex Chair for Cyber Strategy "aims to develop fundamental and applied research in the geopolitics of cyberspace in order to feed strategic reflections related to its political, economic, military and regulatory importance".[85] For several years, the Castex chair has organized conferences and workshops bringing together young researchers, experts in the cyber field, entrepreneurs, military figures, civil servants, and politicians to deal with geopolitical, strategic, legal, and sovereignty issues in cyber space. The Castex Chair facilitates formal and informal debates involving both government officials and entrepreneurs.[86] It has also produced several significant results. The Post-Soviet Cyberspace Observatory and the Arabic-speaking Cyberspace Observatory are two examples. Staffed by two teams of researchers, the Observatories are connected to the Directorate General for International Relations and Strategy. They have regular contacts with COMCYBER, a unit of the Ministry of the Armed Forces.

Interestingly, the chairwoman of the Castex Chair has been given some diplomatic positions: she is a board member of the *Defence and National Security Strategic Review* published by MinArm[87] and is directly involved in the Paris Call for Action of 2018. She is often consulted by MEAE diplomats as they prepare for international negotiations in NATO. Her contribution is in identifying and framing salient issues, interpreting global trends, producing technical proposals, and organising global events and meetings.[88] The Castex Chair is a good example of science diplomacy in action.

Beyond those examples, a range of general observations can be made about France's cyber security infrastructure. In a country where high civil servants have traditionally had minimal interaction with scientists, science diplomacy reflects that cyber security is an emerging issue of global importance, which requires new skills that not all administrators have. Specific knowledge — and not only technical knowledge, such as computer skills — complements the traditional expertise of government employees. For example, one diplomat explained to us how valuable experts in international public law have been to understanding and construing the evolution of the cyber-doctrines of foreign countries.[89] By combining different research approaches and fields of study, researchers produce original information (such as the cartography of cyber space) which can then be converted into valuable advice for diplomats and policy makers.

Researchers adapt their language, their way of working, and also their publications to produce useful policy briefs for officials. One source from the MEAE mentioned to us: "we do not have time enough to read fifty pages, we only read two-page papers".[90] It is remarkable that some scientists we interviewed spontaneously used the traditional language of diplomacy: some of them told us about the "1.5 track meetings" in which they had participated.[91] All that indicates that researchers are taking an active part in science diplomacy. The common social background of the researchers and diplomats — they are often young, with similar kind of education, and many of them are reserve officers or grew

[85] Chaire Castex de Cyberstrategie: The Aims of the Castex Chair. Retrieved from: http://www.cyberstrategie.org/?q=en/the-aims-of-the-castex-chair

[86] See for example the international conference organized at UNESCO in April 2017. ANSSI (2017): Conférence "Construire la paix et la sécurité internationals de la société numérique". Retrieved from: https://www.ssi.gouv.fr/actualite/conference-construire-la-paix-et-la-securite-internationales-de-la-societe-numerique-le-programme-maintenant-disponible/

[87] The review is the official document whose purpose is to set up a strategic framework for the French defence effort. Ministry of the Armed Forces (2017): Defence and National Security Strategic Review.

[88] Interview, Castex Chair, 23 April 2019.

[89] Interview, MEAE, 9 April 2019.

[90] Ibid.

[91] Usually, track 1 is an official one. Track 1.5 can (but not necessarily) be official and involves government staff as well as external experts, while track 2 does not involve the government at all.

up in military families — facilitate cooperation between the fields. But, above all, their interaction contributes to the institutionalisation of a "common language",[92] shared agendas, and similar ways of working.

Nevertheless, "cyber science diplomacy" does not seem to exist as a specific sub-discipline in the French context, or at least it is not well recognized as such. It does not appear in any text, and there is no clear statement of the way the sciences and cyber diplomacy can cooperate. Cyber security is not mentioned in the MEAE's 2013 science diplomacy report,[93] nor has it appeared since then in the MEAE's agenda for science diplomacy.[94]

One of the explanations for this is that the framework of "cyber" diplomacy is quite fragile in France. The Digital Ambassador's portfolio grew quickly and he lacks resources (having only two full-time staff), which weakens his interactions with academics. According to a diplomat in charge of cyber security at the MEAE, the attention that French embassies devote to cyber issues "depends on the people in charge and on the role configuration".[95] Embassies' interest in cyber issues does not exceed the personal interest of their ambassadors. For example, a diplomat told us that cyber issues are mainly a strategic affairs issue for embassies[96], and an academic explained that his main interlocutor at the French embassy in Japan was the scientific advisor for information and communications technologies[97]. Most of the time, cyber issues are not formally reflected in the embassies' organizational charts.[98]

Moreover, relationships between diplomats and scientists remain rather narrow and involve only a very few actors (maybe a dozen, at least as far as the "social sciences" are concerned). Cooperation depends a lot on the personal relationships that stakeholders maintain. Even where those personal relationships exist, they generally are informal, and they are not everywhere institutionalised. Academics do not receive much feedback on their work from the diplomats. They often say that diplomats still need to develop a better understanding of cyber issues and their importance to the nation. In short, cyber science diplomacy in France needs stronger institutional support.

5. European Union's Approach to Science Diplomacy in Cyber Space

5.1 Governance Arrangement

The first milestone in the EU's development of diplomacy in cyber space was the adoption of a grand strategic document: the *Cybersecurity Strategy of the European Union — An Open, Safe and Secure Cyberspace*. The strategy was adopted in February 2013 by the European Commission, together with the High Representative for Foreign Affairs and Security Policy. It presented the EU's vision for responding to various cyber threats and safeguarding European cyber space. It set five priorities: building cyber resilience, reducing cyber crime, developing cyber defence capabilities and the industrial and technological

[92] Interview, Castex Chair, 5 February 2019.

[93] MEAE - Direction générale de la mondialisation, du développement et des partenariats (2013): Une diplomatie scientifique pour la France. January 2013. Retrieved from: https://www.diplomatie.gouv.fr/fr/politique-etrangere-de-la-france/diplomatie-scientifique/

[94] MEAE: Scientific Diplomacy. Retrieved from: https://www.diplomatie.gouv.fr/en/french-foreign-policy/scientific-diplomacy/

[95] Interview, MEAE, 9 April 2019.

[96] Interview, French Permanent Representation, 24 April 2019.

[97] Interview, INRIA, 6 February 2019.

[98] See for example the embassy of France in Japan: Embassy of France in Tokyo: Présentation des services. Retrieved from: https://jp.ambafrance.org/Presentation-des-services#Service-pour-la-science-et-la-technologie

resources for cyber security and, finally, promoting core EU values.[99] The strategy also set the further goal of articulating "a coherent EU international cyberspace policy, which will be aimed at increased engagement and stronger relations with key international partners and organisations, as well as with civil society and private sector".[100] Thus, the desire to mainstream cyber security issues into EU international relations and the Common Foreign and Security Policy (CFSP) gave birth to EU cyber diplomacy.

Pursuant to the 2013 *Cyber Security Strategy*, the Commission tabled a package of cyber security measures in September 2017. The package introduced new initiatives to further develop European cyber response and resilience — among others, strengthening the role and mandate of the EU Agency for Network and Information Security (ENISA), introducing a cyber security certification scheme recognised across the EU Member States, and prompt implementation of the Directive on Security of Network and Information Systems (the NIS Directive). The package does not ignore the EU's external relations; it promotes the application of international law in cyber space, responsible state behaviour, and the development of bilateral cyber dialogues.[101]

Cyber security has become a top diplomatic issue for the EU. The 2015 Council Conclusions on Cyber Diplomacy proposed a range of specific objectives and principles for preventing conflict, reducing threats to cyber security, and increasing stability in international relations as regards cyber space.[102] The EU Cyber Diplomacy Toolbox was adopted by the EU in September 2017. It completes a triad of important EU cyber diplomacy documents. The toolbox's purpose is to encourage greater cooperation and more agile joint EU diplomatic reaction to malicious cyber events. It articulates possible countermeasures, including sanctions, that could be taken by the CFSP to respond to cyber attacks originating beyond Europe's borders.

Although these strategic documents laid the foundation for EU cyber diplomacy and its future development, none of them addresses the use of science as a diplomatic tool for enhancing cyber cooperation with external actors. On the other hand, although it appears that the EU has not formulated a coherent science diplomacy strategy for cyber space on paper, in practice it has been active in the field to a certain degree.

5.2 Stakeholders and Governance Practice

When it comes to cyber diplomacy on a general level, the European External Action Service (EEAS) department specialized in cyber issues has progressively developed in recent years. As of spring 2019, it employs six people. It is interesting to note here that Heli Tiirmaa-Klaar, the former Head of Cyber Policy Coordination for the EEAS from 2012 to 2018, was herself a cyber expert (she earlier coordinated the implementation of the Estonian cyber strategy). Her successor, Wiktor Staniecki, is a career diplomat with a traditional background. This change could mean that cyber issues are increasingly a routine part of the diplomatic agenda. The EEAS cyber department is in charge of advocacy at NATO and the OSCE. It notably promotes the EU strategy for preventing conflicts and provides support to Member States that have not developed their own capacities and policies in the

[99] European Commission (2013): Cybersecurity Strategy of the European Union: An Open, Safe and Secure Cyberspace. Retrieved from: https://ec.europa.eu/digital-single-market/en/news/eu-cybersecurity-plan-protect-open-internet-and-online-freedom-and-opportunity-cyber-security

[100] Ibid.

[101] European Commission: Cybersecurity. Retrieved from: https://ec.europa.eu/digital-single-market/en/cyber-security

[102] European Council and Council of the EU (19 June 2017): Cyber Attacks: EU Ready to Respond with a Range of Measures, Including Sanction. Retrieved from: https://www.consilium.europa.eu/fr/press/press-releases/2017/06/19/cyber-diplomacy-toolbox/

field.[103] The EEAS is also active in bilateral cyber dialogues between the EU and third countries and participates in both international conferences and more informal relationships.

International scientific cooperation is important to preserving the EU's "strategic autonomy", which is one of its top priorities. Indeed, under the influence of some Member States (France and Germany in particular), the EU institutions have taken action over several years to ensure the EU's technical sovereignty and enhance its cyber resilience. The EU's strategy rests on three pillars: legislation (the NIS Directive), normative leverage (appealing to standards and norms to encourage consensus), and industrial tools (such as public-private partnerships).[104] Synergy with the scientific community is a cross-cutting objective and is a tool used internally for developing and facilitating innovative projects. The EU has several sources of funding for such projects. The Directorate General for Migration and Home Affairs (DG Home) and especially the Directorate General for Communications Networks, Content and Technology (DG CNECT) have their own budget lines to finance technical projects. The main funding instrument is the Horizon 2020 (H2020) work programme 2018-2020 "Secure Societies - Protecting Freedom and Security of Europe and its Citizens". In 2018, seven H2020 projects in the cyber security field were funded under the rubric of innovation actions, five under research and innovation actions, two under the Marie Skłodowska-Curie actions, one under Coordination and Support Actions, and one by the European Research Council. The largest number of projects was funded under the Small and Medium Enterprise funding scheme (11 projects).[105]

The European Commission's proposal for a European Cybersecurity Competence Network and Centre also supports some of the current projects. The main purpose of this new initiative, which is funded under the next multi-annual financial framework for 2021 to 2027, is to "help the EU retain and develop the cybersecurity technological and industrial capacities necessary to secure its Digital Single Market" while increasing "the competitiveness of the EU's cybersecurity industry and turn[ing] cybersecurity into a competitive advantage of other European industries".[106] The Centre, together with the Network, is supposed to clarify the EU funding landscape by implementing a coordinating mechanism for cyber security-related financial support from the Horizon Europe and Digital Europe programmes.[107] It helps to promote a "European cybersecurity community" in that way.[108]

At the time of writing this report, 63.5 million euros are invested in four Horizon 2020 pilot projects dealing with electronic government and the economic dimensions (energy, finance, transport) and technological dimensions (ICTs, industry) of cyber security.[109] The cyber security programme Competence Research Innovation (CONCORDIA) gathers 46

[103] Interview, EEAS, 24 April 2019.

[104] European Commission press release (5 July 2016): Commission signs agreement with industry on cybersecurity and steps up efforts to tackle cyber-threats. Retrieved from: http://europa.eu/rapid/press-release_IP-16-2321_en.htm

[105] Amires: Cybersecurity Projects within H2020. Retrieved from: http://amires.eu/cyber-security-projects-within-h2020/

[106] European Commission: Proposal for a European Cybersecurity Competence Network and Centre. Retrieved from: https://ec.europa.eu/digital-single-market/en/proposal-european-cybersecurity-competence-network-and-centre

[107] Council of the EU, press release (2019): EU to pool and network its cybersecurity expertise – Council agrees its position on cybersecurity centres. Retrieved from: https://www.consilium.europa.eu/en/press/press-releases/2019/03/13/eu-to-pool-and-network-its-cybersecurity-expertise-council-agrees-its-position-on-cybersecurity-centres/
The major binding criterion was to bring together at least twenty partners from at least nine countries to work on four use cases.

[108] Interview, a SPARTA member, 6 February 2019.

[109] European Commission: Cybersecurity: Horizon 2020 Pilot Projects. Retrieved from: https://ec.europa.eu/newsroom/dae/document.cfm?doc_id=57561

partners involving 14 member states; Cyber Security for Europe (CSE) gathers 43 partners involving 20 member states; ECHO gathers 30 partners involving 15 member states; and, finally, SPARTA gathers 44 partners involving 14 member states. The SPARTA consortium links national agencies (like ANSSI in France), laboratories, and industrial actors such as Thales. Its purpose is to innovate defence against new cyber attacks, to ensure protection of highly connected computing environments, and promote the security of artificial intelligence.

Although these initiatives are all focused on the Member States and stakeholders within the borders of the EU, one of the four pilot projects announced at the beginning of 2019 seeks to have an impact beyond the EU. The European Network of Cybersecurity Centres and Competence Hub for Innovation and Operations (ECHO) project includes 30 partner organizations from 15 EU Member States and Ukraine. It aims to "organize and optimize the currently fragmented cybersecurity efforts across the EU".[110] The question remains, will these ambitious plans stay only on paper or will they be carried out in practice?

Bilateral cooperation with third countries has been one of the objectives of the EU's funding policies for the past several years. As stated in one of the EU's calls for action:

an exchange of views and possible cooperation around cybersecurity and privacy research and innovation approaches, policies and best practices with like-minded third countries is necessary in order to bring relevant elements of comparison and allow European stakeholders (public and private) to actively participate in those discussions which will determine the future global cyber security landscape.[111]

The EU first introduced this particular type of diplomacy by funding wide-ranging projects of other countries. It frequently uses this tool in its relations with its strategic partners, but what follows below shows that it is also a useful tool of cooperation with other countries.

Earlier, the EU's Seventh Framework Programme (FP7) of 2007–2013 funded several ICT-oriented projects that led to the development of the EU's science diplomacy in cyber topics. To name one of them, the Facilitate Industry and Research in Europe (FIRE) project operated between 2012 and 2014. FIRE's goal was to "provide a strategic approach, organizational support and network capability for researchers, technology developers, consultants, system integrators and governments to improve their European co-operation". It also sought to "find alignment and collaborative or export opportunities for European technology solutions with other targeted markets such as the US, Canada, Brazil, Argentina, Chile and Japan".[112] Another FP7 ICT project was Building International Cooperation for Trustworthy ICT (BIC), which ran between 2011 and 2013. The project was aimed at developing models for cooperation between EU researchers and their colleagues in Brazil, India and South Africa, countries which "represent significant emergent world-impacting information economies through the scale and sophistication of their growing ICT sectors".[113] The BIC project offered added value in two other ways. It extended cooperation to include stakeholders involved in another, previously established project, INCO-TRUST, namely the USA, Japan, Australia, South Korea and Canada.

[110] ECHO (25 February 2019): ECHO Project Press Release. Retrieved from: https://www.echonetwork.eu/wp-content/uploads/2019/02/Echo_press_relase_2502.pdf

[111] European Commission (14 October 2015): EU Cooperation and International Dialogues in Cybersecurity and Privacy Research and Innovation. Retrieved from: https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/topic-details/ds-05-2016

[112] European Commission – Cordis: FIRE – Objective. Retrieved from: https://cordis.europa.eu/project/rcn/105736/factsheet/en

[113] European Commission – Cordis: BIC – Objective. Retrieved from: https://cordis.europa.eu/project/rcn/95486/factsheet/en

Furthermore, BIC promised to sustain development of its activities even after its official end date by means of its International Advisory Group and Working Group structures.[114]

Besides the tool of funding projects, the EU develops strategic partnerships with key state players around the globe[115] that include cooperation on cyber security issues. The types of cyber cooperation with the EU's strategic partners vary based on the character of the partners' relationships with the EU outside of cyber space. For example, while the EU's cyber cooperation with the United States is the most active, mirroring its generally good bilateral relations with the U.S., its activities with the Russian Federation are focused mainly on confidence-building measures because Russian territory is perceived to be the source of numerous cyber attacks and cyber espionage against the EU.[116]

The EU's strategic cyber partnerships with Japan and the United States are its most highly developed. In 2010, the EU and the U.S. established a Working Group on Cyber-security and Cyber-crime, whose main goal has been addressing priorities related to cyber security and cyber crime.[117] Another important platform for bilateral cyber relations is EU-U.S. Cyber Dialogue, which held its first meeting in December 2014 and has continued to meet annually. The dialogue is co-chaired by representatives from the U.S. Department of State and the EEAS. It serves as an official platform for information-sharing and coordination of actions on cyber-related issues. Similarly, the EU and Japan have organized annual Cyber Dialogue meetings since 2014, as a platform for regular cooperation. The goals are similar to those of the EU-U.S. Cyber Dialogues. The dialogues affirm a commitment to closer cooperation and to improving the existing bilateral structures and practices.[118]

Because the strategic cyber partnerships with Japan and the United States are the EU's most highly developed, they include elements of cyber science diplomacy. The EU-U.S. Cyber Dialogue in December 2016 is an example. During its third meeting, the EU and U.S. representatives announced the creation of the Transatlantic Cyber Policy Research Initiative (TCPRI). The press release for the event notes that:

[In order to] support burgeoning governmental transatlantic cooperation in cyberspace, the European Union and the United States launched the Transatlantic Cyber Policy Research Initiative, bringing together European and U.S. civil society, academic, industry and think-tank experts to address key cyber policy challenges and increase policy research capacity on cyber issues.[119]

Although the TCPRI initially appeared to be the most promising initiative in EU-U.S. cyber relations, both partners failed to deliver on their plans to take appropriate, timely action. That prompted a German independent think-tank, the Stiftung Neue Verantwortung (SNV), to hold a workshop that aimed to discuss the future of the TCPRI. The workshop convened sixteen cyber security experts and researchers from both the United States and the EU in Washington, D.C. in December 2018 to devise a new model for implementation of the TCPRI.[120]

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[114] European Commission – Cordis: BIC – Objective. Retrieved from: https://cordis.europa.eu/project/rcn/95486/factsheet/en ; BIC: Home. Retrieved from: http://www.bic-trust.eu/index.html

[115] These are the USA, Canada, Japan, Brazil, Russia, China, India, Mexico, South Africa and South Korea.

[116] Renard, Thomas (2018): EU Cyber Partnerships: Assessing the EU Strategic Partnerships with Third Countries in the Cyber Domain. In: *European Politics and Society. 19*(3), pp. 321-337.

[117] Council of the EU (20 November 2010): EU-US Summit, joint statement. Retrieved from: http://europa.eu/rapid/press-release_PRES-10-315_en.htm?locale=en

[118] EEAS, press release (14 March 2018): 3rd EU-Japan Cyber Dialogue – Joint Elements. Retrieved from: https://eeas.europa.eu/topics/eu-international-cyberspace-policy/41330/3rd-eu-%E2%80%93-japan-cyber-dialogue-joint-elements_en

[119] EEAS, press release (16 December 2016): EU-US Cyber Dialogue. Retrieved from: https://eeas.europa.eu/headquarters/headquarters-homepage_en/18132/EU-U.S.%20Cyber%20Dialogue

[120] SNV (2018): EU-US Cyber Diplomacy Workshop on Transatlantic Cyber Policy Research Initiative. Retrieved from: https://www.stiftung-nv.de/en/node/2484

Another promising initiative in EU-U.S. cyber relations that gives hints of the development of cyber science diplomacy is the Accelerating EU-U.S. Dialogue for Research and Innovation in Cybersecurity & Privacy (AEGIS). The AEGIS project, funded under Horizon 2020 and begun in 2017, aims, among other things, "to promote collaboration and innovation partnerships between researchers, innovators, and industry from Europe and the US with the goal of coordinating the multiple research efforts underway in the areas of cybersecurity and privacy".[121] Besides publishing white papers, policy briefs and recommendations on relevant topics, AEGIS also holds two regular events, a Cybersecurity Reflection Group Round Table and the Open Cyber Camp EU-U.S. The Cybersecurity Reflection Group Round Tables gather EU and U.S. experts, policy makers, researchers and business leaders working with cyber security and privacy issues to discuss and enhance their bilateral cooperation. Similarly, the Open Cyber Camp EU-U.S. invites entrepreneurs, industry leaders, and researchers to gather and identify new challenges to cyber security, enhance privacy-protection cooperation, and build partnerships across the Atlantic.[122]

As in its partnership with the United States, the EU is also developing research projects with Japan. The Nippon-European Cyberdefence-Oriented Multilayer Threat Analysis (NECOMA) project, which ran between 2013 and 2016, is an example. The project, which focused on data collection and threat analysis, was co-funded by the EU's Seventh Framework Programme and the Strategic International Collaborative R&D Promotion Project of the Japanese Ministry of Internal Affairs and Communication.[123] Another example is the Horizon 2020-funded EUNITY Cybersecurity and Privacy Dialogue between Europe and Japan which "aims to encourage, facilitate and develop the dialogue between Europe and Japan on cybersecurity and privacy research and innovation trends and challenges, in order to foster and promote cybersecurity activities in both regions".[124] Overall, there are around 75 joint EU-Japan projects operating under the auspices of Horizon 2020 nowadays. ICT is the most popular area of research.[125] The EU is well-aware of the importance of cyber security research and cooperation with its strategic partners. That was illustrated in the Call for EU Cooperation and International Dialogues in Cybersecurity and Privacy Research and Innovation issued under H2020 in 2016. Two of its three strands of proposals were for projects of international dialogue with Japan and the USA[126].

The importance of research cooperation between the EU and Japan has also been affirmed in ICT Strategies Workshops. During these workshops, government-to-government and industry-to-government meetings and expert-level gatherings are organised on topics such as the digital economy, artificial intelligence and cyber security. For instance, during the Seventh ICT Strategies Workshop in April 2018, the EU and Japan proposed that they should "explore participation in research" as a follow-up activity.[127]

Last but not least, the Cyber Diplomacy and Resilience Clusters (EU Cyber Direct) should be mentioned. Since 2018, Cyber Direct's purpose has been to establish a "one-stop-shop" for official cyber dialogues with the EU's strategic partners (Brazil, China, India, Japan, South Korea, and the United States) as well as Latin America and the Asia-Pacific region more broadly. Recognizing that "the EU's role, its policies and institutional set up are still

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121 AEGIS: About us. Retrieved from: http://aegis-project.org/about-us/

122 AEGIS: Home. Retrieved from: http://aegis-project.org/

123 NECOMA: Home. Retrieved from: http://www.necoma-project.eu/

124 EUNITY: Home. Retrieved from: https://www.eunity-project.eu/en/

125 Japan - National Contact Point: Summary of EU-Japan collaborations through Horizon 2020 and FP7. Retrieved from: https://www.ncp-japan.jp/horizon-2020/summary-eu-japan-collaborations-horizon-2020-fp7

126 European Commission (14 October 2015): EU Cooperation and International Dialogues in Cybersecurity and Privacy Research and Innovation. Retrieved from: https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/topic-details/ds-05-2016

127 Delegation of the EU to Japan, press release (2018): EU and Japan intensify bilateral cooperation on digital economy issues. Retrieved from: https://eeas.europa.eu/delegations/japan/43252/eu-and-japan-intensify-bilateral-cooperation-digital-economy-issues_en

poorly understood in other parts of the world",[128] the project gathers together members of the EU Institute for Security Studies (EU ISS), the German Marshall Fund of the United States (GMF) and the Stiftung Neue Verantwortung (SNV). In addition to publishing research and analysis papers, EU Cyber Direct organises regular workshops, conferences and meetings. Its last EU Cyber Forum invited actors from several different sectors: diplomats from Brazil, Ireland and Finland, academics and experts, representatives of the EU administrations, etc. "This whole-of-the-EU approach ensures that the [scientific] agenda of the Forum remains policy relevant and feeds directly into the policy dialogues and cooperative arrangements that the EU pursues with partner countries".[129] The Cyber Forum is a major initiative for EU cyber science diplomacy.

[128] EU Cyber Direct (9 April 2019): EU Cyber Forum 2019. Retrieved from: https://eucyberdirect.eu/content_events/eu-cyber-forum-2019/
[129] Ibid.

6. Meta-perspective

The case studies above (especially the national ones) have certain common aspects, besides being driven by foreign policy as an increasingly salient security issue, which deserve consideration. The first is the role of diplomats who have a particular focus on cyber security (most often with title "cyber attachés"). In the Czech case, these are cyber experts delegated from NCISA and deployed in three countries that are key to the Czech Republic's international cyber security. Germany has a much wider network of cyber attachés. The Federal Foreign Office currently deploys twenty cyber diplomats around the world. In contrast, France has decided to use a slightly different model. Besides two full-time employees who are focused on cyber security issues at the MEAE and a cyber counsellor deployed with the French Permanent Representation in Brussels, France has also named a digital ambassador, who is attached to the MEAE. Each of the countries studied has diplomats with a particular responsibility for cyber security issues. However, they are not necessarily cyber experts themselves.

Besides the cyber diplomats, all three states have also deployed science diplomats. France has rich experience in this regard. Similarly, Germany has a broad network of science attachés posted at thirty embassies abroad. These diplomats are not all career diplomats. A number of them are civil servants dispatched from the Federal Ministry of Education and Research. The Czech Republic is the least advanced in this regard, having only two science diplomats and no plans to deploy more.

Given that the cyber attachés and science diplomats are often deployed in the same embassies, a relevant question is how these two positions interact. Do they overlap and do they coexist in harmony? For example, the Czech Republic's two diplomats are deployed in same embassy. They work more or less symbiotically if the situation requires it. Their relationships are not governed by a clear, institutionalised division of their agendas and responsibilities but are based on mutual personal agreement. In comparison, the responsibilities of German science diplomats and cyber attachés are very clearly defined. However, there are no predefined cooperation schemes or interfaces between them. Their cooperation depends on the interest of the involved personnel in linking their spheres of responsibility.

The countries also share certain limitations on science diplomacy in the area of cyber security. For example, all the case studies indicate that the three countries and the EU have no clear idea what science diplomacy in relation to cyber security encompasses and no strategic approach to linking the two disciplines. Moreover, the Czech and German cases reveal that those two countries do not have a clear government-wide understanding of what exactly is meant by the term "science diplomacy" and what activities it should involve.

Furthermore, all of the national cases show that the relationship between diplomats and scientists remains quite narrow and involves very few actors. Their relationships are often informal and very weakly institutionalised. This inevitably leads to the conclusion that in most cases, cooperation very much depends on the personal interests and previous experience of those in charge, who are able to determine their own approach to diplomacy and undertake particular activities independently. This often results in cooperation between government structures and academia that is more on a case-by-case basis than in a sustainable manner.

The Czech Republic, France and Germany are clearly countries with very different levels of advancement when it comes to promotion of science diplomacy in relation to cyber security. As seen in the sections above, the understanding of science diplomacy in this area includes elements of science in diplomacy, science for diplomacy, and global challenges. France is the most focused on this type of diplomacy of the three countries. Germany has apparently realized its importance and is planning to expand it (e.g., by establishing a new German Institute for International Cyber Security). The least advanced of the three countries is the Czech Republic, which despite its cyber security potential, does not possess a sustainable framework for science diplomacy. However, no matter how far advanced the three countries may be, their science diplomacy shares certain common aspects in its relation to cyber security. These include the roles played by their cyber and science diplomats and the limits of their science diplomacy in the cyber realm.

Trying to synthesize a conclusion from the different dimensions displayed by the case of the EU, the following three elements should be highlighted. First, ongoing EU activities are aimed at more strategic and better coordinated responses to the challenges of science and technology. Motivated by its stated strategy of achieving technological autonomy, the EU funds policies that have several objectives: better integration of Member States' national resources; facilitation of trans-sectorial synergies between actors from industries, laboratories and institutions; and, inside some of the funded projects, better cooperation between disciplines (e.g., computer and social sciences).

Second, the EU's scientific diplomacy agenda is being institutionalized. Even if it is far too early to fully assess this dynamic, several recent initiatives seem to be trying to bring various types of scientific expertise into diplomatic initiatives. One indication of the development of the EU's science diplomacy is that researchers involved into some of the projects use diplomatic vocabulary to describe their own work, for example, the term “track 1.5” used by a French interviewee.[130]

Third, we can identify two main challenges for cyber science diplomacy. For one, there is a question about how the goal of “strategic autonomy” might hinder international cooperation with third countries. Strategic autonomy may motivate synergies at EU level, but the way it can be reconciled with bilateral initiatives with other countries still needs to be assessed. Another question is whether the science diplomacy practiced in some specific institutions (such as EU ISS) and some projects (like the EU's Cyber Direct) will now be mobilised in other EU official arenas. For example, TCPRI has been described as an interesting “pilot experience” but those experiences have never been translated into general practice.[131] Relationships between participants in the scientific projects and the EU institutions vary significantly. As one interviewee said, “the EEAS has its own agenda”.[132] Another difficulty is turnover among EU officials’ working in various departments of the Commission and the EEAS, which means regularly rebuilding relationships and mutual understanding of technical issues.[133] For those reasons, science diplomacy in the cyber field on the EU level remains weakly institutionalised.

[130] Interview, EU Cyber Direct, 2 May 2019.

[131] Interview, TCPRI, 12 April 2019.

[132] Ibid.

[133] Interview, EEAS, 24 April 2019.

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Interview, SPARTA, researcher, 6 February 2019.

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Interview, Egmont Institute, cyber expert, 23 April 2019.

Interview, EEAS, cyber expert, 24 April 2019.

Interview, EU Cyber Direct, researcher, 2 May 2019.

Other Interviews

TrendMicro private expert (central player of the French cyber field)

Le Monde specialist for cyber issues

CEIS expert (a think tank responsible for relations with MinDef)

ANSSI (directorate for international affairs)

ANSSI (expertise directorate)

CESDIP (researcher, political science, he previously held the "Cybersecurity and Cyberdefense" Chair of Saint-Cyr-Coëtquidan military schools)

CRESC (researcher, also teacher in Saint-Cyr-Coëtquidan military schools)

Chaire CASTEX (researcher, geostrategy)

Chaire CASTEX/Paris 8 (researcher, geostrategy)

AMNESCYS & CESICE (researcher, international law)

AMNESCYS (researcher, computer sciences, also member of the Castex Chair)

Observations

Symposium "Research methods into cybersecurity in the humanities and social sciences", CESDIP/University of Saint-Quentin, 19 November 2018.

Meeting Cybersécurité – Cybercercle/Nano-Innov', Paris Saclay, 22 November 2018.

International Cybersecurity Forum, Lille, 17-18 January 2019.

4. The science and diplomacy of global challenges: Food security in EU-Africa relations

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1. Governance arrangement

1.1. Food Security: the EU commitment to a global concern

As a supranational actor committed to engaging more actively in international affairs, the EU has chosen to make knowledge central to its identity and policy system. Simultaneously, the EU has to face increasingly urgent and complex challenges, more interdependent and global in nature, and which require more and more scientific expertise to be addressed – food security is one of them.

Food security has been defined by the Food and Agriculture Organization (FAO) of the United Nations (UN) as:

> *"Food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active and healthy life. Household food security is the application of this concept to the family level, with individuals within households as the focus of concern"*[1].

Food security is a concept that covers several major dimensions : (i) the availability in sufficient quantities of food of appropriate nature and quality and in all parts of the national territory whatever the source of this food (local production, import or food aid); (ii) the access to the necessary food resource for a nourishing diet - these resources include both monetary resources and access rights to produce food; (iii) stability of access to food, that is, access to food for the population cannot be put at risk by any natural or economic shock; (iv) the appropriate use of food (good cooking and preparation of various foods) favouring an adequate supply of nutrients and energy in a context where the consumption of this food is safe for health (hygiene, drinking water, health or medical infrastructure)[2].

During the last 20-30 years, we actually observed institutional and scientific debates on the necessary reshaping of global food security goals. These debates are directly linked to the series of food crises and food scandals that, in the 1990s, challenged the post war implementation of the "Green Revolution" - a system based on quantity food production thanks to the use of fertilizers, on economic liberalization and international trade and which postulates that agro-industrial complex and open market would provide food security:

> *"The green revolution of the 1960s and 1970s depended on applications of fertilizers, pesticides and irrigation to create conditions in which high-yielding modern varieties could thrive. It provided the basis for a quantum leap forward in food production. But it also taught scientists and policy-makers some important lessons for the future."*[3]

The first Green revolution succeeded in improving yields in the breadbasket regions where it was implemented and increased food crop productivity (rice production in Asia and Southern America is an illustration). But, as former UN special rapporteur Olivier de Schutter writes, the Green revolution "*sometimes came at a high social and environmental cost, including the depletion of soils, pollution of groundwater, increased inequalities among famers, and the productivity gains were not always sustainable in the long term*."[4]

[1] FAO (2003): Trade Reforms and Food Security. Conceptualizing the Linkages. Rome: FAO.

[2] FAO (2008): The Right to Food and Access to Natural Resources. Using Human Rights Arguments and Mechanisms to Improve Resource Access for the Rural Poor. Rome: FAO.; FAO (2009): The State of Food Insecurity in the World. Economic crises – impacts and lessons learned. Rome: FAO.

[3] FAO: Towards a Green Revolution. Retrieved from: http://www.fao.org/3/x0262e/x0262e06.htm

[4] De Schutter, Olivier, Gaëtan Vanloqueren (2011): The New Green Revolution: How Twenty-First-Century Science can Feed the World. In: Solutions. Vol.2, 4, pp. 33-44.

Next to the necessary sustainability of soil and the necessary social equality for the production of food and for its access, climate change is another key factor for the rethinking of world agro-systems. Indeed, food production experts observed that climate changes already have dramatic consequences on agriculture and international food security[5]. 600 million additional people could be at risk of hunger as a direct result of climate changes[6] since the world population is estimated to increase to 9 billion by 2050, and while arable soils are diminishing.

In addition to this, experts remark that modern agriculture is dependent to oil and highly sensitive to oil prices[7]. Food production relies on oil or gas at many stages: pesticides and nitrogen fertilizers are made of oil and gas, irrigation, machinery runs, transports are all oil dependent, thus increasing the economic pressure on the food market and generating social conflicts. In this respect, the European Union and UN agencies report that hunger and malnutrition have increased between 2000 and 2010 (around 1 billion people in food insecurity in 2010, according to the EU*)* as a direct consequence of the economic crisis in 2008 when food prices on global market soared, and sparked "food riots" across Africa, Asia, and Latin America. Although prices stabilized in 2011, global food prices in May 2011 where higher than they were in June 2008.

All these social, environmental and economic risks forced the FAO to engage into the conceptualization of a more comprehensive "New Green Revolution" aiming at supporting not only food quantity crop, but the sustainable development of local farming systems and aiming at improving food safety all along the food chain.

> *"The new green revolution draws on the best of the technologies that have doubled production over the past 30 years. At the same time, it emphasizes alternative approaches and improved farm management and information systems in order to minimize environmental damage from external inputs and benefit poor farmers and marginal areas bypassed by the original green revolution[8]."*

In a comprehensive publication by the FAO in 2011 on global food security and food safety[9], food experts called for a shift from a quantity based food security conception toward a food security conception concerned also by the social-cultural and environmental impacts of food production with special emphasis on the preservation of natural resources – as renown "father" of the Green Revolution in India M. S. Swaminathan underlines, "*unsustainable consumption of natural resources presents a grave threat to food security*"[10]. From a general standpoint, food security has thus merged with new variables (energy, water, climate, migration) by introducing more linkages[11].

This shift from a security food supply policy to a policy also worried about social sustainability and environmental safety food production is supported by the EU. During the last 20 years, the EU developed a food security policy in close cooperation with Rome-based UN agencies, namely International Fund for Agricultural Development (IFAD), the Food and Agriculture Organization (FAO), and the World Food Program (WFP).

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[5] FAO (2008): Climate change and food security: framework document. Retrieved from: http://www.fao.org/forestry/15538-079b31d45081fe9c3dbc6ff34de4807e4.pdf

[6] De Schutter, Olivier, Gaëtan Vanloqueren (2011): The New Green Revolution: How Twenty-First-Century Science can Feed the World. In: Solutions. Vol.2, 4, pp. 33-44.

[7] Alghalith, Moawia (2010): The interaction between food prices and oil prices. In: Energy Economics. 32(6), pp. 1520-1522.

[8] FAO: Towards a Green Revolution. Retrieved from: http://www.fao.org/3/x0262e/x0262e06.htm

[9] FAO (2011): New Paradigm of Agriculture.

[10] Alghalith, Moawia (2010): The interaction between food prices and oil prices. In: Energy Economics. 32(6), p. 1521.

[11] Fattibene, Daniele (2016): Strengthening the EU's External Action: The Need for an EU Food Diplomacy? Istituto Affari Internazionali Working Paper.

The partnership between the EU and the UN agencies on International Governance System and on Food and Nutrition Security has been redefined in 2010 – two years after the food price shock of 2008 – in a key text: the *Policy Framework on Food Security (PFFS)*. The policy paper, which resulted of a joint effort taken by DG International Cooperation and Development (DEVCO) and DG European Civil Protection and Humanitarian Aid Operations (ECHO), is a communication from the Commission to the Council and the European Parliament which aimed at providing a Framework to assist developing countries in addressing food security challenges. The text follows recent reflections on the necessary transformation of global food systems. The Commission initiative completes and defines the key issues in the current food security agenda, such as nutrition, price volatility, social protection and safety nets, biofuels, food safety, research and innovation, and the "right to food" concept which states that each household either has the means to produce or buy its own food.

Food security projects are mainly treated as part of the Global Public Goods and Challenges (GPGC) thematic programme. About 1.5 billion euros have been allocated each year for "Food and Nutrition Security and Sustainable Agriculture" projects between 2014-2020[12]. Beyond the classical intergovernmental level, the EU food security policy is now two-layered. The international level involves, on the one hand, other regional or international actors: about 60 countries built their bilateral relations with the EU on food security projects. On the other hand, the EU is committed to cooperation with the growing number of international actors dealing with food security: the FAO, the African Union, the Economic Community of West African States (ECOWAS), the above-mentioned International Fund for Agricultural Development (IFAD), NGOs and international research organisations such as the International Food Policy Research Institute (IFPRI).

As for the internal level, it implies on the one hand Commission Directorate-Generals (DGs), especially DEVCO[13], which coordinates geographical funding instruments and thematic programmes dedicated to specific topics[14], AGRI, (both implied in promoting food safety and developing bilateral cooperation) and ECHO (mainly involved in humanitarian assistance policies). Through its international delegations, EEAS plays also a role "on the ground", mainly to shape the cross-cutting nature of food security and to coordinate the activities of DGs abroad.

In a nutshell, a set of institutions, concerns, competencies, partnerships and programmes draws the outlines of the EU food security diplomacy. Thus, a key question is to understand to what extend science plays a role in deploying this food security diplomacy – or in other words, to what extent there is a science diplomacy of the issue of food security.

1.2. Food security diplomacy and funded research: the EU-AU relationships case

The now classical categorisation of different forms of science diplomacy (i.e. diplomacy for science, science for diplomacy, and science in diplomacy) is helpful to apprehend the science diplomacy dimensions of Food security[15].

- Activities of international networking in food security research are a cooperation policy purpose, and for instance can clearly be understood as "**diplomacy for science**", or diplomacy facilitating international scientific cooperation.

[12] Idem.

[13] Before the Treaty of Lisbon entered into force, DEVCO prerogative were covered by the Europe Aid structure.

[14] European Commission: Food and Nutrition Security. Retrieved from: https://ec.europa.eu/europeaid/sectors/food-and-agriculture/food-and-nutrition-security_en

[15] The Royal Society / AAAS (2010): New Frontiers in Science Diplomacy. Navigating the changing balance of power. RS Policy document 01/10.

- The way the food security challenge is linked to issues of stability, conflict prevention, health, well-being, or migration also makes of Food security research activities a case of "**science for diplomacy**", or as science cooperation improving international relations. Food security is also an important market issue for EU relationships with different regions, especially Africa.
- What needs to be explored more precisely is then Food security as a case of "**Science in diplomacy**" or of science (here food security research) advising / informing diplomacy (here EU external relations).

A more comprehensive way to apprehend food security as science diplomacy issue for the EU is to analyse the interfaces between science (EU food security research) and diplomacy (food security as an issue for the EU as global actor). Given that food security is explicitly identified as one the major global challenges, that the EU is more and more acting as "knowledge power" capable of harnessing its knowledge capacity to address global challenges, and more especially given the fact that the EU is spending millions to fund food security research, especially in Horizon 2020, one would expect to observe clearly designed strategic interfaces between science and diplomacy on this topic. Is it the case? This is what this study will try determine[16].

In order to picture the importance of food security research for the EU, we can look at the issue of food security in Horizon 2020. Horizon 2020 identifies 7 so called "societal challenges", "*where targeted investment in research and innovation can have a real impact benefitting the citizen*"[17]. In terms of science diplomacy, societal challenges are interesting because they carry the idea that science has potential but not yet answers, and thus by extension requires a different approach by EU policy makers in general, and diplomats more particularly when global challenges are concerned. Within the pillar "societal challenges", the societal challenge n°2 is "Food Security, Sustainable Agriculture and Forestry, Marine, Maritime and Inland Water Research and the Bioeconomy". This societal challenge n°2 as a whole is not framed in a way that shows general foreign policy concerns (agricultural or forestry policies for instance seem more central). But when looking more precisely, for example, at Horizon 2020 work programmes 2016-2017 and 2018-2020, within the call "Sustainable food security", there is a dedicated section on "*Support to the Implementation of the EU-Africa Partnership on Food and Nutrition Security and Sustainable Agriculture*"[18]. Here the nexus between a foreign policy overarching objective (supporting the implementation of the EU-Africa partnership) and science is explicit, which makes the topics under this section particularly relevant for the S4D4C core questioning, and an ideal case to study.

What is then more precisely the position and history of the food security issue for the African Union (AU) and for the EU-Africa relationships, and more especially of food security as a science diplomacy issue?

For a number of reasons, EU-AU food diplomatic channels can be seen as a key issue for both partners. On the African side, the starting point is that Africa remains the most food insecure region of the world and[19], as such, the African Union countries have come together

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[16] For more details regarding the methodology used, please refer to the last section of this report

[17] European Commission: Societal Challenges. Retrieved from: https://ec.europa.eu/programmes/horizon2020/en/h2020-section/societal-challenges

[18] European Commission: Food Security, Sustainable Agriculture and Forestry, Marine, Maritime and Inland Water Research and the Bioeconomy. Retrieved from: https://ec.europa.eu/programmes/horizon2020/en/h2020-section/food-security-sustainable-agriculture-and-forestry-marine-maritime-and-inland-water

[19] The UN Millennium Development Goals Report 2015 highlights that "in sub-Saharan Africa, projections for the 2014-2016 period indicate a rate of undernourishment of almost 23 per cent. While the hunger rate has fallen, the number of undernourished people has increased by 44 million since 1990, reflecting the region's high population growth rate." Retrieved from: https://www.un.org/millenniumgoals/2015_MDG_Report/pdf/MDG%202015%20rev%20(July%201).pdf

on this topic. In July 2003, African Heads of State and Government signed a declaration on Agriculture and Food Security in Maputo, Mozambique. The Maputo Declaration called for a pan-African flagship programme to enhance agriculture production and bring about food security on the continent. The Comprehensive African Agriculture Development Programme (CAADP) is the resulting African policy framework for attaining food security, nutrition and sustainable development through agriculture-led investment at both national and regional levels. CAADP aims to increase public investment in agriculture by a minimum of 10 per cent of national budgets, and to raise agricultural productivity by at least 6 per cent. To date, 44 African countries have signed the CAADP Compact to allocate 10 per cent of their national budgets to agriculture, and 39 countries have formulated national agriculture and food security investment plans.[20] More recently, the African Union's Science, Technology and Innovation Strategy for Africa 2024 (STISA-2024)[21], adopted in 2014, outlines six priority areas that will contribute to the AU Agenda 2063. Priority 1 is the eradication of hunger and achieving food security.

This brings us into the current era of 'agricultural diplomacy' towards food security in Africa, with major actors such as the USA, Brazil and China, among others, each approaching the issue of development aid from different perspectives. Several countries in Africa signed bilateral Science and Technology Cooperation Agreements with the European Union: South Africa (1996, entered into force 1997), Egypt (2005, entered into force 2008), Tunisia (2003, entered into force 2004), Morocco (2004, entered into force 2005) and Algeria (signed 2012, entered into force 2013). Current bi-lateral projects include efforts to improve food security and reducing poverty through intra-regional fish trade; strengthen institutional capacity to enhance governance of the fisheries sector in Africa; and a regional focus on animal genetic resources.

After depicting the general landscape of food security governance at the global level, and the relevance of looking at issue of food security in EU-AU relationships as a EU science diplomacy case, we will now study more in depth the stakeholders and governance practices, looking at the interfaces between food security research and diplomacy (section 2), and highlighting some challenges and weaknesses (section 3).

[20] NEPAD: Overview. Retrieved from: https://www.nepad.org/caadp/overview

[21] African Union: STISA-2024. Retrieved from: https://au.int/sites/default/files/newsevents/workingdocuments/33178-wd-stisa-english_-_final.pdf

2. Stakeholders & governance practices (1): exploring the science – diplomacy interfaces in funding policies

2.1. Science to increase foreign policy goal: the HLPD on S&T and the roadmap on FNSSA

A first question to raise is how does EU funded research on food security interact with diplomacy arena? What are the interfaces and contact points between Horizon 2020 Food security research and the EU foreign policy?

A starting point for the analysis is the Joint Africa-EU Strategy (JAES), adopted at the Lisbon Summit in 2007 by the Heads of State of both continents and transcribed in a Council policy note[22]. Its main objective was to deploy a long-term approach of "*how to ensure peace and security and leverage faster socio-economic growth and sustainable development in Africa*"[23], and insisted on the importance of food security issues as well as science cooperation. Institutional stakeholders of JAES are officially the Heads of State and Governments of EU Member States in the European Council and the Foreign Affairs Council of the EU. On the operational level, EEAS and DG DEVCO ensure policy and strategic coordination.

JAES gave a framework for deepening the partnership via the EU-Africa Summits and resulted in the implementation of the EU-Africa High Level Policy Dialogue (HLPD) on Science, Technology and Innovation at the 2nd Africa-EU Summit in Tripoli, in 2010.

This dialogue is designed to serve as the main interface for regular cooperation on research and innovation policy. Since 2011, its operational Bureau is co-chaired by DG Research and Innovation for the EU, and by African Ministerial Council on Science and Technology (AMCOST) for the African Union, but the dialogue gathers S&T representatives from the Member States of both continents. Its mandate was established in Addis Ababa. A first step of its activity consisted in carrying out a mapping study in order to draw the STI cooperation landscape between the EU and AU. A second step occurred in the 2013 Brussels HLPD meeting, whose one of the conclusions was that:

> *"There is a need for the EU-Africa HLPD to focus on a reduced number of common challenges for the STI cooperation to be effective, although there are many common challenges such as climate change, global health, and improved livelihood. The first priority will be the role of STI in promoting food and nutrition security and sustainable agriculture."*[24]

The EU-Africa Summit 2014 led to two important initiatives. First, it was established that as a cross-cutting challenge, STI

> *"contributes to the attainment of all other socio-economic development objectives, including the Millennium Development Goals (MDGs) and the future post-2015 and Sustainable Development Goals (SDG) targets. Investments in STI are vital to promote growth and employment, improve competitiveness and identify and address pressing global societal challenges such as climate change, affordable renewable energy and energy efficiency, infectious diseases or food and nutrition security"*[25]*.*

[22] Council of the European Union (2007): The Africa-EU Strategic Partnership. A Joint Africa-EU Strategy.

[23] European Commission: Africa, Policy Background. Retrieved from: http://ec.europa.eu/research/iscp/index.cfm?pg=africa#policydialogue

[24] European Commission (2013): Conclusions. EU-Africa High Level Policy Dialogue on STI Brussels, 28-29 November 2013, p.3.

[25] European Commission: Africa, Policy Background. Retrieved from: http://ec.europa.eu/research/iscp/index.cfm?pg=africa#policydialogue

Second, it set up an expert working group (EWG) to provide a roadmap for building a jointly funded research and innovation partnership focused on food and nutrition security and sustainable agriculture. The EWG established that the most useful instruments to implement this strategy were jointly funded competitive calls (ERA-NET[26], AU Research Grants[27], Horizon 2020). The work of the expert group was adopted in April 2016 in Addis Ababa by the HLPD Senior Officials Meeting and the "Roadmap towards an EU-Africa R&I Partnership on Food and Nutrition Security and Sustainable Agriculture (FNSSA)" emerged.

Key goals of the FNSSA partnership include boosting the impact of AU-EU joint research at local level by addressing the entire value-chain; strengthening capacity-building (human, research infrastructures and institutional); focusing on demonstration projects and pilot actions to bring research and innovation results to the users; increasing production of high quality food with appropriate inputs, to enhance income growth and promoting rural development[28].

These goals are achieved, in part, by two funding streams: African Union Research Grants, supported by the EU Pan-African programme, funded by the EU, but managed directly by the African Union Commission, with a view to building a system of competitive research grants at Pan-African level; and Horizon 2020 projects, created in response to targeted calls to Africa focusing on FNSSA, and allowing for synergies with emphasis on local multi-stakeholder action, among them, the ERA-NET co-fund LEAP-Agri (refer to the schematic below).

At the time of writing this report in spring 2019, Horizon 2020 feeds several with regional, but also infra-regional strategic partnerships, such as the ten-year initiative PRIMA (for Partnership for Research and Innovation in the Mediterranean Area). Since 2018, PRIMA consists in a joint programme improving solutions for water availability and sustainable agriculture production in the Mediterranean basin. On this basis, it includes nine EU Member States as well as Algeria, Egypt, Morocco and Tunisia[29].

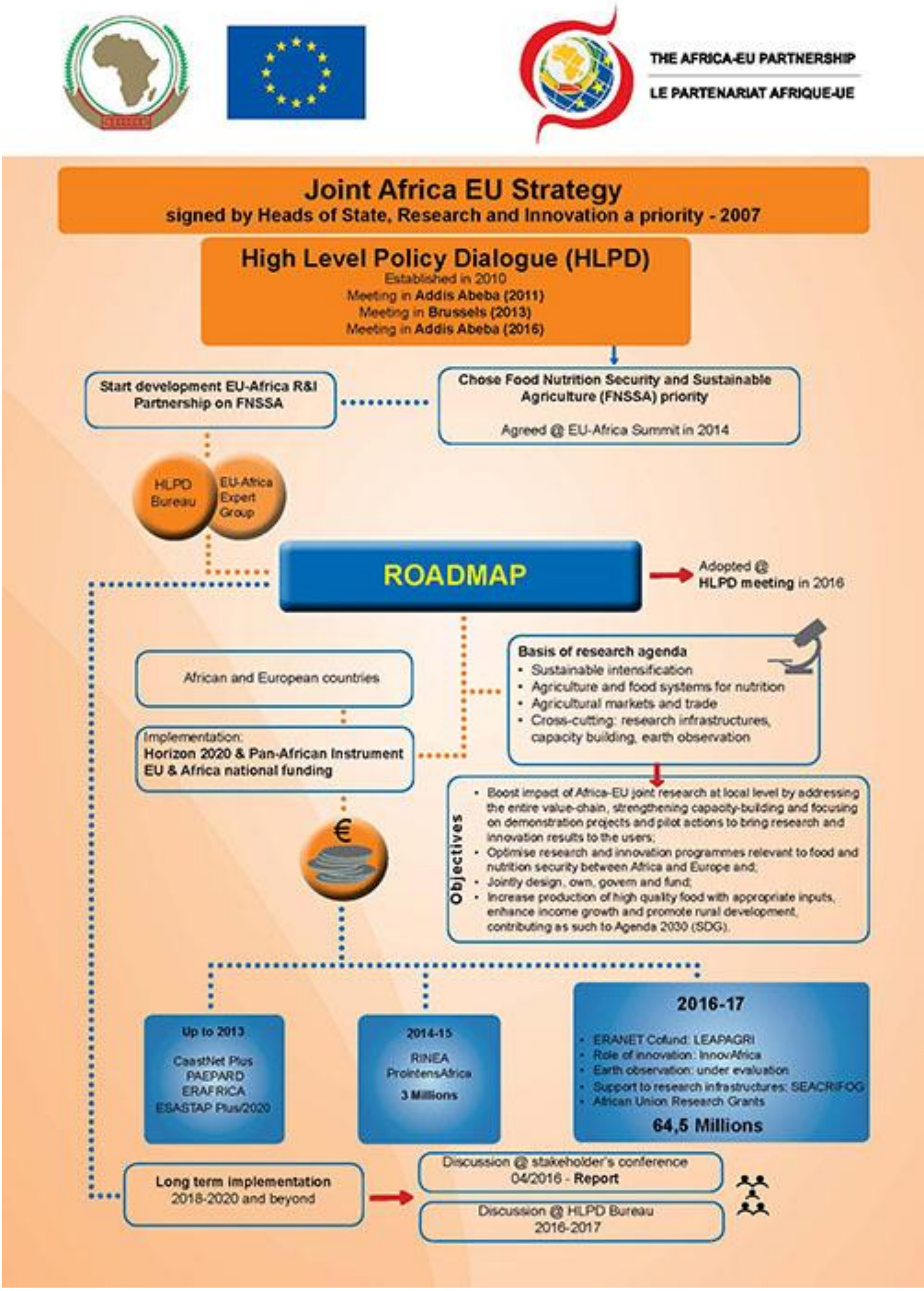
As such, Horizon 2020 instrument encloses a strong international science cooperation concern, but with a flexible cooperation arrangement (classical" cooperation arrangements would force African countries to put cash in the cooperation, which would not be possible, here the arrangement allows to involve in a more flexible way experts from both continents).

[26] The ERA-NET scheme gathers research activities at a national or regional level (notably regarding digital food systems). European Commission: ERA-Net Cofund scheme. Retrieved from: https://ec.europa.eu/programmes/horizon2020/en/h2020-section/era-net

[27] The AU grants are managed by the AU but deal with smaller projects (between three to five partners). The budget is mainly coming from DG DEVCO.

[28] African Union: EU-Africa Research and Innovation Partnership on Food and Nutrition Security and Sustainable Agriculture. Retrieved from: https://ec.europa.eu/research/iscp/pdf/policy/eu-africa_research_innovation_cooperation_on_fnssa_en.pdf

[29] European Commission: Partnership for Research and Innovation in the Mediterranean Area (PRIMA). Retrieved from: http://ec.europa.eu/research/environment/index.cfm?pg=prima



Source: https://www.africa-eu-sti-portal

In short, food security has been framed as an important science topic as well it has been considered as a top-priority issue for EU-AU international cooperation: official initiatives, strategy documents, *ad hoc* bodies and foreign policy aims actually make food security a real science diplomacy object.

2.2. At the EU internal level, a cross-cutting concern for science international cooperation

This international dynamic directly interacts with internal EU changes: once the EU's growth strategy (Europe 2020) has given a major role to research and innovation, Horizon 2020 has become a strategic tool to developing international cooperation and addressing the grand societal challenges (themselves being commitments to sustainable developments goals)[30].

How is EU funded research on FNNSA designed so as to affect EU foreign relations and cooperation development policy? Given that a substantial part of this cooperation framework is based on FP/H2020 projects, we will now examine how "science diplomacy" is used on the issue of food security in the area of European Union-African Union relationships.

A significant share of the EU budget is now dedicated to food security researches: 3,851 of the 80 billion euro Horizon 2020 programme are dedicated to the societal challenge 2, which includes (around of 5% of the overall budget), which includes food security, sustainable agriculture and forestry, marine maritime and inland water research and the Bioeconomy[31]. On the operational level, funding is mobilized through existing instruments: Horizon 2020 and AU grants.

A high level working group gathering representatives of different DGs has been set up to steer the EU-AU partnership, to put projects into clusters and to roll out the monitoring framework.

The Horizon 2020 topic writing process is rather complex, and reveals the cross-cutting mobilization of multiple institutions of the EU on an issue such as food security: several DGs – RTD, DEVCO, AGRI –; two different directorates at EEAS (Africa, multilateral challenges), and the EU Delegation to the AU. Though we are looking at a *research* program, DGs AGRI and DEVCO participate in the funding in important proportions (each one has its own budgetary line[32]), according to their policy jurisdictions[33]. DG RTD is for example more involved in food and nutrition, while DG AGRI funds soil, sustainable intensification, or food systems research projects.

Across this institutional division of work and the specific competencies pattern, all the players share internal tools to provide upstream expertise for enlightening the "calls" for FP/H2020 from a scientific point of view. Relations between DGs and advisory groups enable scientific advice for the calls writing. As a matter of fact, DGs mobilize their own background expertise (the research unit at DG AGRI for instance) to shape the topics. As a DG AGRI official tells us: "*you have yourself to be a scientist to understand what they [the scientists] research, and which research trends are interesting for a topic of the program*"[34]. They can also rely on the Commission's dedicated Joint Research Centre,

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[30] Idem.

[31] European Commission: Horizon 2020 Presentation material. Retrieved from: https://ec.europa.eu/programmes/horizon2020/en/background-material

[32] DG DEVCO budget is for example 9 billion in the 2014-2020 multiannual financial framework for 60 countries (*ie.* 1.5 billion a year), mainly for supporting the local delegates. This budget distribution is going to change with the implementation of Horizon Europe.

[33] H2020 on agriculture is for example designed and funded 80% by DG AGRI.

[34] Interview, DG Agri.

whose both missions are to struggle against expertise fragmentation and to provide science knowledge for EU policy making by sharing collected knowledge[35]. More particularly, the Knowledge Centre for Global Food and Nutrition Security (KC-FNS) puts together members of DGs (notably DEVCO) and JRC so as to develop knowledge on priority sub-topics, such as food crises and agricology[36]. Together with other DGs (via focal points and contact persons), it contributes to build the priority topics of the calls.

How were the "food security" societal challenge calls negotiated in general? Can we identify any diplomacy concern or anticipated feedback loops clearly involved? By comparing the different Work Programmes under Societal Challenge 2, we observe de facto the rise of a strong and explicit foreign policy concern in the formulation of the food security topic in Horizon 2020. While it was absent of the previous work programmes, the former call includes a "targeted international cooperation" section:

> *"Activities promoted address global challenges and allow for significant international cooperation, exchanges and sharing of resources. In addition to general openings for international cooperation, targeted activities are foreseen to support the implementation of the EU-Africa Partnership on Food and Nutrition Security and Sustainable Agriculture (FNSSA) and implement the EU-China FAB Flagship initiative"*[37].

This diplomatic concern in the work program text is not only a superficial framing. **Interviews reveal an actual diplomatic awareness of the actors involved in the drafting of the topic.** Whereas the above mentioned High Level Policy Dialogue deals more with bureaucratic issues than with a political concern, the DGs services have developed specific ways of working in order both to underline the policy-oriented dimension of science, and their diplomacy background. Interviews provide interesting information on the way all the EU players have 'incorporated' related know-how, which is for instance particularly observable in a series of activities and meetings organised in the topic drafting process.

For example, those **established practices** refer to the "**boundary people**" some of the EU players have learnt to identify as the ideal to work with and invite for science policy events: indeed, they need scientists who are not only good in strict scientific terms, but also good in communication and dissemination, and able to present research issues and findings 'in black and white', i.e. in a simple and striking manner. They rely on known scientists who are in the 'circuit' who they keep a database on. The best ones for this role are heads of science organizations, as they speak not only for themselves, but for scientists as a group and are already involved in science policy. In other words, it is better to use executive directors than merely good scientists[38].

In addition to this policy-oriented attention to competency, they also insist during preliminary "info days" with project teams in a presentation of the policy background of FNSSA, and the topics global framework: the science diplomacy dimension here is about **explaining/translating the diplomatic dimension of the call**. As one said, "*in the way we formulate the topics, we try to articulate with the challenges for the continent*"[39]. During these explanatory meetings, another more implicit strategy is about creating networks, by gathering different people on a given topic, and potentially let them get in touch, without

[35] European Commission: Joint Research Centre. Retrieved from: https://ec.europa.eu/info/departments/joint-research-centre_en

[36] KC-FNS is designed to complement the International Food Policy Research Institute.

[37] Horizon 2020 Work Programme 2018-2020. 9 - Food security, sustainable agriculture and forestry, marine, maritime and inland water research and the bioeconomy, p. 56. Societal challenge n°2 covers four flagships: All Atlantic Ocean Research Alliance Flagship; EU-Africa Partnership on Food and Nutrition Security and Sustainable Agriculture (FNSSA); EU-China FAB Flagship initiative; The Future of Seas and Oceans Flagship Initiative.

[38] Interview, DG Research.

[39] Interview, DG Agri.

any explicit Commission interference, for potential common projects applications once the call is out. **Science diplomacy emerges out here as connecting scientists on relevant topics.**

Later in the process of research funding, a typical science diplomacy activity of these EU policy science actors involved in the administration of Horizon 2020 topics consist in the diplomatic dimension 'briefing' they do for experts in the evaluation phase. While Horizon 2020 topics actors have no say in the evaluation of applications itself done by external independent experts and coordinated by the Research Executive Agency (REA), they attend evaluation meeting and do "*a presentation of the policy background of FNSSA, and why the topic and so on*"[40]. Here they see their role as **explaining/ translating the diplomatic dimension of the call for the experts responsible for the selection of the projects**.

In short, we observe the institutionalisation of the general aims which shape the global science cooperation framework into **know-how and relational and translational skills**, which can be understood as constitutive of science diplomacy activities.

2.3. S&T attachés: Science diplomats as brokers?

Beyond these science diplomacy skills and know-how observable in the cross cutting policy activities of the design and management of research funding (but generally not objectified by actors as "science diplomacy"), science diplomacy also passes through specific and **established roles and positions of dedicated "science diplomats"**, namely the S&T attachés in the EU delegations. "Science attachés" in the EU delegations have actually played a key role over a certain period, like one did in Addis Ababa for this food security case between 2012 and 2016.

As an important interlocutor for the African Union S&T Department, he played a key function for building networking resources and shared understandings. His mission included a political dialogue dimension and a more practical cooperation dimension (through the framework programs). The attaché operated as a **facilitator**, meeting regularly and socially with the African actors. His mission was about working with the AU, but also about meeting people at the national level – in particular with some countries where agreements are well developed, as with South Africa[41]. He also actively participated in the HLPD development.

This concrete coordination work could also appear as a key function in a context where material resources are scarce sometimes: technological communications are weak, and lack of data (exact figures country by country of the type of funding available at the national level, if any…) have also been pointed out.

More fundamentally, the practical role of the attaché was also to measure, to construe and to take into account the institutional fragilities of the AU. The resources of the AU to implement programs are actually sparse: in terms of funding, in terms of structures, in terms of staff. The AU is very dependent on contributions from donors (around half of its budget), meaning that on many activities, the AU does not decide the agenda (which is likely to depend on donors). The weak political mandate of the AU commission on science cooperation also makes the inter-regional cooperation tricky. It is up to the S&T Division

[40] Interview, DG RTD.

[41] The EU and South Africa established an Action Plan for their Strategic partnership in May 2007. Regarding the food security topic, South Africa is actively involved in several ERANET projects and FNSSA. The South African National Research Foundation is also the only African R&I funding agency involved in the Belmont Forum which addresses, together with the EC, some of the grand research challenges such as food security. See European Commission (2018): Roadmap for EU-South Africa S&T cooperation. Policy document.

at the AU[42] to consult their member states, but they struggle to mobilize them. Moreover, there are complexities and challenges for Europe/Africa scientific cooperation at the level of the projects and the research teams: in many African countries, the administrative capacity to understand and deal with the management of an EU grant is still fragile.

All in all, by interpreting institutional backdrop and complexities of the inter-regional EU-AU dialogue, S&T attachés act as diplomats usually do. They **work as a broker, an intermediary between continents, between regional organisations, between diplomacy and science within the same regional organisation**.

Since 2016, there is no more S&T attaché position in Addis (this mandate was the first and last one): because of budget cuts, the experience has been prematurely halted. Besides the issue of the resources which are *de facto* discontinued, this choice also raises the question of how the future Roadmap will be implemented[43]. In the implementation, there is consequently not really a clear and continuous channel through which EU funded research on FNSSA affects or fuels EU foreign policy.

3. Stakeholders & governance practice (3): weaknesses & challenges

Given that food security is a major EU global challenge on the one hand, and that the EU is spending millions to fund food security research on the other hand, one would expect to observe clearly designed strategic interfaces between science and diplomacy on this topic. Yet, it seems that in spite of a more or less widespread use of the label, there is **no shared understanding** of "science diplomacy", nor a clearly identified institutional circuit of how food security research can contribute to European foreign policy.

3.1. No shared understanding of what is (or should be) "science" for/in diplomacy

A real challenge for food security "science diplomacy" is the importance of internal segmentations inside the EU organizational landscape. Interviews actually suggest that marked differences between organisational interests and institutional subcultures of each player make the endorsement of common objectives rather difficult. Despite the EU attempts to go beyond segmentation – e.g. with the recent establishment of the Knowledge centre for global food and nutrition security – DGs are still characterized by their organisational autonomy. Each player has its own rationale and aims/standards for success: RTD seeks excellence and impact, DEVCO development impact, ENVIRONMENT is more focused on ecological issues, etc.

This is especially so in legitimate uses of "science". There is indeed **no agreement on what kind of sciences should be fostered**. A first principle of division refers to the **excellence / relevance opposition**. For example, there is a conflict between the sort of "applied" and "scalable" research needed in Africa (as DG DEVCO seeks) and the aims of "excellence" (science for itself) both embedded in Horizon 2020 (as DG RTD and especially DG AGRI targets – see below for more details)[44]. "Development impact" is here opposed to "excellence" Horizon 2020's focus, which can interfere with the sort of research that is needed. Reciprocally, in DG AGRI, the main use of the Horizon 2020 is to create opportunities for African researchers to become part of international networks, and part of the FNSSA is invested in such way to help them get involved in those international

[42] African Union: Science and Technology Division. Retrieved from: https://au.int/en/st-division

[43] Interview, DG Agri.

[44] Interview, DG Agri.

networks. Promoting high quality research development and research capacities in general in Africa is here one of the main objectives.

An interesting paradox here is that it is mainly DG AGRI which advocates the "excellence" objective. DG RTD spotlights other aims also referring to the "impact" focus and use of multi actor projects (researchers and businesses), as one explained:

> *"It's part of the science diplomacy: using science for just the **political deals**, but also **economic diplomacy**. Because it also creates the potential for the markets, particularly when I speak about innovation. Then it's also the scaling up, getting to the markets. Also say for our start-up companies and using this market potential"*[45].

Those differences have effects on the topic drafting and on the research topography. Thus, even if open calls in 2019 for Horizon 2020 will include enlarged participation of African countries, their participation is not linear: there was an important participation of African partners in FP7, much more than in Horizon 2020. One of the reasons for this is that Horizon 2020 pushed towards innovation, which resulted in the decrease of collaborations with developing countries.

From this perspective, "science diplomacy" doesn't obey to a clear and shared strategy, but labels different ways to using science to achieve different foreign policy goals.

3.2. EU science diplomacy and asymmetries

Besides the internal Commission divides, we also can identify **frailties of the cross-cutting diplomatic channel**. While the EEAS officially considers that "*science diplomacy is a way to make diplomacy through "parallel means"*" and concur with the Commission statement that it is an "*instrument of soft power"*, it also conceded in 2016 that science diplomacy "*still need[ed] to be mainstreamed*"[46]. Our interviews *de facto* suggest that **contacts between different DGs & EEAS are rather scarce and weakly institutionalized**.

In terms of diplomatic process, the EU delegation interlocutor is the EEAS. So in order to stay "in the loop", DG RTD usually needs to identify the attaché covering R&D and establish direct contacts. This seems to be an ***ad hoc* process, which remains dependent on the mutual interest** in maintaining these. Reciprocally, the former attaché in Addis Ababa mainly reported to DG Research. The contacts with colleagues in delegations are mainly personal contacts than structured ones. Above all, DGs testimonies regularly point out the **EEAS is little involved**: direct meetings are scare, and feedbacks channels regard the general information only, as confirmed by the EEAS officials we met. G5 "Development & cooperation" is actually not endowed with many technical resources and obliged to prioritise its own issues (they first and foremost need briefings to make "politically informed choices"): as a player said, "*in two hours, you speak about peace, not science*".

Thus, the configuration of players offers a contrasted science – diplomacy interaction layout. The strong and explicit **foreign policy concerns** in the formulation of the food security topic in Horizon 2020 are **more held by DG RTD, DG DEVCO, DG AGRI actors than by the EEAS**. It is even more paradoxical that **non-diplomatic players can sometimes be rather reluctant in endorsing the label of "science diplomacy"**. From that point of view, the "diplomatic" dimension of DG's role is not self-evident, partly because some fear that it might be understood by EU partners as "hidden agenda" of

[45] Interview, DG RTD.

[46] European External Action Service: Science Diplomacy. Retrieved from: https://eeas.europa.eu/topics/science-diplomacy/410/science-diplomacy_en

science cooperation, partly because the **"science diplomacy" term is viewed as ex-post, non-embedded from ordinary concerns or defined by social scientists**.

The way actors involved in science diplomacy interfaces perceive their role and mission reveals an **asymmetrical awareness** of science diplomacy. This is certainly not specific to the issue of food security, but appears in quite a striking manner on this issue. On the side of the actors of EU science policy, whether at DG RTD, or at research units of DG AGRI for instance, we actually do observe a strong awareness of diplomacy issues. Global challenges and EU global strategy to address them are not only known by science policy actors, but quite much re-appropriated by discussing how food security links to issues of stability, conflict prevention, health, well-being, migration, etc. There is awareness that the future of EU science cannot be thought regardless of EU global challenges, and a real ability of EU science policy officers to formulate a discourse saying so. **They don't think of themselves as diplomats, but are aware of the diplomatic dimension of their work**, and most of the time familiar with notion of "science diplomacy" – though they might define it in very different ways with more or less positive connotations.

Science policy actors are more aware of diplomacy issues than diplomats of science issues. On the side of EEAS actors met for this case, whether involved in inter-regional affairs, or multi-lateral challenges direction, the awareness of the importance of science for EU foreign relations appears quite weak. The notion that EU funded science on global challenges may fuel EU global actions remains quite alien. There is not apparently such expectation from EEAS actors, **nor any clear organizational process designed so that the main findings of EU funded food security research are known and appropriated by EEAS actors**. As for the **label "science diplomacy", it is not used in practice**, or maybe **considered as a threat** (which in the perspective of some EEAS actors would be coming from actors of science policy wanting to "play the diplomats", while having no general expertise in foreign relations).

This asymmetrical awareness might be associated to an **asymmetrical relative recognition or prestige of positions** (dealing with international cooperation in science policy, or dealing with science and technology issues in foreign policy). It seems that positions and activities related to science diplomacy are quite valued in EU science policy field and often held by actors with both a high profile and strong convictions on these topics. This is why a potential reorganisation of DG RTD mainstreaming international issues, and suppressing the international cooperation directorate was not always welcomed by the actors so far most dedicated to science diplomacy issues.

Even if the ideas of soft power, and of the need for knowledge-based solutions to address global challenges are more and more present in EU foreign policy discourse, it apparently does not really affect the way diplomats perceive the relative prestige of positions related to science in EU foreign policy. Holding a position dealing with science diplomacy issues obviously is not the most pursued professional objective and EU diplomats generally do not consider it would the best career-booster to hold such a position.

Without surprise, these asymmetrical science diplomacy awareness and asymmetrical relative recognition of SD related positions result in an **asymmetrical appreciation of the shortfalls and potentials of science diplomacy**. The ambitions for EU science diplomacy are sometimes great on the side of science policy actors, and so might the disillusions or frustrations facing the shortfall of EU actions and weak prioritising of the EU in this direction. On the side of EU diplomats, for the aforementioned reasons, there are not so strong expectations regarding the role of science diplomacy, and consequently less disappointment (as well as attention).

4. Conclusions: What the food security case tells about EU Science diplomacy?

Considering science and technology innovation is framed as a driver for socio-economic growth and stability within the EU, as well as for the EU global strategy, we have been witnessing for a number of years a triple intricate dynamic: 1) the **growing institutionalisation** of instruments between science and diplomacy arenas; 2) the setting of a cross-cutting attention from internal services for science policies and, consequently, the rise of a foreign policy **concern for different "global challenges" in science funding**; 3) the emergence of a **dedicated "science diplomat" role** in the figure of the S&T attachés in EU delegations. Let us look at this triple dynamic for the case of food security research. Global framings (geopolitical and market connected issue, cooperation purpose), specific instruments (HLPD, H2020) and practical know-how (DG's officers awareness and relational skills) thus shape a real science diplomacy framework.

However, **consistency and boundaries** of "science diplomacy" shouldn't be overstate because of remaining vague and unclear. Conversely, we shouldn't overlook the **frictions** both between EC and EEAS, and between DGs themselves: the analysis of professional practices reveals **asymmetrical relations** between players of research arenas (who retain some degree of autonomy), science diplomats (who seem to be quiet often marginalized in their own spaces), and diplomats (to whom science is not a key issue).

5. Empirical material

Document analysis:

- H2020 project material (calls, database of H2020 projects)
- EU publications
- Detailed analysis of the "Food security - Support to the Implementation of the EU-Africa Partnership on Food and Nutrition Security and Sustainable Agriculture" section of the work programs
- Document analysis/secondary data analysis: Academic publications, "Sustainable food security- FNSSA" projects
- Key documents on EU-Africa partnership and FNSSA

10 interviews with actors from the following agencies & services:

- DG RTD
- DG DEVCO
- DG AGRI
- JRC
- EEAS

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5. International dimensions of the EU’s FET Flagships: Large-scale strategic research investments as a site of de-facto science diplomacy

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List of Acronyms

CERN	European Organization for Nuclear Research
DG	Directorate-General
DG CONNECT	Directorate-General for Communications Networks, Content and Technology
DG RTD	Directorate-General for Research and Innovation
DG TRADE	Directorate-General for Trade
EC	European Commission
EEAS	European Union External Action
EPFL	École Polytechnique Fédérale de Lausanne
ERA-Net	European Research Area networks (a project type in the Framework Programme)
ESA	European Space Agency
EU	European Union
FET	Future and Emerging Technology
FLAG-ERA	"The Flagship ERA-NET" (FP7 / Horizon 2020 ERA-Net projects)
FP	Framework Programme
HBP	Human Brain Project
IBM	International Business Machines Corporation (American multinational technology company)
ICT	Information and Communication Technologies
IP	Intellectual Property
QFlag	"Quantum Technology Flagship Coordination and Support Action" (Horizon 2020 project)
QuantERA	"ERA-NET Cofund in Quantum Technologies" (Horizon 2020 ERA-Net project)
SDGs	Sustainable Development Goals
SESAME	Synchrotron-light for Experimental Science and Applications in the Middle East
SWD	Staff Working Document
TAIPI	"Tools and Actions for Impact Assessment and Policy makers Information" (FP7 project)
US	United States
ZSI	Zentrum für Soziale Innovation (Centre for Social Innovation)

1. Introduction

The European Union's Future and Emerging Technology (FET) Flagship projects are among the largest and most ambitious cooperative research endeavours on the globe. The European Commission launched the Flagship programme as part of its 7th Research and Innovation Framework Programme. The first two (Graphene, Human Brain Project) of three Flagship projects started in 2013, the third (Quantum Flagship) kicked off in 2018 (already under a Horizon 2020 regime). Each of the three is expected to absorb around € 1bn of public and private funding over a potential 10-year runtime to transform outstanding European research in areas of strategic relevant into technological innovation as well as economic and societal benefit.

In looking at the Flagship projects from a science diplomacy perspective, we ask the question of the international reverberations of large-scale research investments. The hypothesis is that these initiatives cannot and do not take place in a purely European space. They constitute interventions that potentially cross European boundaries. Research on topics such as graphene or the human brain is taking place around the globe, much of it in collaborative settings. Europe is not the only region trying to exploit research in these areas for economic and societal benefit. This poses a number of questions:

- How did/do the FET Flagships affect EU foreign relations and vice versa?
- How are they perceived in the EU and non-EU foreign and science policy community?
- To what extent is international cooperation relevant in/for the Flagships? How is it organised? How did the international cooperation dynamics change over time?
- How could they be relevant in future EU foreign relations?

We consider this case as being driven by science opportunities while at the same time, the European instruments available are also driving many aspects.

We have approached these questions with a qualitative research methodology consisting of a mix of desk-based document analysis, semi-structured interviews and participant observation completed between June 2018 and February 2019. Document analysis focused on official EU documents as well as policy and scholarly discussion of the FET Flagship instruments. This research was guided by insights gathered through interviews and observations and partly guided by ZSI's experience in the TAIPI project (2015-2018), a Framework Programme 7-funded project developing a monitoring framework for the first two FET Flagships. A set of eight semi-structured interviews were carried out face-to-face or via telephone. In addition, the main author of the report attended the first conference of the Quantum Flagship.

2. Governance arrangements and background of the case

The format of the FET Flagships goes back to a European Commission Communication in the year 2009[1]. Launching FET Flagships was proposed as one line of action to 'moving the ICT frontier' and to ensuring European leadership in FETs. The document shows that the idea of FET comes out of ICT-related research and innovation policy. This is still reflected in FET Flagship governance, which is institutionally located at DG CONNECT (while the Research Framework Programme governance is of course driven by DG Research and Innovation).

The 2009 Commission Communication asks to "prepare ambitious Europe-wide, goal-driven FET flagship initiatives that can combine large, sustained European research efforts on clearly defined foundational challenges, on a scale too large to be addressed by current FET initiatives"[2]. Essentially, the rationale behind the Flagships is a perceived mismatch between ICT-related foundational challenges and available funding instruments. The example given in the document is 'understanding how nature processes information' and building biocomputers on the basis of this new understanding.

The 2009 document was explicit about the global nature of these endeavours: "They should foster extensive and ambitious European and global collaboration and pool resources going beyond the existing fragmented initiatives and programmes"[3]. It was not specified how the inner-EU cooperation would compare to the global cooperation. As we shall see, in practical terms, the Flagships defined quite clear boundaries between European (meaning among EU Member States and countries associated to the Framework Programme) and global cooperation.

While the programmatic background of the Flagships was already defined by the 2009 Communication, the governance model for the first generation Flagships was published in the form of a European Commission Staff Working Document in 2014[4]. The model essentially describes a combination of an EC-funded (via the Framework Programmes) core project that is linked to a series of so-called partnering projects at different geographical levels. The main idea is that the substantial funding for the core project motivates other stakeholders to align their research agendas, leading to more funding for coordinated thematically defined research efforts. The figure shows the relation between the core and the partnering projects as well as the respective funding institutions.

[1] European Commission (2009): Moving the ICT frontiers - a strategy for research on future and emerging technologies in Europe. Communication COM (2009) 184 final.

[2] Ibid. p. 9.

[3] Ibid.

[4] European Commission (2014): FET Flagships: A novel partnering approach to address grand scientific challenges and to boost innovation in Europe. Commission Staff Working Document, SWD (2014) 283 final.

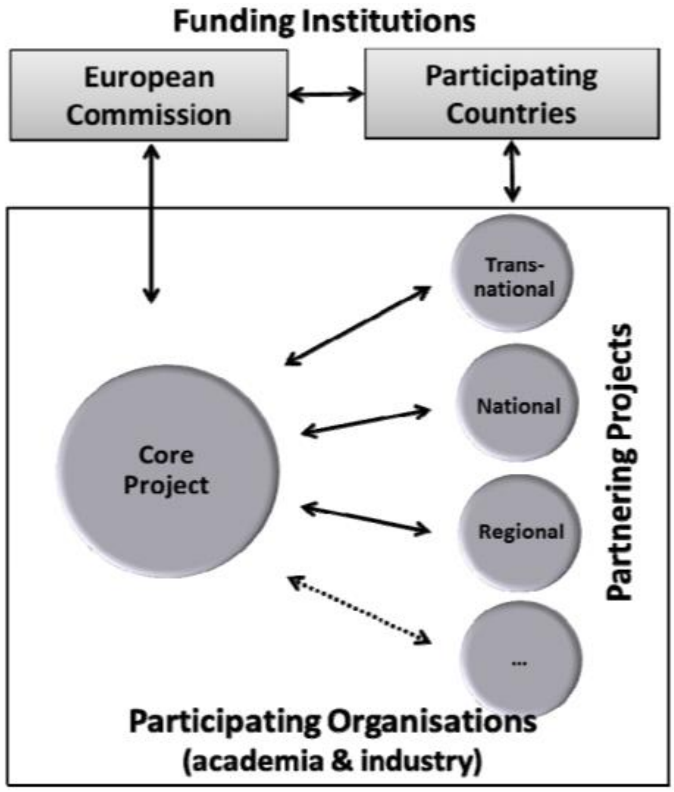

***Figure 1: The Model of FET Flagships*[5]**

Three governance bodies link these stakeholders.

- The Framework Partnership Board brings together the Flagship core project consortium and the European Commission.
- The Board of Funders brings together the European Commission and the participating countries.
- The Flagship Governance Forum is the broadest governance body bringing together the funders, the core project as well as the partnering projects.

This governance model is the blueprint for the two first-generation Flagships.

2.1. First-generation flagships – Graphene and the Human Brain Project

Besides laying out the main idea and expectations behind the Flagships, the 2009 Commission Communication also specified the goal of launching at least two of them until 2013 – a goal that was achieved with the start of Graphene and the Human Brain Project (HBP) in 2013. The selection process of these two Flagships started in 2010[6]. A preparatory study concluded that research communities would have to be involved in order to make the Flagships a success. What followed was an open-ended, bottom-up selection process (starting with an open consultation in 2010).

In July 2010, a Call for pilots was published. Out of 21 eligible proposals, six pilots were launched in 2011. In 2012, through a second call, out of the six pilots, two – Graphene and HBP – were selected to be launched as full Flagships. The selection was based on an

[5] Source: European Commission (2014): FET Flagships: A novel partnering approach to address grand scientific challenges and to boost innovation in Europe. Commission Staff Working Document, SWD(2014) 283 final. Retrieved from http://ec.europa.eu/information_society/newsroom/cf/dae/document.cfm?doc_id=6812 p. 8.

[6] cf. Ibid.

evaluation involving experts from academia, industry and policy. The selected flagships received funding for a 30-month ramp up phase (2013-2016) under an FP7 regime (funded with € 54 million) and are in the operational phase projected for 2016-2023 (funded with € 50 million per year) funded by Horizon 2020. In total, each of the Flagships receives EU funding of € 500 million over a ten-year time span. An additional € 500 million is expected to be funded through the so-called partnering projects (funded by EU Member States and other sources).

The two first-generation Flagship projects' partner structure is as follows:

- The Graphene project is coordinated by Chalmers University (Sweden) and brings together over 150 academic and industrial research groups in 23 countries plus an additional 60 associate members. Full partners are from EU countries or countries associated to the Framework Programmes (like Israel, Norway or Switzerland). Associate members include institutions in non-EU countries like Armenia, Ukraine (which are associated to the FP) or Belarus. Around a third of partners are companies.
- The Human Brain project is coordinated by the École Polytechnique Federale de Lausanne (EPFL) in Switzerland and brings together a total of 131 partner institutions from EU Member States and countries associated to the Framework Programmes. In the case of HBP, there are only a few private sector partners.

In order to support partnering projects, a European Research Area Network (ERA-Net) multi-national funding scheme was established in parallel to the two core projects. This ERA-Net 'FLAG-ERA' brought together funding partners from 26 EU Member States to coordinate national-level efforts and mobilise additional support for the selected topics. In four Calls for Proposals (2015, 2016, 2017 and 2019), a total indicative budget of around € 69 million was mobilised (for both Flagships). Although case contributions to joint calls are not the only support from EU Member States to the Flagships and their topics, these numbers still fall short of expectations projecting € 500m partnering project funding over the year runtime[7].

With the two Flagships running operational phase starting in 2016, the European Commission invited a panel of experts to conduct an interim evaluation of the Flagships. The evaluation asked the question of the relevance, effectiveness and efficiency of the Flagships so far as well as of their added value. Among the results, it was pointed out that "[w]hile the Flagships demonstrate their effectiveness in delivering excellent science, their future effectiveness in supporting innovation still needs to be demonstrated"[8]. The evaluation is also explicit about the need to consider whether two very different objectives – excellent science and excellent innovation – can indeed be covered with one and the same instrument. The evaluation panel also notes that linking research investments from public and private sources at both European and national level is proving more difficult than expected.[9] In the eyes of the evaluators, this has implications for the selection process of future flagships.

[7] cf. European Research Area and Innovation Committee (2018): Final Report by the ERAC Ad-hoc Working Group on Partnerships on the 'Recommendations on increasing the efficiency of implementation of partnerships'. ERAC 1211 / 18, p.7, Retrieved from: http://data.consilium.europa.eu/doc/document/ST-1211-2018-INIT/en/pdf

[8] Carrozza, M. C., C. Brogren, M. Kleiber, M. Kleiner, R. McKernan, P. T. Kidd, J. Lindberg, C.A. Lodemann, M. Sivasegaram, C. M. Oddo (2017): FET Flagships Interim Evaluation [Final Report]. p.7, Retrieved from: https://ec.europa.eu/newsroom/document.cfm?doc_id=42760

[9] ibid., p. 8

2.2. A third Flagship

The formation of the third Flagship project, the Quantum Flagship, was already announced during the work of the interim evaluation panel of the first two Flagships. As is also noted by the panel[10], the selection process for this third Flagship was different from the first two: the Quantum topic has not been selected following a bottom-up process, but a top-down approach. The topic selection was, of course, done in close coordination with the scientific community, industry and, importantly, EU Member States. The scientific community followed an invitation by Günther Oettinger, the Commissioner for the Digital Economy, to formulate a strategy for Europe to stay at the front of the second Quantum Revolution. The so-called Quantum Manifesto[11] was handed over in May 2016 at the Quantum Europe Conference in Amsterdam. Following this, a High-Level Steering Committee was set up to advise the Commission on the design, implementation and governance of the Flagship.

The mechanism and governance model of the Quantum Flagship are different from Graphene and HBP. There is no core project and partnering projects, but a set of research and innovation projects that are aligned by a framework structure (basically a Coordination and Support Action and a stakeholder network). They are selected by peer review following Call for Proposals oriented along a strategic research agenda. In the ramp-up phase of the Quantum Flagship (2018-2021), 20 projects have been awarded a total of € 132 million in four application areas (quantum communication, quantum simulation, quantum computing and quantum metrology and sensing).

Similar to FLAG-ERA for the first two Flagships, there is also an ERA-Net project (‘QuantERA’) bringing together European Member States (and countries associated to Horizon 2020) for additional funding. It is seen as a success of the setup and implementation of the Quantum Flagship that QuantERA indeed managed to coordinate national-level efforts to a stronger degree than FLAG-ERA. The first QuantERA call in 2017 already mobilised a total funding of € 36 million, the 2019 Call an additional € 20 million. As stated above, EU Member States invested a total of € 69 million in four FLAG-ERA Calls (covering both of the former Flagships).

2.3. The future of the Flagships

At the time of writing this report (2019), it is understood that the continuation of the FET Flagship instrument in Horizon Europe is not foreseen. Before this became clear, a discussion about selection processes was implemented. In spring 2016, the European Commission launched an online consultation that resulted in 24 proposals for future Flagships. At the end of 2016, Commissioner Oettinger organised a round-table conference with Member States and representatives from the scientific and industrial communities. The idea was to discuss the selection of the four to six most promising topics for future Flagships. In March 2019, six ‘Preparatory Actions’ for future Flagships were selected for funding.

- "Time Machine” on the access of historical information
- "Humane AI Flagship" on artificial intelligence
- "Energy-X" on chemical energy conversion technologies
- "LifeTime" on genomics research
- "Sunrise" on renewable energies
- "Restore" on "living drugs" and regenerative medicine

Each of these initiatives received € 1 million to develop a research agenda and an implementation plan. Ultimately, two new Flagships were to be selected to start in 2020.

[10] ibid., p. 20

[11] QUROPE (2016): Quantum Manifesto. A New Era of Technology. Retrieved from: http://qurope.eu/manifesto

However, the latest plans for the upcoming 'Horizon Europe' Framework Programme abandon the concept of Flagship projects – none of the preparatory actions will be funded as such.[12]

In conclusion, FET Flagship governance is rooted at the EU-level, involving DG CONNECT and DG RTD as the relevant European Commission bodies. The national level of EU Member States is involved to varying degrees. The idea is that the large Flagship initiatives offer an incentive to Member States to coordinate national-level funding in the respective thematic areas. As we have seen, this objective was reached to varying degrees.

The main policy hypothesis behind the Flagships is that an instrument of the size and type of the Flagships is necessary to advance European science in strategically relevant areas where it is possible to transform research excellence into technological development and socio-economic benefits. There is a fundamental paradox linked to this expectation, which affects the way the Flagships relate to European Union foreign (science) policy: the Flagships support transnational collaborative research at an unprecedented scale. At the same time, they have the mandate to generate innovation leading to economic benefits for the European Union. The way this is operationalised is that the Flagships have only EU research institutions (and institutions from countries associated to the Framework Programmes) as full partners. Technically, the openness principle of the Framework Programmes does not allow to exclude non-European partners. Hence, other softer approaches were necessary to construct the Flagships the way it was done (highlighting the objective of triggering EU economic impact, adjusting IP rules, informally communicating expectations). Having only EU partners in the Flagships is, however, not sufficient to dissolve the paradox of cooperation and competition. The Flagships cannot and do not operate in a void. The European Commission relies on non-European reviewers for selecting Flagship projects. Scientists involved in the Flagships travel, speak about their work, have prior and ongoing collaborations with non-European partners. They move from one country to the next. Participating companies might have multinational geometries going well beyond Europe. The question how this tension is resolved (or not) is what makes the Flagships an interesting case from a science diplomacy perspective.

3. Stakeholder landscape

As indicated above, the following stakeholders are involved in the FET Flagships:

- The European Commission programme owners and funding bodies. This concerns DG Research and Innovation as the responsible body for the Research Framework Programmes. Most importantly, however, it concerns DG CONNECT as the one responsible for the ICT-related parts in the Framework Programme.
- National-level research and innovation Ministries and funding bodies that are represented in ERA-Nets 'FLAG-ERA' and 'QuantERA' as well as in the relevant governance bodies (the Board of Funders).
- Research institutions participating in the Flagships (the coordinators at Chalmers and EPFL as well as the QFlag consortium servicing the Quantum Flagship; the partners of Graphene and HPB as well as the Quantum Flagship projects).
- Individuals involved in a number of advisory bodies like the Quantum Flagship Strategic Advisory Board.
- The European Parliament is, of course, involved in the design of the Framework Programmes and, thus, its support to FET Flagships. During their implementation,

[12] ScienceMag (2019): Europe abandonds plans for 'flagship' billion-euro research projects. Retrieved from: https://www.sciencemag.org/news/2019/05/europe-abandons-plans-flagship-billion-euro-research-projects

the Parliament is also informed about the development of the Flagship initiatives (through periodic hearings[13]).
- The Council configuration responsible for research and innovation, the European Research Area and Innovation Committee, is also conducting oversight work of the instrument[14].

What is interesting from the perspective of our case, is the absence of certain actors. Neither the document analysis nor the interview work or the participant observation produced any evidence of structured interactions with EU or national-level foreign policy institutions. Most notably, the European External Action Service has not been involved in FET Flagship-related discourse or policy-making in any substantive way. As to EEAS headquarters and the staff of Federica Mogherini, High Representative of the Union for Foreign Affairs and Security Policy and Vice-President of the European Commission, there was no evidence of involvement. As to the European Union Delegations, the Counsellors assigned to DG Research and Innovation or DG CONNECT have been aware of the instrument and of the discussions in the EU's partner regions. However, their role in FET Flagship governance was described as limited, and, according to our research, their institutional linkage with the Commission bodies they report to (DG CONNECT and DG Research and Innovation respectively) is stronger than their embedding in EEAS hierarchy.

The FET Flagships are instruments of EU research policy. Their relevance beyond Europe is dealt with, if at all, in EU foreign research policy, rather than foreign policy in general. In practical terms, this means that the topic is considered when the European Commissioners responsible for research or ICT travel abroad or meet with foreign delegations. The topic might also be touched upon in one of the sectoral policy dialogues in ICT or research and innovation. However, the policy dialogues are mostly used to discuss opportunities for collaboration and possible joint undertakings. As the FET Flagships were not actively seeking third country participation, the topic was not high on the agenda of these dialogue meetings.

What our research shows, thus, is that the FET Flagships have not found their way into formalised EU-level foreign policy-making. However, as we shall see, FET Flagships as an intervention cause substantial interactions with non-EU stakeholders. They developed their own foreign policy and science diplomacy dynamics.

4. De-facto governance practices

We have seen that, on a formalised level, the role of non-EU stakeholders in the FET Flagships is limited. Although not ruled out in principle, participation in the Flagships is de facto restricted to EU and associate countries (with a few exceptions like a Belarusian partner in the Quantum flagship[15]). The work of scientists around the globe in evaluating Flagships and partnering project proposals is hidden behind the walls of blind peer review. The recommendation of the Interim Evaluation to establish an international strategic advisory board (to „[i]mprove strategic management to enhance openness of the Flagships

[13] One of which the authors was able to attend.

[14] cf. for instance European Research Area and Innovation Committee (2018): Final Report by the ERAC Ad-hoc Working Group on Partnerships on the 'Recommendations on increasing the efficiency of implementation of partnerships'. ERAC 1211 / 18. Retrieved from: http://data.consilium.europa.eu/doc/document/ST-1211-2018-INIT/en/pdf

[15] EaP-PLUS (2018): A Belarusian team joined the FET Flagship on Quantum Technologies. Retrieved from: https://www.eap-plus.eu/object/news/230

towards adopting new directions [by being] more open to external inputs that can challenge assumptions and direction"[16]) is not yet implemented at the time of our research.

However, there are a number of interactions with non-EU regions, creating a Flagship-specific foreign research policy that is linked to the broader questions of Framework Programmes governance and that has an impact on the EU's soft power and image in the world. These interactions also raise the question of unintended side effects of sectoral foreign policy and implicit science diplomacy.

4.1. Non-EU research policies as a trigger of Flagship governance

The FET Flagship programme was set up in an EU policy environment, but its thematic orientation was reacting to global developments in research and research policy. Barack Obama launched the ten-year US Brain Initiative in February 2013, at a time when the selection process of the first two Flagships was under way. Evidence from our interviews suggests that developments like these might have affected the EU's selection of Flagship topics. Similarly, in the case of the Quantum Flagship, the very visibly promoted activities of the Chinese government have strengthened proponents for a European flagship in this arena. Part of this was also the collaboration of the Austrian quantum physicist Anton Zeilinger with his Chinese colleague and former Post-Doc Jian Wei-Pan, which resulted in the first "Quantum Call" between China and Austria[17]. The prospect of China pulling ahead of Europe by combining large-scale public investment with access to European quantum science strengthened arguments in favour of a European Quantum Flagship. The interactions between the Flagships and similar large-scale initiatives in other world regions go both ways, however.

4.2. Flagships as a trigger of non-EU research policies

As the Flagship Interim Evaluation states (and our interviews confirm), the Flagships "have created an international profile for Europe's researchers at the forefront of science and technology developments, and arguably triggered significant investment internationally in these domains"[18]. The Flagships are perceived by partner regions as relevant research policy interventions. Non-EU stakeholders, again mostly in research policy, react and relate to these interventions. In the case of brain research, as we have seen, the US announced its Brain Initiative in early 2013, before the start of the Human Brain Project. China launched its 15-year Brain Project in 2016. In the case of quantum science, the European Flagship has intensified discussions around a national approach in the US, which resulted in the signing of a National Quantum Initiative Act end of 2018.

These examples show that the decision to fund a Flagship and a specific area reverberates in the international research policy sphere. Partner regions might react with their own programmes. They might also try to establish specific cooperation linkages with the European Flagships. If the cooperation options are too limited and rules to restrictive, this might lead to the protest of potential partners or shed a strange light on the Framework Programme's 'open to the world' principle. If cooperation rules are too open, the fear is that results of EU-funded research will be exploited elsewhere. This is where the Flagships

[16] Carrozza, M. C., C. Brogren, M. Kleiber, M. Kleiner, R. McKernan, P. T. Kidd, J. Lindberg, C.A. Lodemann, M. Sivasegaram, C. M. Oddo (2017): FET Flagships Interim Evaluation [Final Report]. p. 10, Retrieved from: https://ec.europa.eu/newsroom/document.cfm?doc_id=42760.

[17] cf. Liao, Sheng-Kai, et al. (2018): Satellite-Relayed Intercontinental Quantum Network. In: Phys. Rev. Lett., 120, 030501.

[18] Carrozza, M. C., C. Brogren, M. Kleiber, M. Kleiner, R. McKernan, P. T. Kidd, J. Lindberg, C.A. Lodemann, M. Sivasegaram, C. M. Oddo (2017): FET Flagships Interim Evaluation [Final Report]. p.14, Retrieved from: https://ec.europa.eu/newsroom/document.cfm?doc_id=42760

have to consolidate a culture of open cooperation deeply embedded in the practices and careers of Flagship researchers with the competitiveness principles behind innovation diplomacy.

4.3. Establishing cooperation regimes

As indicated above, the Flagships have no full partners from outside the EU (and the countries associated to the framework programmes). However, cooperation is practised at a less formalised level in all of the three running flagships. The way these collaboration dynamics play out in detail is very different between the Flagships. Interviewees explain the type and causality of these interactions with the state of the research field and the (perceived) relevance of the EU in global research in the respective area. Reflecting on the ways the Flagships engage with non-EU partners sheds light on the practical difficulties of, first, integrating science diplomacy considerations into research policy and, second, consolidating cooperation and competition.

4.3.1. Graphene

The area of graphene research closely links areas like physics with promising applications in areas where Europe's industry is strong or has strong stakes. Graphene is the Flagship with the highest probability of triggering economic impact through graphene-based products and processes reaching the market. It also has the highest share of industry partners among the Flagships. The assessment of the role of the industrial partners in the Graphene Flagship varies: they play an important role, not only in professional management of Graphene IP, but their personnel resources are limited compared to academia partners, which means the project is still very much research oriented. There are no comparable large-scale funding schemes for graphene research around the world. The Graphene Flagship held joint workshops with researchers from Australia, China, Japan, South Korea and the US. These workshops focused on the basic research aspects, however. There is also a mobility scheme for Graphene researchers to attend international meetings. Although staff fluctuation and researcher mobility are of course commonplace, there is concern with regard to the specific efforts of some regions (especially China) to recruit Graphene researchers. Although there is agreement that international cooperation is important research-wise, there is also an increased consciousness about the limits of open cooperation.

4.3.2. Human Brain Project

Compared to the Graphene Flagship, the research conducted in the human brain project has been characterised as less applied and further away from industry. A lot of HBP is about establishing the infrastructures necessary for brain research. The consortium also has less industry partners than Graphene. According to our data, international cooperation was high on the agenda of HBP at the outset, especially with the US and its Brain Initiative. With some early troubles around HBP[19], however, the stakeholders were then focused on getting the project on track and attention was taken away from the issue of international cooperation. Joint workshops were organised back-to-back with other events, e.g. in the frame of scientific conferences. There was also an exchange workshop with NIH in the US as well as with Canadian brain research consortia. There were political level discussions

[19] The neuroscience community criticised the scope of the Flagship project, cf. The Lancet Neurology (2017): Editorial. Retrieved from: https://www.thelancet.com/pdfs/journals/laneur/PIIS1474-4422(17)30013-3.pdf

with China and Japan and early discussions around possible joint funding schemes with the US and Australia. HBP provided support to set up the Australian brain initiative.

4.3.3. Quantum Flagship

The specificity of the Quantum Flagship, apart from being the third flagship with a different setup and governance (see above), is the role the EU plays in the research field. In quantum research, Europe has been presented (and was perceived) as a global leader[20]. The Flagship investment is motivated by the idea of not losing scientific leadership and of turning research excellence into economic value – not least in light of the large private sector investments in the area by US-based multinationals (like IBM) or the defence sector investments in China and the US. International cooperation has been a topic in the Quantum Flagship right from the start. Unlike the other flagships, however, in this case it was partner regions actively seeking to collaborate. The wish to engage with the Quantum Flagship has been communicated at the political level (of research ministers) as well as vis-à-vis the Flagship researchers. The explicit interest put pressure on Quantum Flagship stakeholders, which were, at the time of the research, busy with setting up the Flagship operations.

Discussing ways to engage with non-EU partners was high on the agenda right from the start of the Quantum Flagship. These discussions, however, could not be conducted openly (at least some internal coordination was necessary in advance), which contrasted with the overall design of the first Flagship events (the kick-off event in 2018 and the Grenoble event in early 2019). For instance, a session on international cooperation was foreseen at the kick-off event, but was then postponed. Some stakeholders fear that an open cooperation regime (with in-depth scientific exchange, joint funding or even participation in the flagship) might be detrimental to the EU's interests. Worries especially at the European Commission are that other regions might be better able to exploit the knowledge generated by the Flagship (e.g. building on private sector investments at a scale not available in Europe) or to put technology to military use without the EU having a say in it. Other Flagship stakeholders consider cooperation essential, not least as an opportunity for EU science diplomacy. These discussions illustrate the challenges for research policy instruments of the scale of the flagships to define a balance between openness and restriction, cooperation and competition.

4.3.4. Cooperation regimes between openness and competition rationales

We can summarise the international cooperation approach of the Flagships as follows: There is no full partner participation from third countries. There are discussion events and joint conferences/workshops at both political and research level. There is no joint funding with third country partners yet, although some bilateral (EU-partner country) programmes are reportedly under preparation. There are only some unilaterally funded mobility schemes. Independent of these programmes, there is academic mobility of Flagship researchers.

In terms of protecting intellectual property, Flagship partners are required (by law through the grant agreement) to request permission from the European Commission for any IP protection or exploitation outside of the EU. While patents are, of course, a key

[20] In the words of the community behind the Quantum Manifesto: "Quantum physics was created in Europe in the first decades of the twentieth century […]. One hundred years on, Europe still plays a leading role in quantum research. Compared to the rest of the world, Europe has more researchers and a broader research scope, linking fundamental and applied science and engineering. Top institutions can be found across Europe, covering all aspects of quantum technologies from basic physics to electronics and computer science" - QUROPE (2016): Quantum Manifesto. A New Era of Technology. p.9, Retrieved from: http://qurope.eu/manifesto

performance indicator, they have to be filed and commercialised in the EU first. We have already alluded to the fact that this raised concerns among some of the industrial partners, especially some multinational companies (interested in) participating in the Quantum Flagship. As long as they had legal entities established in the eligible countries, participation was possible, but they are also required to comply with the specific IP regulations.

The European Commission is aware that the research taking place in the Flagships cannot be isolated (researchers move, they meet at conferences, they collaborate elsewhere). Therefore, the approach is to provide the necessary regulatory environment to make sure the economic value created by the EU-funded research actually benefits the EU's economy. This regulatory environment focuses on the exploitation side more than it does on the knowledge generation side.

Events like the Kick-off conference and the European Quantum Technology Conference 2019 in Grenoble[21] illustrate that a concurrent focus on exploitation can be tricky: On the one hand, Flagship stakeholders have an interest in presenting the Flagship and the work that they will engage in. At the same time, there are issues of competition and IP: presenting future research activities can lead to others adapting the same approach and, potentially, reaching the targets before the Flagship researchers do. Properly managing the information flows within the Flagship and between the Flagship and its environment is challenging, especially during a ramp-up phase.

Some stakeholders pushed for this competitive rationale more than others: DG TRADE and DG CONNECT more than DG RTD; the European industrial partners more than the researchers in universities and public sector research. What our findings show is that concerns about competitiveness took up resources that might otherwise have been used to define a niche for science diplomacy. The following three aspects could have been systematically reflected upon at European Commission level, but were not:

- The Flagships' lack of an explicit (not necessarily public!) science diplomacy strategy can lead to unintended consequences. In particular, the balancing act of consolidating cooperation needs (and demands) with competitiveness considerations can lead to unintended side effects in research, trade and, potentially, broader foreign policy.
- Even if Flagships are considered instruments targeting EU economic benefits, strategically inviting/including third country partners (e.g. from emerging economies) could have triggered positive effects for Europe's relations with these regions.
- Likewise, especially with regard to Human Brain Research and the Quantum Flagship, the link between large-scale European investment and global challenges/SDGs could have been more explicitly designed and used.

Our results suggest that the obstacles for considering science diplomacy more explicitly were: the lack of resources on the side of Flagship stakeholders; the novelty of the topic/discourse; limited interfaces and a lack of foreign policy stakeholders. The latter two have to do with the way how the governance interfaces around science diplomacy are constituted at EU-level.

4.4. Interfaces

As indicated above, our research did not uncover any formal interactions between EU research policy around the Flagships and the Common Foreign and Security Policy as operationalised through High Representative Mogherini, her cabinet and the EEAS

[21] EQTC 2019: European Quantum Technology Conference (EQTC19). Retrieved from: https://eqtc19.sciencesconf.org/

hierarchy. Interactions took place at the level of DG RTD and DG CONNECT staff in European Delegations.

As to the European Commission Headquarters in Brussels, it is important to keep in mind that the Framework Programme governance itself already involves several DGs (EEAS is not among them). In the case of the Flagships these are DG RTD and DG CONNECT. DG Research and Innovation is responsible for the Framework Programme in general, including the issue of international cooperation. DG CONNECT is responsible for the ICT-related parts of the Programme including the governance of the FET Flagships. As our research suggests, this constellation is not without disagreements. Complexity is increased when it comes to defining the relationship with partners like China, where other DGs (e.g. DG TRADE) have very specific and articulate positions.

In this context, it is also important to remember the genesis of the science diplomacy discourse at EU-level. The discussion was launched and promoted by Commissioner Carlos Moedas, responsible for Research and Innovation. The way the concept was used is twofold:

- The Commissioner and other stakeholders presented some EU research policy initiatives as science diplomacy-relevant, particularly international research infrastructures (e.g. the SESAME synchrotron) and joint funding initiatives (like PRIMA).
- In addition, science diplomacy found its way into Horizon 2020 funding, but not as an element of project evaluation and selection, but as a topic of research (the S4D4C project itself being an example).

The EC-level discussions around science diplomacy were not expanded to systematically include other DGs. This specific set of interfaces (and the lack thereof) leads to or at least reinforces a framing of Flagships that does not include science diplomacy considerations. For instance, Flagships are not seen as global challenge-related big science initiatives or research infrastructures, but as competitiveness instruments. International cooperation regimes are defined on the go instead of following a comprehensive strategy that is defined in advance.

The assessment of the outcomes of this approach is beyond the scope of this case study. It might as well be that the combination of a general cautious approach to cooperation with the punctual initiatives of motivated stakeholders (engaging with non-EU stakeholders) triggers suitable outcomes. A systematic evaluation might also show, however, that the de facto research foreign policy-making combined with uncoordinated initiatives of individual stakeholders (Flagship researchers acting as science diplomats in ways that are not coordinated with EU or national level foreign policy) might lead to missed opportunities or unintended negative side effects.

5. Relevance and use of knowledge

As indicated above, there are no explicit links between the FET Flagships and their governance with official EU-level foreign policy. When it comes to the sectoral international relations in research and innovation policy, for example domain knowledge can be considered. This includes knowledge of technologies and technical assemblies: When actors compare the state-of-the-art in areas such as graphene or quantum research, they build their judgement on questions like who was able to put a graphene-based product on the market, who could showcase quantum communication or who had the most promising approaches for quantum computers. In that sense, knowledge (or experiments) in niches that become highly visible are important to claim leadership and, subsequently, mobilise funding, trigger cooperation requests, etc. Knowledge of models can also be considered, e.g. of the human brain or animal brains.

Apart from knowledge per se, several 'input' factors to scientific knowledge production were relevant in the discussions around the FET Flagships:

- Data: Data was an argument both in favour and against international cooperation in the Flagships. For instance, it is known (and has been communicated) that China has large data sets that could be relevant for the area of neuroscience and brain research.
- Research infrastructure: The HBP Flagship as a whole is, to a large extent, conceived of as a research infrastructure allowing participating researchers to access data (and processing power) necessary for the kind of complex modelling necessary to research the human brain. In the area of quantum research, the question of quantum satellites has become important (for instance, ESA has not launched a satellite for quantum communication yet, but the Chinese have).
- Standards: The question who could and would define standards in the respective fields is also relevant for Flagship governance (standard models of the brain, communication standards, etc.).

There is no evidence (yet) that the Flagship projects produce scientific knowledge that is used in foreign policy (in the spirit of 'sd'). This might change with applications in Quantum Communication (secure communication for foreign policy).

6. Issues of multi-level policy-making

Given the nature of its funding, the Flagship-related policy-making is multi-level by definition: It involves various European Commission DGs as pointed out above as well as EU Member States and associated countries co-funding partnering projects. The dynamics around this involve significant 'diplomacy for science' work that could potentially expand to non-EU stakeholders (in preparing co-funding schemes with third country partners). Importantly, however, there are no formal links to foreign policy, not at EU-level and not at Member State-level. The stakeholders involved in the multi-level governance of the Flagships are research policy-makers. When it comes to the Member States, this includes research and/or innovation ministries. On occasions, there are national-level coordination mechanisms, but again, they do not involve the EU science diplomacy or foreign policy (instead, the Swiss coordinators of HBP might coordinate with their bodies responsible for defining the relations between the EU and Switzerland). The Flagships are rooted in the broader research policy discussions at EU-level.

As such, the future development of the case also depends on the design of the next Framework Programme, Horizon Europe. As discussed above, the instrument of the Flagships is likely to be discontinued, which also raises questions for the importance of the present Flagships – in general and for the EU's international relations in particular.

7. Conclusions: How is the case changing our understanding of Science Diplomacy?

The FET Flagships are not conceived of as science diplomacy instruments by the European Commission. To what extent, then, are they more than research policy? The foreign research policy dynamics that we have depicted above suggest to consider them as an instance of sectoral foreign policy and an example of unintended science diplomacy. The case draws our attention to the possible unintended consequences of sectoral foreign policy in the areas of research and innovation. Although hardly any research policy and funding instruments are specifically designed for a science diplomacy use (the exception might be certain co-funding schemes or participation rules), an EU science diplomacy strategy should consider these broader instruments, for two reasons:

- To monitor unintended consequences (of the research policy intervention as such, but also of the science diplomacy-related activities of its stakeholders, including non-traditional actors in diplomacy),
- To reflect on windows of opportunity for science diplomacy.

Even though the FET Flagships are targeted at advancing EU research and innovation, with a corresponding focus on competitiveness (commonplace in innovation diplomacy, but more alien to science diplomacy), science diplomacy could be built into the scheme (e.g. by strategically allowing participation from – or infrastructure access for – certain third countries while restricting it from others). In addition, the case suggests that monitoring intended and unintended effects of research policy instruments (at least of a certain scale) on international relations should be part of a science diplomacy strategy.

Science diplomacy related to initiatives such as the Flagships will, of course, always be different from the well-publicised science diplomacy aspects of big science collaborations or infrastructures (CERN, SESAME, etc.). It will also be difficult to argue for innovation as a public good.[22] However, the European research community is used to openness and collaboration. If instruments like the Flagships end up connecting it to a form of innovation diplomacy that is about claiming stakes in the global knowledge economy (similar to other forms of diplomacy being about stakes in land or other resources), we should at least have the consequences of this process in mind. Disguising realist international relations in an idealist framework of international science relations without reflecting on the effects of sizeable research policy interventions on the EU's international relations can ultimately be detrimental to both research and international relations goals.

[22] cf. Leijten, J. (2019): Innovation policy and international relations: Directions for EU diplomacy. In: European Journal of Futures Research. 7(1), p.4. https://doi.org/10.1186/s40309-019-0156-1

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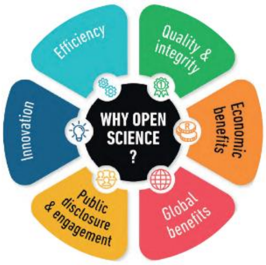

6. Open Science Diplomacy

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FIGURE: Why Open Science? Graphic for University of Cape Town, Gaelen Pinnock, CC-BY-SA-4.0

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Executive Summary

Following the call by EU Commissioner for research, science and innovation Carlos Moedas for "Open Science, Open Innovation, and Open to the World" in 2015, the case investigates applications and implications of Open Science for science diplomacy.

Open Science is the idea that scientific knowledge of all kinds should be openly shared as early as it is practical in the research process. The international Open Science movement strives to improve accessibility to and reusability of research and takes the opportunity to renegotiate the social roles and responsibilities of publicly funded research. The umbrella term of Open Science covers open access to publications, open research data and methods, open source software, open infrastructures, open educational resources, open evaluation, and citizen science. There are already many initiatives and programmes supporting the Open Science approach. Most recently various funders came together acting as the so-called "cOAlitionS" to implement Open Access by 2021 and to encourage new business models for sustainable scholarly communication. Moreover, with the European Open Science Cloud Europe is striving to lead Open Science to new frontiers.

Commissioner Moedas has outlined the leading role of Europe in the implementation of Open Science within the RRI (Responsible Research and Innovation) framework for research and innovation funding. In his "Three O" (Open Science, Open Innovation, Open to the World) approach, he has defined a set of priorities to make Europe a stronger global actor through science and collaboration, thus implying core aspects of science diplomacy. It is therefore vital to explore opportunities offered by Open Science, particularly open data and open access, to the provision of scientific advice to foreign policy. How can Open Science be exploited for decision-making support, knowledge resources and science diplomacy governance frameworks? How is the European Open Science strategy perceived and can thus be harnessed for foreign policy?

How could science diplomacy and Open Science mutually benefit from each other, while the modus operandi of the global science system is facing fundamental changes?

Key findings

This case study examines thus the Open Science policy arena as potential site for science diplomacy. Document analysis, participatory observation as well as qualitative interviews with Open Science stakeholders (scientists, administrators, funders, policy makers, etc) focused on European issues of internationalization of Open Access to scholarly publications and infrastructures for Open Research Data. Plan S - a strategy to promote Open Access to scholarly publications supported by many European and international research funding and policy actors - and the European Open Science Cloud EOSC – a virtual environment for research data, provide interesting grounds for more detailed investigations in that matter.

The central finding is that Open Science Diplomacy can be considered today mostly as international political cooperation for the advancement of the transition towards Open Science, even though Science Diplomacy is not a term commonly used in the global Open Science arena. However, the impact of changes in the international science system on foreign relations is in some cases already tangible – e.g. in the creation of international partnerships for the promotion and coordination of Open Access publishing or in the exchange of Open Research Data.

On the other hand, Open Science has only marginally been used for science advice in foreign relations until now. Their potential link was reflected in most case interviews as "non-existent", "un-anticipated", but "interesting" and "improvable". This potential – for example to tackle societal challenges efficiently across borders - has not been harnessed yet in diplomatic contexts, even though research policy makers and Open Science advocates are aware of it and start to promote it.

Challenges

- Governance of international Open Science activities in the public sector varies highly and can hardly be generalised.
- International stakeholder landscapes have changed profoundly in the last 30 years, towards a broad variety of advocacy actors and policy implementing organisations (such as funders and research organisations) with the increased involvement of publishing and content service industries, however many cross-border activities rely on informal and personal relationships.
- The European Open Science priorities are under benevolent international observation, commitments are increasing, however the tendency to implementation is still cautious.
- Open Science is very rarely on the diplomatic agenda, and science diplomacy is only marginally used for the orchestration and coordination of Open Science, even though Open Science advocates would welcome more involvement of foreign policy actors.
- Even pressing issues, like the international coordination of standards and legal frameworks for the exchange of data ("data diplomacy"), as well as new opportunities for innovation are not yet discussed in the light of Open Science developments.
- Rare involvement of diplomatic institutions, such as embassies, is mostly triggered by local advocates, such as library consortia, and is often not sustainable.

Key Recommendations

- The European Union and the European Member States as well as associated countries should put Open Science on the agenda for international scientific cooperation to tackle societal challenges, define missions and realise the UN Sustainable Development Goals (SDGs).
- Foreign policy actors need tailored information about Open Science in the form of case studies, best practice reports, etc. in order to understand the potential both for their needs and for the advancement of international scientific cooperation and innovation.
- Open Science actors could benefit from diplomatic skills for multi-national, multi-stakeholder negotiations, when the right interfaces are in place to translate needs into coherent sets of policies, monitoring measures, etc. Mainstreaming Open Science and aligning it with multi-level interests, national priorities and international policies does not only require strong leadership and sophisticated negotiation and communication strategies, but most importantly a holistic overview about major trends and international developments.

1. Introduction– Open Science Diplomacy

Open Science is the idea that scientific knowledge of all kinds should be openly shared as early as is practical in the research process. Open Science is an international movement comprising of Open Access to scholarly publications and data, Open Methods and Open Source, Open Education, Open Evaluation, and Citizen Science, all of which are in some way or another dependent on dedicated infrastructures, relevant measures for assessment and specific skill sets. As an international science policy arena it emerged around 2012, mainly driven by European Union research policies, but also pushed by the OECD and the G7. Open Science shows

- few institutionalized rules and procedures,
- heterogeneous actors,
- a domination by domain-specific priorities,
- the building on long-standing grassroots and bottom-up engagement,
- and the potential to changing the modus operandi of the global science system.

There is no such thing as Open Science Diplomacy, it is rather an auxiliary hypothesis guiding this case study. As a hypothetical term Open Science Diplomacy condenses a prominent EU science policy strategy – and its underlying paradigms – into an investigative instrument: "Open Science, Open Innovation and Open to the World"[1]. Open Science Diplomacy could be defined as international political cooperation for the advancement of the transition towards Open Science. As Research Commissioner Moedas stated: "As part of my own commitment to make European research open to the world, I will continue to develop EU science diplomacy at every opportunity, engaging with new countries and ensuring that science in Europe contributes as much to peace as it does to prosperity"[2]. Open Science Diplomacy delineates in this case not just scientific cooperation across borders, but the foreign policy dimension of this cooperation dedicated to open research practices. "Open to the World" could mean that European Science diplomacy should enhance the external dimension of European science and innovation policies, share EU values, visions and priorities, and achieve the SDGs[3]. However, it could also mean that Europe is sharing its achievements too fast and too wide, if not based on strong international partnerships, as some fear. Against this backdrop, this case study identifies and analyses applications and implications of Open Science in science diplomacy and vice versa.

Neither the term Open Science nor the term Science Diplomacy come with universally accepted definitions[4]. Regarding both concepts, there is room to see what is actually happening and what values and practices are at play. Commonly, Open Science is connoted with: Increasing the availability of knowledge as a public good, typically adhering to

[1] European Commission (2016): Open Science, Open Innovation and Open to the World. Luxembourg: Publications Office of the European Union.

[2] Moedas, C. (2016): Science Diplomacy in the European Union. In: Science & Diplomacy, 5(1). Retrieved from: http://www.sciencediplomacy.org/perspective/2016/science-diplomacy-in-european-union as accessed 01 June 2019.

[3] Slaus, I., H. Wallace, K. Cuhls, M. Gual Soler (2017): 3.3 Science Diplomacy. In: Directorate-General for Research and Innovation & European Commission (ed.): The RISE Report—"Europe´s future: Open Innovation, Open Science, Open to the World", pp. 106–118. Retrieved from: http://ec.europa.eu/research/openvision/pdf/publications/ki0217113enn.pdf as accessed on 01 June 2019.

[4] For Open Science see debate here: Bosman, J., B. Kramer (2017, March 26): Defining Open Science Definitions. I&M / I&O 2.0. Retrieved from: https://im2punt0.wordpress.com/2017/03/27/defining-open-science-definitions/ as accessed 01 June 2019. For Science Diplomacy see here: Gluckman, P. D., V. C. Turekian, R.W. Grimes, T. Kishi (2017): Science diplomacy: A pragmatic perspective from the inside. In: Science & Diplomacy. 6(4), pp 1–13.; López de San Román, A., S. Schunz (2018): Understanding European Union Science Diplomacy. JCMS: Journal of Common Market Studies, 56(2), pp. 247–266.; S4D4C (2019): S4D4C's Madrid Declaration on Science Diplomacy published. Retrieved from: http://www.s4d4c.eu as accessed 01 June 2019.

principles such as accessibility, transparency, reproducibility, and re-usability included in some combination. Many other terms are being used synonymously with Open Science, such as Open Research, Open Scholarship, Science 2.0, and eScience[5]. There are no reports or articles available on the relation of Open Science and Science diplomacy, if at all, we find similar constellations in scholarly literature on Open Innovation Diplomacy[6] or Data Diplomacy[7]. Openness is considered in regard to diplomacy mostly as opposite to secrecy[8], and sometimes referred to in the context of "public diplomacy"[9]. However, we do find events, that thematise the relationship of Open Science and diplomacy, like the 2019 CODATA conference in Beijing, which is co-hosting a high-level policy event with the title: "Implementing Open Research Data Policy and Practice"[10], directed to international research policy makers and representatives of the research systems.

In the decade up to 2019 Europe has expanded its science, technology and innovation (STI) agenda with the concept of Responsible Research and Innovation (RRI) towards considering RRI dimensions such as ethics, gender equality, open access, science education, public engagement, governance throughout the entire research and innovation process[11]. The Open Science Agenda builds on these dimensions, and should add answers and solutions to the following issues

- Europe is too "rarely succeeding in getting research results to market. Technologies developed in Europe are most of the time commercialised elsewhere.
- Although Europe generates more scientific output than any other region in the world, in some areas we fall behind on the very best science. At the same time, there is a revolution happening in the way science works. Every part of the scientific method is becoming an open, collaborative and participative process.
- Europe punches below its weight in international science and science diplomacy. Our collective scientific importance should be matched by a more active voice in global debates."[12]

In his approach to EU science diplomacy Commissioner Moedas outlined the leading role of Europe in the implementation of Open Science within the RRI framework for research and innovation funding, and the potential of Europe becoming a role model of Open Science. It is thus vital to explore opportunities offered by Open Science, particularly open data and open access, to the provision of scientific advice to foreign policy and vice versa.

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[5] Open Science MOOC. Retrieved from: https://opensciencemooc.eu/ as accessed 01 June 2019.

[6] Carayannis, E. G., D.F.J. Campbell (2011): Open Innovation Diplomacy and a 21st Century Fractal Research, Education and Innovation (FREIE) Ecosystem: Building on the Quadruple and Quintuple Helix Innovation Concepts and the "Mode 3" Knowledge Production System. Journal of the Knowledge Economy, 2(3), pp. 327–372. https://doi.org/10.1007/s13132-011-0058-3

[7] Boyd, A., J. Gatewood, S. Thorson, T.D. Bowman (2019): Data Diplomacy. In: Science & Diplomacy, 8(1). Retrieved from: http://sciencediplomacy.org/article/2019/data-diplomacy as accessed 01 June 2019.

[8] Wichowski, A. (2015): 'Secrecy is for losers': Why diplomats should embrace openness to protect national security. In: Digital diplomacy theory and practice, Routledge New York, NY, pp. 52–70.

[9] Melissen, J. (2005): The new public diplomacy: Between theory and practice. In: The new public diplomacy, Springer, pp. 3–27.

[10] CODATA Conference 2019. Retrieved from: http://www.codata.org/ as accessed 01 June 2019.

[11] Grunwald, A. (2014): The hermeneutic side of responsible research and innovation. In: Journal of Responsible Innovation, 1(3), pp. 274–291.
Owen, R., P. Macnaghten, J. Stilgoe (2012): Responsible research and innovation: From science in society to science for society, with society. In: Science and public policy, 39(6), pp. 751–760.
Randle, S., J. Youtie, D. Guston, B. Hawthorn, C. Newfield, P. Shapira, …N.F. Pidgeon (2012): A trans-Atlantic conversation on responsible innovation and responsible governance.
Flink, T., D. Kaldewey (2018): The new production of legitimacy: STI policy discourses beyond the contract metaphor. In: Research Policy, 47(1), pp. 14–22. https://doi.org/10.1016/j.respol.2017.09.008

[12] Moedas, C., Directorate-General for Research and Innovation (European Commission) (2016): Open innovation, open science, open to the world. Retrieved from: https://op.europa.eu/en/publication-detail/-/publication/3213b335-1cbc-11e6-ba9a-01aa75ed71a1 as accessed 01 June 2019.

How can Open Science be exploited for decision-making support, knowledge resources and science diplomacy governance frameworks? How are RRI and in particular Open Science perceived by non-European partners and can thus be harnessed for EU foreign policy? What requirements of foreign policy interventions for Open Science?

These questions might open up a horizontal division into 1) a content/procedural perspective: how can/does Open Science help foreign policy-making, and 2) a thematic perspective: Open Science as topic of foreign policy (though those perspectives might be overlapping to some extent). Contrasting those dimensions enriched our investigation both in the study of documents and in interviews with experts.

1.1 Methodology

We have approached these questions with a qualitative research methodology consisting of a mix of desk-based document analysis, narrative expert interviews and participant observation completed between June 2018 and June 2019. Document analysis was focusing on EU strategy and policy documents as well as policy and scholarly discussion of member and associated states, as well as international discourse on the state of transition towards Open Science. This research was furthermore guided by insights gathered from the authors role as expert and rapporteur in the Horizon 2020 Policy Support Facility Mutual Learning Exercise on Open Science: Altmetrics and Rewards (2017-2018)[13], as well as her role as active member of the Open Science Network Austria[14]. A set of 23 semi-structured interviews were carried out face-to-face or via telephone from October 2018 to June 2019. Interview partners come from diverse backgrounds, from science policy, research, infrastructures to international organisations. Some of them add an extra-European perspective for instance from Moldova, Argentina, or India. However, finding interview partners was not easy, especially persons from the fields of diplomacy of foreign relations were either too busy or in their own opinion "not knowledgeable enough" about Open Science to be available for an interview – from 23 interviews only 3 persons have a traditional diplomatic background. Nevertheless, 5 others explicitly follow an international cooperation agenda for science, but would not call themselves science diplomats, even though they concede that their international work might cross the Royal Society definitions of science diplomacy[15]. Two other interview partners represented the European Commission, with a focus on Plan S and the European Open Science Cloud.

[13] European Commission (2018): MLE on Open Science—Altmetrics and Rewards—RIO - H2020 PSF. Retrieved from RIO - H2020 PSF website: https://rio.jrc.ec.europa.eu/en/policy-support-facility/mle-open-science-altmetrics-and-rewards as accessed 01 June 2019.

[14] Open Science Network Austria. Retrieved from: https://www.oana.at as accessed 01 June 2019.

[15] Royal Society (2010): New frontiers in science diplomacy: Navigating the changing balance of power. Science Policy Centre London.

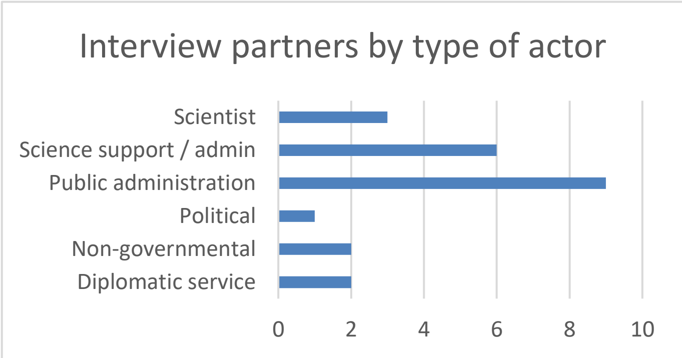

Figure 2: Interview partners by type of actor

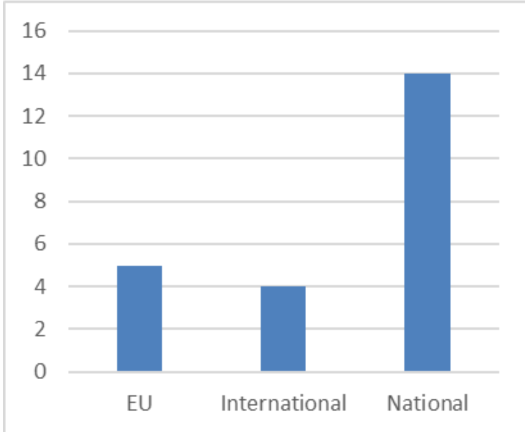

Figure 3: Governance level of interview partners' Open Science activities

In addition, both authors of the report attended conferences, workshops, and meetings dedicated to Open Science, where they could perform participant observations and take notes of informal conversations.

To illustrate the different levels of national and international negotiations on Open Science, we chose to include a recurring excursus to the situation in the Netherlands – authored by Ewert J. Aukes from the S4D4C partner University of Twente.

Figure 4: Wordcloud of topics in interviews

1.2 Background of the case: Open Science as a policy arena

Scholarly research practices are currently changing in fundamental ways and bring about new forms and qualities of interactions within society around the globe. Increasingly, researchers utilize online platforms and tools, produce digitally, share and reuse data and educational materials, and communicate via social media and mobile ICT. There are now innumerable possibilities of producing and sharing knowledge. The Open Science movement is based on the idea that scientific knowledge of all kinds should be openly shared as early as is practical in the research process. By demanding maximum transparency and shareability in knowledge production and transfer as well as the participation of (all) relevant stakeholders in the scientific process, Open Science strives to increase:

- reproducibility and accountability
- reusability and innovation (in its broadest sense)
- collaboration and societal participation respecting diversity, fairness and social responsibility.

It is important to emphasize that Open Science does not only focus on knowledge artefacts, research outputs, and technological affordances. It is first and foremost about social practices, thus the norms and values for organising research in society[16].

Open Science principles are currently discussed on a global scale by governments, funders, research-performing organizations and individual researchers. There is hope that with opening the publicly funded STI system and enhanced international collaboration societal and environmental challenges can be better tackled and scientific knowledge can become robust enough to be rapidly mobilized and reusable. This broad debate tackles the social function of publicly funded research and the current state of research systems in general. Thus, Open Science provides an opportunity to renegotiate the social roles of science, their links to inclusive growth, societal well-being, education and industry and to ask how multi-level agendas and interests can best be converged. Furthermore, the debate on Open Science sheds light on new developments of international scientific cooperation and coordination.

The European Union has embraced Open Science as a means to tackle multiple issues since 2015. "Open Science has the potential to increase the quality, impact and benefits of science and to accelerate advancement of knowledge by making it more reliable, more efficient and accurate, better understandable by society and responsive to societal challenges, and has the potential to enable growth and innovation through reuse of scientific results by all stakeholders at all levels of society, and ultimately contribute to growth and competitiveness of Europe." – European Union Competitiveness Council, 2016[17]

In Europe – mainly driven by a) the Open Access requirements in Horizon 2020, the framework programme for Research and Innovation and b) the European Research Area ERA roadmaps – there are many initiatives: several Member States have already adopted or prepared national Open Science Plans (f.i. NL, SE, FI, PT, FR); Member States and Associated Countries are working together in the European Research Area Committees (ERAC) in furthering the advancement of Open Science and Innovation and ERA implementation (priority of an open labour market for researchers and priority of optimal circulation and transfer of scientific knowledge), and are discussing how best to align various other EU policies and treaties with the implementation of Open Science. Since Europe is facing diverging velocities in the implementation of Open Science both within

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[16] Smith, M. L., R. Seward (2017): Openness as social praxis. In: First Monday, 22(4).

[17] European Union Competitiveness Council, 2016. Retrieved from: https://www.consilium.europa.eu/en/meetings/compet/2016/05/26-27/ as accessed 01 June 2019.

research communities and research and education policies, the international perspective might help to align cross-cutting issues and core driving aspects of Open Science along differences of European science governance.

Open Science has become an international policy effort: the 2016 Amsterdam Call for Action[18] (at the Netherlands' EU presidency on 4 and 5 April 2016) set out the following objectives: to provide **open access for scientific publications** by 2020, to make **open research data** and data stewardship the default approach for publicly funded research, to develop **new assessment and reward systems**, and to **align policies internationally** and **exchange best practices**. By 2017 G7 science ministers have signed a memorandum on international coordination of the development of incentives and infrastructures for Open Research. Placing science and innovation at the heart of the political agenda, G7 countries aim at **inclusive growth** and **social innovation**. They promote balancing regulation and incentives of Open Science to **increase productivity** and social impact[19]. Several leading charities and private funders have initiated the Open Research Funders Group ORFG[20]. OECD[21] and UNESCO[22] are producing reports on Open and Inclusive Collaboration in Science and are calling for **better policies and legal frameworks** for the conduct of Open Science. In the USA, the NIH (OA mandate since 2008), NSF, etc. are following the 2013 White House memorandum by developing and implementing Open Science policies[23]. Asian, South American and African countries are increasingly engaging in Open Science activities, mobilising multiple bottom-up initiatives, developing Open Access strategies, while some are already enforcing OA mandates[24].

2. Open Science Governance: What are the questions for international cooperation and science diplomacy?

Dynamics in the development of international science and policy have also come along with conspicuous changes in the stakeholder landscape over the last 30 years. Today, we see a broad variety of advocacy actors and policy implementing organisations (such as funders and research organisations) with the increased involvement of publishing and content service industries, while many cross-border activities still rely on informal and personal relationships as our interview partners recount. This is no different in the Open Science arena. However, what the Open Access movement has dramatically unmasked since the early years 2000s is the imbalanced and costly system of scholarly publishing and the global power corporate gatekeepers and scoring mechanisms, such as the Journal Impact

[18] Amsterdam Call For Action for Open Science. Retrieved from: https://www.government.nl/documents/reports/2016/04/04/amsterdam-call-for-action-on-open-science as accessed 01 June 2019.

[19] G7 Expert Group on Open Science. Retrieved from: http://www.g8.utoronto.ca/science/2017-annex4-open-science.html as accessed 01 June 2019.

[20] Open Research Funders Group. Retrieved from: http://www.orfg.org/ as accessed 01 June 2019.

[21] Dai, Q., E. Shin, C. Smith (2018): Open and inclusive collaboration in science: A framework. https://doi.org/10.1787/2dbff737-en

[22] UNESCO reports. Retrieved from: http://www.unesco.org/new/en/communication-and-information/access-to-knowledge/open-access-to-scientific-information/ as accessed 01 June 2019.

[23] National Academies of Sciences, E., Affairs, P. and G., Information, B. on R. D. and, & Enterprise, C. on T. an O. S. (2018): Office of Science and Technology Policy 2013 Memorandum: Increasing Access to the Results of Federally Funded Scientific Research. Retrieved from: https://www.ncbi.nlm.nih.gov/books/NBK525415/ as accessed 01 June 2019.

[24] Innovation Policy Platform: Open science country notes. Retrieved from: https://www.innovationpolicyplatform.org/www.innovationpolicyplatform.org/content/open-science-country-notes/index.html as accessed 01 June 2019.; UNESCO Global Open Access Portal. Retrieved from: http://www.unesco.org/new/en/communication-and-information/portals-and-platforms/goap/access-by-region/asia-and-the-pacific/ as accessed 01 June 2019.

Factor, which are evidently biased and inadequate to measure scientific performance, as well as the power of their gatekeepers in the publishing industry[25].

Since 2008 – the launch of the Open Access Pilot in FP7 - Europe has established a broad catalogue of measures to initiate, adopt and further promote a systematic and paradigmatic shift towards collaboration, sharing and sustainability in publicly funded research: starting from Open Access to Publications and Research Data in the current Framework Programme Horizon 2020, building necessary infrastructures following the vision of an European Open Science Cloud, and envisioning more openness in evaluation and hiring procedures[26], as well as building the foundations for skills and competencies for the next Framework Programme. In the proposal for Horizon Europe, Open Science is again a major cross-cutting principle: "Fostering Open Science and ensuring visibility to the public and open access to scientific publications and research data, including appropriate exceptions" in included in the objectives for Horizon Europe. There are mandatory open access (to publications and data) rules foreseen, as well as the need to develop adequate "incentives or obligations to adhere to Open Science practices" while listing several rewarding mechanisms for "promoting the adoption of Open Science practices, responsible R&I" [27]. However, there are several aspects that still have to be sorted out and detailed in the coming years, like aligning principles of FAIR data sharing with intellectual property regulation and exploitation opportunities, broadening Open Access to other forms of research output, requiring institutions to assume responsibility and introduce adequate open policies, and introducing responsible, new-generation metrics for assessing output and both scientific and societal impact[28].

Open Science and Science Diplomacy: where there is a will, there is a way?

With all those activities, Europe is indeed at the international forefront of implementing Open Science in public funding schemes. The European Commission acts as role-model for European member states and associated countries – as observations as well as interview partners confirm. On the other hand, the European Union constantly works on enlarging their international research cooperation. Even though receiving European funding entails adhering to the open access standards for publications and data, it does not mean that these necessary conditions are discussed as part of the science cooperation agenda. Moreover, the Open Science strategy seems to be not as closely linked to the science diplomacy agenda, as originally intended. How can Open Science help to develop S&T leadership as well as strengthen regional as well as global relationships? How exactly Open Science could form the basic "infrastructure" for "Open Innovation" and "**Open to the World**", these questions were left unanswered, since the report of the RISE group and the book on the three Os were published in 2016[29]. Even in those reports concrete proposals for the linking of Open Science and Science diplomacy are missing. Neither the cooperation

[25] Hicks, D., P. Wouters, L. Waltman, S. De Rijcke, I. Rafols (2015): Bibliometrics: the Leiden Manifesto for research metrics. In: Nature News, 520(7548), p. 429.

[26] Working Group on Rewards under Open Science (2017): Evaluation of Research Careers fully acknowledging Open Science Practices. European Commission.

[27] For relevant excerpts of the agreed texts of proposal and regulation of Horizon Europe in April 2019, see this statement by SPARC, retrieved from: https://sparceurope.org/open-science-essential-for-new-horizon-europe-funding-programme/ as accessed 01 June 2019.

[28] Burgelman, J. C. (2017): European Perspectives on Open Science Policy. Policy gehalten auf der SA-EU Science Workshop, Johannesburg. Retrieved from: https://www.slideshare.net/AfricanOpenSciencePlatform/european-perspectives-on-open-science-policyjc-burgelman as accessed 01 June 2019.

[29] Directorate-General for Research and Innovation (2017): Europe's future: Open innovation, open science, open to the world. Reflections of the Research, Innovation and Science Policy Experts (RISE) High Level Group. Brussels: European Commission.;
European Commission (2016): Open Science, Open Innovation and Open to the World. Luxembourg: Publications Office of the European Union.

among Member States for the orchestration of Open Access activities, nor the external relations necessary for a global coordination were further outlined, even though the main emphasis was put on **global collaboration and mobility**. Openness in this regard means that "researchers and innovators are able to work together smoothly with colleagues worldwide and where researchers, scientific **knowledge and technology circulate** as freely as possible"[30], and join forces to tackle scientific and global challenges: "Science is and must remain 'Open to the World' as a matter of necessity (it cannot be otherwise in a globalised world), as a matter of quality (we need **access to the best knowledge worldwide**) and as a **contribution to progress** (investing in research makes sense in human, social and economic terms)."[31], said Carlos Moedas in a speech at the World Science Forum 2017 on the World Science Day for Peace and Development in Jordan, at the advent of the signature of Jordan to PRIMA, the Partnership for Research and Innovation in the Mediterranean Area.

A central finding of this case study is that the link between Science diplomacy and Open Science activities is barely acknowledgeable. Science diplomacy is not a common term in the realms of global Open Science. Nevertheless, a lot of things are going on – on the frontstage and the backstage of international political cooperation for the advancement of the transition towards Open Science. Whereas the European Union has focused in the last decade more on a European agenda and the alignment of approaches for Open Access and Open Data, the orchestration of international science policies towards a transition to Open Access requires other strategies and needs to build sustainable structures, as here traditional publishing business models and knowledge markets are disrupted. Stakeholders from research, policy and industry are sorting out their positions and new relationships around the implementation of Plan S, a framework for the regulation of publishing practices for publicly funded research, which will be described in more detail in the chapters to follow[32].

Whereas Plan S coordination has already triggered some specific international cooperation of science and diplomacy, other areas of Open Science, such as Open Data or Open Educational Resources have not yet reached their diplomatic dimensions, even though they are discussed on international level. From the interviews we learn that **policy stakeholders are still sceptical**. While we see commitment everywhere in the world and stakeholders are urgently seeking to improve the sustainability of STI systems and to distribute access to its benefits more equally, such activities and recommendations are often met with scepticism by policy makers, as there is a lack of reliable evidence to support the narratives of opportunities and benefits through Open Science, especially of socio-economic benefits[33]. So, one major issue in the internationalization of Open Science currently is to get policy-makers, funders, researchers and industry together to produce this evidence, another issue it to comprehend the potential for STI leadership, on regional and global scale. We need to better understand how the tree Os actually work together and profit or limit each other. Furthermore, investment into Open Science is an inherently international effort that requires not only global thinking but also international exchanges of best practices for governance or alignment of policies. This is of great importance to

[30] European Commission (2016): Open Science, Open Innovation and Open to the World. Luxembourg: Publications Office of the European Union, p. 68.

[31] Moedas, Carlos: speech 2017. Retrieved from: https://ec.europa.eu/commission/commissioners/2014-2019/moedas/blog/open-world-aspects-wp_en as accessed 01 June 2019.

[32] On 4 September 2018, the cOAlition S published a strategy aimed at further advancing and accelerating Open Access to scholarly publications. Research results funded with public money must be published in Open Access journals or repositories accessible to the general public from 2021. Plan S defines the framework conditions under which publications must be published. See for further information: https://www.coalition-s.org/ as accessed 01 June 2019.

[33] Ali-Khan, S. E., A. Jean, E. MacDonald, E.R. Gold (2018): Defining Success in Open Science. MNI open research, 2.

tackle the most frequently brought up issue of **reciprocity**. As one interview partner put it: "If we go too fast, if we give away our know-how for free without the warranty of reciprocity, we are naïve."[34] This quote illustrates the dilemma of the collaborative and the competitive ends of global science.

In Chapter 4 the sections on "De-facto Governance" will explain in more detail the governance challenges arising in two interlinked areas: the coordination of Open Access policies on a global scale and the opening of research infrastructures to better collaboration and open access to research data. With the example of two European-led initiatives, i.e. Plan S and the European Open Science Cloud, we illustrate both issues of governance and cooperation and some international perspectives on Europe's efforts. Before, we summarise how the international Open Access movement was introduced to Dutch science policy stakeholders and turned into a national agenda.

2.1 Excursus 1: Open Science governance arrangements in the Netherlands (Ewert Aukes, Jan 2019)

2.1.1 From international movement to domestic policy change

Depending on who you ask in the Netherlands, the roots of Open Science date back to different times. While there is an argument to make that modern-day science practices, e.g. scientific publication dominated by international commercial publishing houses, are much more closed now than they were before, the Dutch Science Organization (NWO), the Netherlands' largest research funding organization, has presented a timeline which contains many of the significant events that are mentioned by many of the people interviewed (Figure 1).[35]

[34] Interview 22, October 2018.

[35] The Dutch knowledge hub on all things OA, www.openaccess.nl/nl/in-nederland/stand-van-zaken, presents a slightly different timeline. It ranges from 2011 until now and unsurprisingly focuses on OA news that is applicable to the Dutch academic context. Some of the events feature in both the timelines of NWO and openaccess.nl, some figure exclusively in either of the two. The information on the Big Deals of the Dutch academic sector with the large academic publishing houses for the section below is taken mainly from the openaccess.nl timeline.

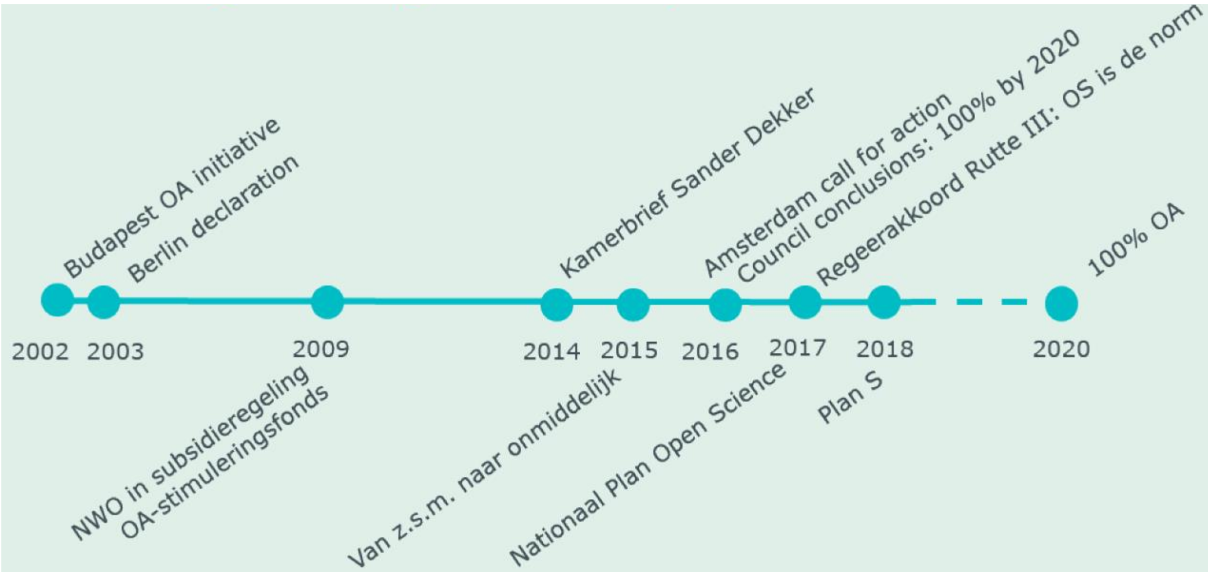

Figure 5: History of Open Science in the Netherlands (source: presentation president NWO).

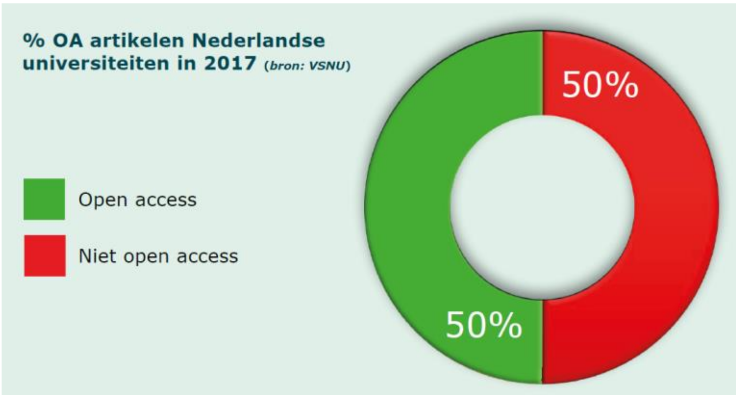

Figure 6: Share of Dutch scientific publications published in Open Access outlets in 2017 (source: presentation president NWO).

First science policy ideas to open up scientific publications to a larger public already surfaced in the early 2000's with the Budapest Open Access Initiative and the Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities. According to NWO, the first Dutch impact of the Open Science movement effectuated in 2009, when NWO began funding Open Access (OA) publications: a maximum of 5000€ was available per NWO-funded project for publications in scientific, peer reviewed OA journals.[36] The recent history of Open Science in the Netherlands begins with a much-reported letter to the Parliament by then undersecretary of education, culture and science Dekker stating that the public funding of research in the Netherlands calls for OA publication of all research. This goal was to be achieved by 2024.[37] An often-mentioned event and even judged a pivotal year by some was the year 2016. Not only did the Dutch

[36] Due to the age of the fund, NWO does not have official webpages with descriptions of this fund available. The only trace I found of this is on a blog on OA: Marijke van der Ploeg (21 March 2010): Open Access fonds NOW. Retrieved from: https://marijke-anyway.blogspot.com/2010/03/open-access-fonds-nwo.html as accessed 01 June 2019.

[37] Dekker, S. (2013, 15 November): Open Access van publicaties [Letter to Parliament]. Retrieved from: https://www.tweedekamer.nl/kamerstukken/brieven_regering/detail?id=2013Z22375&did=2013D45933 as accessed 01 June 2019.

government put Open Access high on the European agenda with the Amsterdam call for action during its EU presidency that year, but also the European Council decided that by 2020 100% of European scientific output is to be published OA. A process with a strong impact on the publication of publicly available scientific output were the so-called 'Big Deals' with publishing houses (see Text Box 1). The governmental stimulus to publish scientific output in OA outlets had already led to a 50% share by 2017 (Figure 2). Moreover, early that same year the Dutch National Plan Open Science saw the light of day which is considered a very important framework document for OS in the Netherlands (NWO representative). This plan embodied the commitment of Dutch science and science policy organizations to the 2020 100% OA goal. Besides accounting for what was already going on in terms of Open Science, it stated 14 ambitions in four fields: Full open access to publications, making research data optimally suitable for reuse, Recognition of and rewards for researchers and promoting and supporting Open Science.[38] The implementation of the National Plan Open Science led to the two-year appointment of a National Coordinator Open Science in 2018, a role meant for furthering the realisation of Dutch Open Science ambitions and strengthening the Netherlands' pioneer position on the topic. Later on in 2017, Open Science's momentum was bolstered by the coalition agreement of the newly formed cabinet under PM Rutte stating that Open Science and open access would become the norm in scientific research.[39]

[38] OCW (9 February 2017) National Plan Open Science. doi: 10.4233/uuid:9e9fa82e-06c1-4d0d-9e20-5620259a6c65.

[39] VVD, CDA, D66, ChristenUnie. (2017, 10 October): Vertrouwen in de toekomst: Regeerakkoord 2017 – 2021.

Text box 1

Big Deal negotiations as OA push

As lead actor in the Dutch academic transition towards OA, the Association of Universities in the Netherlands (VSNU) is in charge of negotiations with academic publishing houses. There is an agreement with the government that no new contracts with publishers will be closed that do not include OA provisions. The negotiations take place in cooperation with the Dutch consortium of university libraries and the National library of The Netherlands and has by now yielded the following 'Big Deals':

- Dec 2014: **Springer** deal for 2015 and 2016, no payments for journal subscriptions, but for publication in Springer's approx. 1.500 hybrid journals
- Apr 2015: **Wiley and Sons** agrees to invest in Open Access
- Jul 2015: **SAGE** strikes two-year agreement about OA transition
- Dec 2015: Three-year framework agreement with **Elsevier** on OA publishing
- Feb 2016: OA agreement with **Wiley and Sons**, allowing for OA publication in 1.400 of their journals
- May 2016: From 2017, all articles including an author from a Dutch university will be published OA by the **American Chemical Society** without extra fees
- May 2017: **Cambridge University Press** agrees on OA publication in 339 hybrid journals and 17 fully open journals
- Mar 2018: New agreement with **Springer** allows 2.080 OA published articles per year for four years
- Mar 2018: OA included in new agreement with **Oxford University Press** for the first time
- Jun 2018: OA agreement in contract renewal with Dutch publisher **Wolters Kluwer**
- Jan 2019: articles in **Oxford University Press** journals can be published OA for free for the coming two years

In a meeting organized by NWO at the end of March 2019 to discuss the implication of Plan S and how to prevent detrimental effects, especially for OA publications, several issues were touched upon. Changing the publication rules during the game was seen as the effect of the 100% OA policy with immediate implications for individual scientists. It became clear that the impacts of the 100% OA ambition would differ across the academic demography and would potentially impair mobility of individual scientists. Finally, it can be asked what the Big Deals' foreign policy implications is, given that VSNU, a non-governmental national actor is negotiating those deals with large-scale publishing houses from the Global North which operate on a global scale with commercial interests.

2.2 Contributing to debate on EU level

Gradually, Dutch academic organizations started to link up with the debate on EU level. Of course, Carlos Moedas' '3 O's' had already heaved the topic of Open Science onto the European agenda in 2015. However, once the debate was picking up momentum in the Dutch science policy arena and potential policy objectives began to materialize, Dutch academic organizations such as NWO heeded the necessity of representing the Dutch interests also on a European level. This activity and engagement only grew more intense with the publication of Robert-Jan Smit's 'Plan S' at the end of 2018, which solidified the EC's ambitions with regard to Open Science. Plan S not only presented the opportunity for the Dutch academic sector of playing a leading role in setting the pace for the development of Open Science in the EU and potentially globally, but also the necessity of weighing in on the debate to ensure the Dutch academic sector would not fall behind on the topic of Open Science. NWO coordinates further Plan S negotiations to ensure a unified Dutch voice. In a way, the European efforts to implement Open Science could also be seen as catching up, as there is already a large role for Open Science in South America, albeit with different mechanisms and routes. Finally, the San Francisco DORA declaration was also mentioned by many interviewees as a significant step towards Open Access which was also ratified by Dutch science policy organizations. Currently, the Dutch science policy organizations are negotiating on different levels to realise Plan S and maximize the share of Open Access published publications in the Netherlands.

3. Stakeholder landscape

Interview partners described the stakeholder landscape and actors involved in the Open Science policy arena.

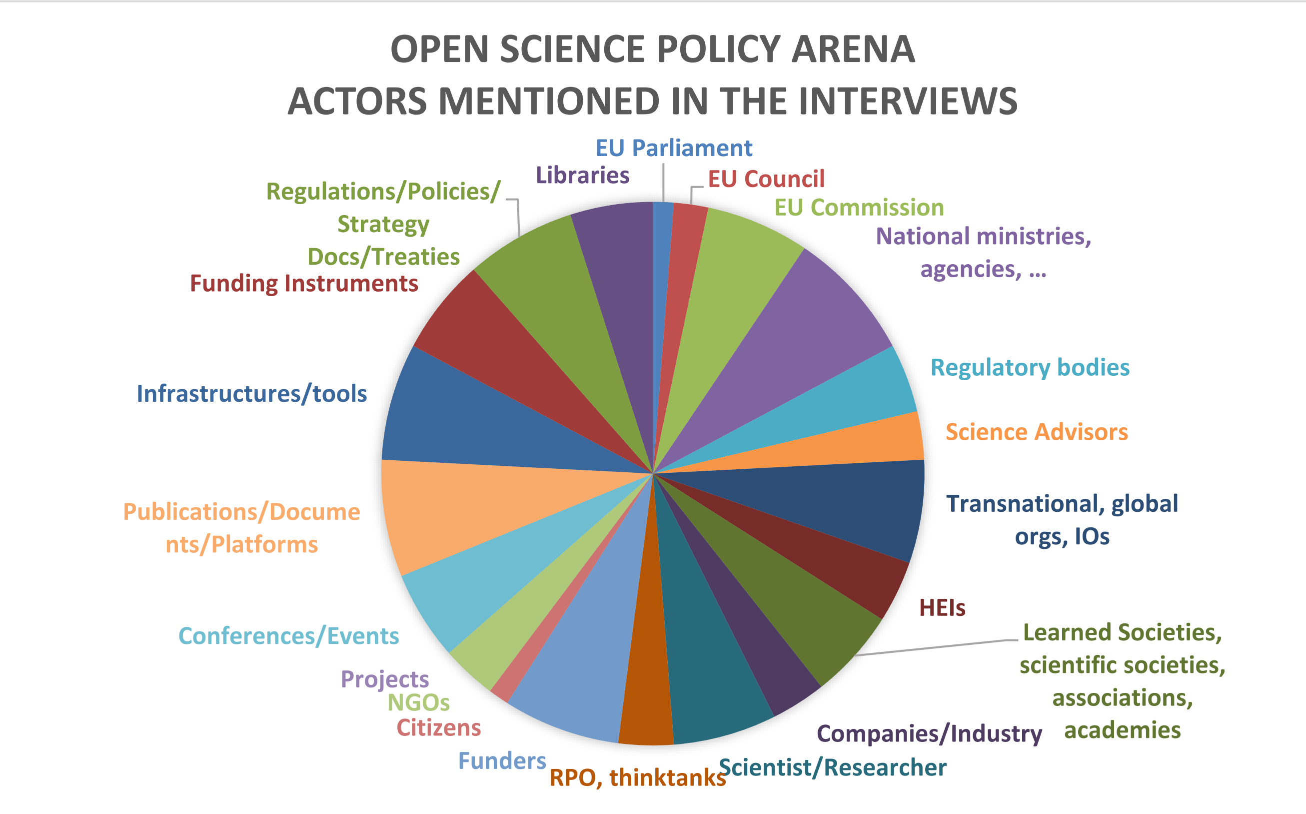

Figure 7: Actors in the Open Science policy arena as mentioned in the interviews. Pie illustrates the distribution of mentions.

Bringing together results from desk research and interviews, the following types of stakeholders are most visibly involved in the international Open Science arena. In the table we describe briefly the activities that were mentioned in the interviews and observed in the case study, which concern Open Science as well as related international or regional cooperative actions.

Type of actor	**description of activities and formats**	**exemplary actors**
Supra-national (science) policy actors	Statements, reports, platforms with description of state of the art, needs analyses, best practices and recommendations. Task forces and working groups.	G7/G8 Science Ministers, OECD, UNESCO, UN, WHO
European (science) policy actors	Policy alignment, regulations (funders) alignment of EU and member states, role models, expert advice, working groups	EU Commission DG Research and Innovation, DG Connect, the European Research Council ERC, ERAC working groups; Open Science Policy Platform; European Competitiveness Council; European Strategy Forum for Research Infrastructures ESFRI, High level expert groups, Science Advisors (SAM)
National-level science policy actors	Working groups (overlapping with ERAC), guidelines or national roadmaps and action plans, research policy and financial and legal frameworks, national research documentation systems	Research, education and innovation ministries and related public services, agencies
Public research funding organisations	Funders are predominately supporting Open Science, except innovation funds, that only rarely and then cautiously implement optional Open Access schemes. The international representatives of European science funders are particularly active, see i.e. Plan S. Policies, guidelines, trainings, international exchanges and coordination (e.g. for transparency of publishing costs)	Science funding agencies, research councils, science academies, or innovation funds Science Europe, Global Research Council
National foreign policy actors /diplomatic services	Event organisation, briefing documents and preparation of negotiations	Delegations in embassies, liaison officers in ministries, science attaches, and dedicated offices, such as the Office of Science and Technology of Austria in Washington OSTA.

Charitable organisations and trusts acting as research funders	Policies, guidelines, trainings and capacity building, international exchanges and coordination, lobbying, infrastructures Often role models for science policy makers.	Wellcome Trust, Gates Foundation, Sloan Foundation, Open Society Foundations, … see also the Open Research Funders Group …
Research performing institutions, higher education institutions and their international representatives	Policies, education and capacity building, infrastructures, lobbying, incentives and rewards, conferences … advocacy and engagement level commonly depending on the activities of libraries	League of European Research Universities (LERU), European University Association (EUA), Association of African Universities (AAU),…
Research infrastructure organisations, libraries, archives, and information services, as well as museums (and their international representations)	Research documentation, repositories, infrastructure, technology, governance models, lobbying, training, international exchanges and coordination, negotiation of big deals with publishers in cooperative library consortia. Either strongly advocating, partially involving, sceptically observing, or fully rejecting Open Science developments. Sceptical are mostly cultural heritage institutions as well as specialist archives, which are depending on sparse resources for long term digitization, curation as well as visitor fees/subscriptions.	Among the advocates are the Association of Research Libraries (ARL), LIBER, OpenAIRE, the Council of the Australian University Librarians (CAUL), The Confederation of Open Access Repositories (COAR), REDALYC, GÉANT (pan-European collaboration on e-infrastructure), DARIAH (European research infrastructure).
Learned societies and their international representatives	Running or publishing scientific journals or research databases, conferences, platforms, lobbying	Discipline specific associations, European Citizen Science Association, Global Young Academy, and the International Science Council
Civil society organisations, NGOs, NPOs, or associations, intermediaries	Research, infrastructure, platforms, networking, consulting, statements, briefings, technology, strategic development, international coordination…	Advocating OS: SPARC, Mozilla, Wikimedia, EIFL, African Open Science Platform, Research Data Alliance (RDA), Wikimedia Policy consultants and support: RAND, Lisbon Council (Open Science Monitor)
Publishing and research services industry	Publishing, indexing, competing and developing new Open Science business models	Monograph or journal publishers, repository and research and documentation

	(Gold OA, Article Processing Charges), monitoring, documenting, analysing, lobbying, infrastructure, policies	infrastructure providers, discovery services, conference services, data management and analysis services, such as the Holtzbrinck Group, Elsevier, Frontiers, F1000, …
Individuals	All of the above-mentioned activities. Many of them speaking out, publishing, blogging, teaching about Open Science (pro and con) and networking	Researchers, technology developers or librarians, involved in grassroots' activities, science administration as well as in policy advisory bodies[40]. Moreover, there is a growing community of internationally mobile students and next generation researchers developing and promoting Open Science activities and policies.

Table 5: Actors in the international Open Science arena as mentioned in the interviews and gathered through observation.

The relations between these actors, as well as their roles vary when looking at the respective thematic and geopolitical domains. The common ground, however, is the inherent international cooperative and political character of all the exchanges that were studied and discussed in the interviews. From the research performing organisation in Europe that wants to establish an open access policy and looks to international best practise via its diverse networks to national policy makers, who are creating new STI policies: many of them – even non-European ones[41] - are first and foremost looking at the status quo in European programmes, then turn to compare countries or organisations with similar configurations in the governance of publicly funded science, before they craft their roadmaps or policies. Providing the necessary modular stepping stones, guidelines and role models, has therefore become more and more important in the last years, as was also demonstrated by the Mutual Learning Exercise on Open Science in 2018[42].

Another set of important actors in the Open Science arena are umbrella organisations or international associations of RPOs and libraries. Since libraries or library consortia were among the first advocates of Open Access – because of their insights to the business models of big commercial publishers – they already share a long history of international lobbying for Open Science topics.

> *"Our approach is that we work with library consortia and that's also something that was a little bit strange for previously closed countries, because before they were used to working in environments where they were told what to do, and they didn't need to have any kind of shared governance mechanisms or*

[40] SEE THE LIST OF MEMBERS OF THE OPEN SCIENCE POLICY PLATFORM https://ec.europa.eu/research/openscience/pdf/ospp_nominated_members.pdf #view=fit&pagemode=none OR THE LIST OF AMBASSADORS FOR PLAN S https://www.coalition-s.org/ambassadors/ as accessed 01 June 2019.

[41] With the exception of Latin American and Caribbean Countries that are part of the long term successful and growing Open Access system CLACSO: there are many regional and national initiatives, such as OA journal platforms, publication and data repositories, framed by supportive governmental policies (see SciELO and RedALyC). Here we find growing attention of European Open Science actors, that Europe can learn from these pioneering developments and well as should establish stronger partnerships. CLACSO. Retrieved from: https://www.clacso.org/ as accessed 01 June 2019.

[42] Mayer, K., S. Leonelli, K. Holmberg, F. Miedema (2018): Mutual Learning Exercise: Open Science—Altmetrics and Rewards. European Commission.

> *collective decision-making processes. […] But they learned very fast, since they are seeing their limitations in budgets and at the same time the demand from the research community."*[43]

Library consortia are also highly trusted stakeholders, particularly in countries facing frequent fluctuations in policy making and research institutions. Similarly, large e-infrastructure providers and consortia promoting data sharing can look back at a large knowledge base of international research cooperation. They are thus also among the strong voices in the discourse, building on their diverse experiences of benefits and challenges of data sharing.

When looking for Open Science Diplomacy, namely implementations of the link of Open Science with Science diplomacy as envisioned by Moedas[44] to serve European values and tackle global challenges, then we find that only recently the topic of Open Access and - even more marginally - the topic of Open Data has found its way to both EU and national-level foreign policy bodies. Yet, we have not discovered any formalised or stabilised interactions aside from ad-hoc activities, which would put Open Science on an EU wide foreign policy agenda. We could not find evidence, other than anecdotal, on any substantial involvement of the European External Action Service. Our interview partners reported several cases, where Open Science was mentioned alongside other science or culture-related agenda points in high level diplomatic exchanges (e.g. between EU-Switzerland, EU-Russia, EU-LAC). Furthermore, we heard of some initiatives, such as the initiative for an Open Science Working Group in the Western Balkans[45], or some regional EU Member States embassies' support of Open Science events e.g. in Africa, as was mentioned in an interview. Exchanges with the USA – according to one interview partner – are more frequent, although mostly bi-lateral between EU member states and the USA, but nevertheless not strategically or systematically aligned until now. In 2018 to celebrate 20 years of science and technology agreement between the EU and the US, a workshop brought together policymakers, funders, researchers, and supporters of Open Science to discuss the opportunities and challenges for international cooperation in Open Science and related paradigms:

> *"The international scientific community is now embracing Open Science approaches. In the European Union (EU), Commissioner Carlos Moedas has set three goals for research and innovation policy: Open Innovation, Open Science and Open to the World. In the United States (US), the Federal Crowdsourcing and Citizen Science Act was signed into law in January 2018. But despite such high-level support, more work is needed to understand and measure the value of Open Science policies, and to understand how to foster international cooperation in this area."*[46]

European Union Delegations – it seems – were made aware more systematically on the topic only recently. In an interview, the Open Access special envoy of the European Commission reports that he asked the EU science counsellors assigned to DG Research and Innovation or DG Connect to both create awareness of Plan S in their regions, and to help to prepare the grounds for meetings with responsible policy makers, which we will describe in more detail in the following sections.

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[43] Interview 13, 27 June 2019.

[44] Moedas, C. (2016): Science Diplomacy in the European Union. In: Science & Diplomacy, 5(1).

[45] Regional Cooperation Council (2017): Regional Cooperation Council | Working Group on Open Science. Retrieved from: https://www.rcc.int/working_groups/30/working-group-on-open-science as accessed 01 June 2019.

[46] Woodrow Wilson International Center for Scholars (2018): Advancing Open Science in the EU and the US. Retrieved from Wilson Center website: https://www.wilsoncenter.org/event/advancing-open-science-the-eu-and-the-us as accessed 01 June 2019.

While this report was finalised in summer 2019 we were informed about a series of events planned around the 2019 UNESCO World Science Day for Peace in November devoted to Open Science. "Open Science is not only an issue of science being open to the research community, as in "open access" and "open data" but refers to a science open to society." Addressing disparities in accessing and sharing scientific knowledge as well as discussing how Open Science can finally become a "game changer for achieving the Sustainable Development Goals, particularly in Africa, developing countries, and Small Island Developing States (SIDS)" are central aspects mentioned by UNESCO[47]. Furthermore, UNESCO invests in a "global dialogue on Open Science to ensure that Open Science practices meet their potential in bridging the world's STI gaps and enabling sustainable development." At the time the UNESCO Executive Board is discussing a follow-up to several preceding recommendations and strategy documents[48] to foster "UNESCO's normative and standard-setting role" in Open Science and has published a consolidated roadmap for a possible UNESCO Recommendation on Open Science[49].

Around the same time, the United Nations announced to host conferences dedicated to Open Science. The first United Nations Open Science Conference on 19 November 2019 is organized by the UN Dag Hammarskjöld Library in collaboration with the Scholarly Publishing and Academic Resources Coalition (SPARC) [50]. Global Open Science is emphasized as "core enabler of the UN 2030 Agenda". The organisers are assembling representatives of different kinds of initiative, research performing organisations, industry, libraries, policy makers and researchers.

Whether or not this is a paradigm change in international foreign policy making in adopting the Open Science topic remains to be seen, however it can be regarded as important step for the topic to be on the global agenda of Science diplomacy.

[47] UNESCO World Science Day for Peace website 2019. Retrieved from: https://en.unesco.org/commemorations/worldscienceday#theme as accessed 1 November 2019.
[48] UNESCO Recommendation on Science and Scientific researchers, approved by the General Conference at its 39th session in 2017 and the UNESCO Strategy on Open Access to scientific information and research approved by the General Conference in its 36th session in 2011.
[49] UNESCO (2019): Consolidated roadmap for a possible UNESCO Recommendation on open science—UNESCO Digital Library (Nr. 207th Meeting of the Executive Board). Retrieved from the UNESCO Executive Board website: https://unesdoc.unesco.org/ark:/48223/pf0000369699 as accessed 1 November 2019.
[50] Open Science Conference 2019 at UN. Retrieved from: https://research.un.org/conferences/OpenScienceUN as accessed 01 November 2019.

3.1 Excursus 2: Open Science stakeholders in the Netherlands (Ewert Aukes, Jan 2019)

An actor network is useful to show the multitude of actors in the Dutch Open Science policy arena (Figure 3). In the following, we will give a description of those actors that are influencing the national Dutch Open Science debate. We will do so following the multi-level governance structure that is also suggested in Figure 3 starting from the bottom up.

3.1.1 Sub-national level

On a sub-national level, those institutions sit that are most implicated in their daily practices: **Universities**, **Research institutes** and **University libraries**. Of course, this is also the level hosting the actual people who are part of the longstanding grassroots movement for Open Access and those co-shape and carry out the Open Science policies: **knowledge workers** (including scientists, librarians, data managers and curators, …).

3.1.2 National level

The national level is populated with organizations participating in the Open Science policy arena. On the one hand, this includes governmental institutions such as the **Dutch cabinet**, but also the **Ministries of Education, Culture and Science** and **Economic Affairs**. On the other hand, there is a plethora of non-governmental organisations who play different roles in the Open Science policy arena. The most prominent non-governmental actors on this level are the **Dutch Science Organization (NWO)** and the **Association of Dutch Universities (VSNU)**. While VSNU leads the Big Deal Open Access publishing contract negotiations, NWO is the first contact point for all negotiations about Open Science on the European level. This role is possible, because NWO sees itself as a neutral party in the Dutch science policy arena. From that position, it can bring parties and agendas together and make connections that improve scientific cooperation. NWO explicitly does not want to be a coordinator but rather a connector that does not steer on content as a NWO representative explained in the interview. The NWO also stimulates Open Science in the Netherlands and Europe by formulating funding conditions to that effect, such as required data management plans. The **Royal Academy of Science (KNAW)** is also situated on this level and represents the interests of basic sciences. A large part of its work is negotiating the meaning of OS and its elements. KNAW is cautious in picking up swiftly on new developments. Things that have taken a long time to develop should not be changed completely in the blink of an eye, we were told in an interview. Although the

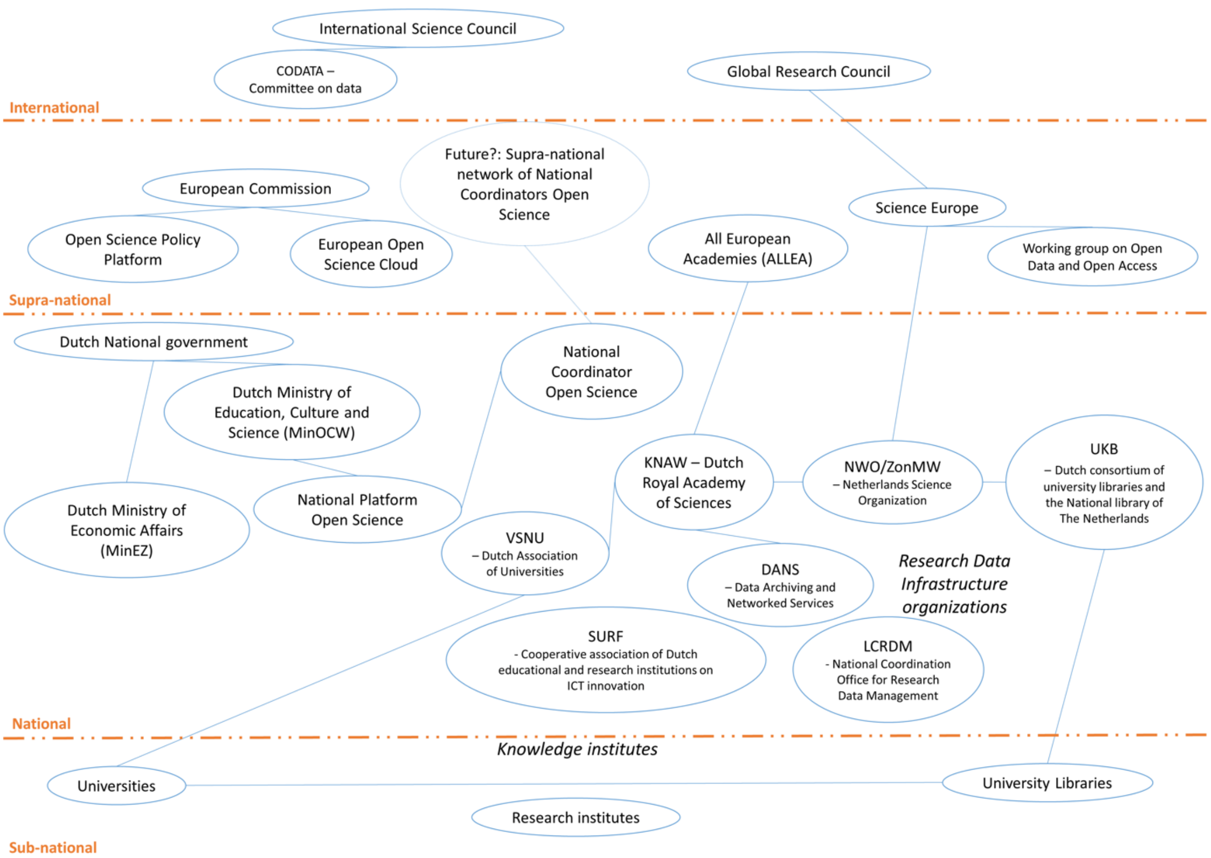

Figure 8: Visualisation of the Dutch actor network on Open Science in a multi-level governance perspective. (Ewert J. Aukes)

Academy is contented with the political activity in the Open Science policy arena, e.g. by Sander Dekker or Robert-Jan Smits, it sees the scientific community as a system of checks and balances that evaluates the feasibility of policy plans. Furthermore, some organizations represent the Dutch science infrastructure as it has developed over the decades. This includes the **Association of University Libraries (UKB),** which represents the interests of all sub-national university libraries as well as the Royal library. It also includes three organizations dealing with scientific data infrastructure. These have broadened possibilities for data sharing over the past decades and figure in the Open Data debate. These data infrastructure organizations are **Data Archiving and Networking Services (DANS)**, the **Cooperative association of Dutch educational and research institutions on ICT innovation (SURF)** and the **National Coordination Office for Research Data Management (LCRDM)**. These data organizations have different origins and are linked to different organizations. DANS is an initiative of NWO and KNAW, while SURF originates in the university context. The overlap in tasks and responsibilities suggests that a closer look at their work may increase the Dutch power in the field of Open Data. Finally, the National Open Science Plan has produced two institutions on the national level: the **National Platform Open Science** and the **National Coordinator Open Science**. The National Platform Open Science connects institutions and organisations in the Netherlands somehow involved with Open Science. By now there are around a dozen participating organizations. The platform is led by a steering group formed by presidents and chairs of Dutch knowledge organizations, which meets twice a year to discuss an agenda prepared by the platform. The Dutch National Coordinator Open Science is also a member of the European Commission's Open Science Policy Platform (see below). Moreover, in May 2018, the European Council on Competitiveness decided that each EU Member State should have a National Coordinator for Open Science, who in turn should form a network for close interaction and exchange. Such a network would increase the possibility for better coordination of Open Science on EU Member States' level.

3.1.3 European level

The actors on the European level, who link up directly with the National Platform OS and the National Coordinator OS are the Open Science Policy Platform OSPP started by the EC and the European Open Science Cloud initiative (EOSC). For now, there is no unified understanding of what the EOSC will be among Dutch science policy actors. According to a KNAW representative, it is "a set of hardware and software that would allow all scientists to store their data in a fair way". This understanding focuses on the Open Data aspect of OS, but discussions about this are still under way. In any case, the EOSC could have a structuration effect on the national level says a NWO representative. As the appointment of a National Coordinator Open Science is promoted throughout Europe, some actors on the national level also envision a Network of National Coordinators Open Science in the future. Finally, the European level is marked by the branch organizations of the NWO and the KNAW. The NWO is organized in Science Europe, the European level organization representing the interests of science funding organizations. Here, NWO influences discussions in the working groups on Open Data and Open Access. KNAW is organized in All European Academies (ALLEA). In the field of Open Science, ALLEA publishes policy reports, organizes events and supports policy makers in interpreting the risks and promises of Open Science, especially as they are perceived by scientists. An NWO representative recognizes the European Commission as an important driver of Open Science as a policy field.

3.1.4 International level

Finally, Open Science as a science policy issue is not limited to the national or European policy arenas. Also, on the international level, organizations or networks representing the science funders (**Global Research Council**) and the **International Science Council** (with its **CODATA commission**) influence the Dutch Open Science debate.

In general, the national science policy organisations act cooperatively. They share a sense of purpose to implement Open Science in the Netherlands as advantageously as possible. There is even a degree of division of labour with responsibilities on EU negotiations and negotiations with publishers. This does not mean that there is unity in how to approach and implement Open Science in the Netherlands. It is rather an exploration process in which many terms and conditions still need to be negotiated.

4. De-facto governance practices

Before delving into the international dimension of Open Science, we should not forget: first and foremost, at its core Open Science remains a grassroots movement that is very well organised and networked among both local organisations, with a strong focus on local impact, as well as international communities, such as the Open Source or Open Hardware community, with a strong focus on innovation and knowledge commons. "Geek diplomacy"[51] – as the socio-political strategy of such groups are sometimes called – describes the "citizen, grassroots involvement" in scientific and political knowledge production by bridging knowledge divides, building alternative infrastructures and creating spaces for knowledge brokerage. While geek diplomacy and the resulting "Open Science diaspora networks"[52] have been described as offering unique opportunities for global cooperation for peace and sustainability, their potential for Science diplomacy has largely remained untapped by foreign policy makers, some of our interview partners report, even though actors in the field of international development and cooperation are already actively supporting Open Science initiatives[53].

With the ongoing digital transformation come new opportunities of cooperation on a global level: "The information- and technological revolutions are reshaping diplomacy in the twenty-first century. […] Diaspora networks, like nongovernmental organizations, civil society groups, and multinational corporations, are increasingly important and influential actors in international relations. Science diasporas are vital to a new architecture of cooperation that will allow us to invent, create, innovate, and solve problems together."[54] Governance of such networks is very diverse and not generalizable; however, our interview partners suggest that more involvement of foreign policy actors would be appreciated for the global transition towards Open Science.

Science diplomacy is not a term commonly used in the global Open Science Arena. While the concept itself covers most of the observable activities in the implementation and internationalization of Open Science – just without trained diplomats and with only marginal involvement of foreign relation and diplomatic services.

The impact of the internationalization efforts driven both by the communities (libraries, researchers, funders) and increasingly also by policy makers on international relations, however, is in some cases already tangible (cooperation for the global transition to Open Access to publications), and in many others (f.i. research frameworks promoting Open Science, European Open Science Cloud) at least noticeable.

Open Science in Public Policy

Open Science related to international public policy is very different between regions. As has been observed, Open Access policies vary from the collaborative investment in central public platforms (for example Brazil and South Africa cooperate on SciELO since 2013[55]), to the set-up of a highly diversified and domain-specific infrastructure (for example in India

[51] Kera, D. (2015): Open source hardware (OSHW) for open science in the global south: Geek diplomacy? Open Science, p. 133.

[52] See Kera (2015) and Burns (2013): Burns, W. J. (2013): The Potential of Science Diasporas. In: Science & Diplomacy, 2(4).

[53] Chan, L., A. Okune, R. Hillyer, A. Posada, D. Albornoz (2019): Contextualizing openness: Situating open science. University of Ottawa Press.

[54] Burns, W. J. (2013): The Potential of Science Diasporas. In: Science & Diplomacy, 2(4).

[55] Scielo launch Report. Retrieved from: https://www.gov.za/scielo-south-africa-open-access-platform-launch as accessed 01 June 2019.

or China). Whereas Brazil and Russia consider the free access to publicly funded research to be the political responsibility of the public sector authorities, and therefore do not support commercial publishing models, India and China are actively fostering institutional and corporate models. In some regions the focus is on local cooperation, such as Latin America or Europe, or selective cooperation between countries, such as Brazil and South Africa, other regions, such as India, Russia or China "appear to seek global impact, in competition with Western countries, which means for instance, that for them the question of English content and the visibility in international initiatives are of prime importance"[56].

Governance of Open Science activities in the public sector also varies highly and can hardly be generalized. In Europe, only few Member States and associated have adopted a national agenda or roadmap for the transition such as the Netherlands, Finland, France, and recently Ireland[57]. The variety of approaches and velocities is based on the role of the state, whether the state is central in the governance of research, such as in Croatia, Latvia, Slovenia or Italy, or if research institutions are to different degrees autonomous actors, like in Switzerland, Sweden, Austria or the Netherlands, or if the general state governance is largely federated such as in Belgium[58]. Even if it seems easier to implement National Open Access or Open Science plans in smaller countries with centralized governance, such as Latvia, Slovenia, or Croatia, this does not reflect the realities of velocities. An important anchor for the coordination of Open Science within Europe is the European Research Area ERA Roadmap. Based on the Internal Market, in which researchers, scientific knowledge and technology is supposed to circulate freely, Open Science is hoped to flourish too. The Council Conclusions adopted in May 2016 are dedicated to the transition towards an Open Science system (9526/16)[59]. The Standing Working Group on Open Science and Innovation of the European Research Area and Innovation Committee (ERAC - OSI) supports and advises on the development and implementation of policies and initiatives with a particular focus to enhance access to scientific information and circulation of the use of knowledge for research and innovation based on action priority 5 of the ERA Roadmap 2015-2020: implementing Open Access and knowledge transfer policies at national level in order to maximise the dissemination, uptake and exploitation of scientific results. In a report (Dec 2018)[60] the working group published a set of recommendations, including the need to produce better evidence and incentives at the crossroads of bringing Open Science and innovation together.

The country representatives in the Mutual Learning Exercise on Open Science[61] agreed that the most important element in advancing the topic regionally is the presence of informal networks, such as the Open Access Network Austria[62], library consortia used to negotiate

[56] Schöpfel, J. (2015): Learning from the BRICS. Open Access to Scientific Information in Emerging Countries. Retrieved from: https://hal.archives-ouvertes.fr/hal-01586530 as accessed 01 June 2019.

[57] Open Research Plan Ireland. Retrieved from: http://norf-ireland.net/wp-content/uploads/2019/07/NORF_Framework_10_July_2019-2.pdf as accessed 01 August 2019.

[58] Leonelli, S. (2018): Implementing Open Science: Strategies, Experiences and Models (Nr. 4). European Commission.;
Mayer, K., S. Leonelli, K. Holmberg, F. Miedema (2018): Mutual Learning Exercise: Open Science—Altmetrics and Rewards. European Commission.

[59] Council Conclusions May2016. Retrieved from: https://data.consilium.europa.eu/doc/document/ST-9526-2016-INIT/en/pdf as accessed 01 June 2019.

[60] ERAC Standing Working Group on Open Science and Innovation (SWG OSI). (2018): Recommendations on Open Science and Innovation (Nr. 1216/18). Retrieved from EUROPEAN RESEARCH AREA AND INNOVATION COMMITTEE website: http://era.gv.at/object/document/4508 as accessed 01 June 2019.

[61] European Commission, Research & Innovation Observatory – Horizon 2020 Policy Support Facility: Mutual Learning Exercise Open Science. Retrieved from: https://rio.jrc.ec.europa.eu/en/policy-support-facility/mle-open-science-altmetrics-and-rewards as accessed 01 June 2019.

[62] Open Science Network Austria. Retrieved from: https://www.oana.at as accessed 01 June 2019.

deals with publishers, or formal transnational networks such as OpenAIRE[63] and even then, the creation or implementation of national roadmaps is not guaranteed.

This results also in who becomes the driving force behind not only the transition to Open Science, but also the international cooperation and coordination of this transition. If there is already a national agenda and a clear implementation plan, actors such as ministries or representative bodies of research organisations engage in transnational exchange on the topic. Without political backing and based more on grass-roots initiatives, international exchange is mainly driven by individual or collective bottom-up action, such as by library consortia. For those actors especially in countries without Open Science activities, the Open Science agenda of the European Commission, and its Framework Programmes Horizon 2020 and Horizon Europe, Plan S and the European Open Science Cloud as well as their other Open Science initiatives, such as the Open Science Policy Platform OSPP are important anchors and role models.

4.1 International alignment of Open Access policies – Plan S and the roles and reactions of funders

Funding organisations, supported by the European Commission and the European Research Council (ERC), are assembling in cOAlition S, which announced to implement a "Plan S" at the ESOF in Toulouse in July 2018. The central principle of the (revised) plan is: "With effect from 2021, all scholarly publications on the results from research funded by public or private grants provided by national, regional and international research councils and funding bodies, must be published in Open Access Journals, on Open Access Platforms, or made immediately available through Open Access Repositories without embargo"[64]. The objective of Plan S is to align international research funding towards coherent Open Access rules. The plan and the procedures for its implementation have been debated among scholars, policy makers, funders, but also publishers since its publication and in the following consultation period.

Among the 10 principles of (the revised) Plan S[65] are the following, which point to the need of international coordination:

- Where applicable, Open Access publication fees are covered by the Funders or universities, not by individual researchers; it is acknowledged that **all scientists should be able to publish their work Open Access** even if their institutions have limited means.
- Funders support the **diversity of business models** for Open Access journals and platforms. When Open Access publication fees are applied, they must be commensurate with the publication services delivered and the structure of such **fees must be transparent to inform the market** and funders potential **standardisation and capping of payments** of fees;
- Funders will develop **robust criteria and requirements for the services** that high-quality Open Access journals, Open Access platforms, and Open Access repositories must provide;
- In cases where high-quality Open Access journals or platforms do not yet exist, the **Funders will, in a coordinated way, provide incentives to establish and support** them when appropriate; support will also be provided for **Open Access infrastructures** where necessary;

[63] OpenAIRE. Retrieved from: https://www.openaire.eu/ as accessed 01 June 2019.

[64] Revised Plan S principles in May 2019. Retrieved from: https://www.coalition-s.org/about/ as accessed 01 June 2019.

[65] cOAlition S. (2018): Plan S implementation guidelines. Retrieved from: https://www.coalition-s.org/principles-and-implementation/ as accessed 01 June 2019.

- Funders do not support the '**hybrid' model** of publishing. However, as a transitional pathway towards full Open Access within a clearly defined timeframe, and only as part of **transformative arrangements**, Funders may contribute to financially supporting such arrangements; The Funders will **monitor compliance and sanction non-compliance**.
- Authors retain copyright of their publication with no restrictions. All publications must be published under an **open license**, preferably the Creative Commons Attribution Licence CC BY.
- Funders encourage governments, universities, research organisations, libraries, academies, and learned societies to **align their strategies, policies, and practices**, notably to ensure **transparency**.
- Funders commit that when assessing research outputs during funding decisions they will **value the intrinsic merit of the work and not consider the publication channel**, its impact factor (or other journal metrics), or the publisher.

There are several dimensions in the plan, which require cohesive planning and strong international cooperation: transparency of costs, coherent catalogue of criteria (e.g. for services required) of eligible OA publishing fees, alignment of criteria for transformative agreements, incentives for creation or fostering of Open Access infrastructures, documentation and monitoring data and tools, far-reaching changes in incentive and reward cultures. Whereas the levels of infrastructure and monitoring do need international cooperation in the creation of the necessary platforms, data bases and tools, they also need new types of governance, which are yet to be determined. Furthermore, the other levels require convincing or nudging research performing organisations, funders as well as higher education institutions to align their policies and strategies, including their hiring strategies with the Plan S principles. There are currently many noteworthy initiatives, from bottom-up pressure to include Open Science criteria in academic job descriptions[66], principles for research integrity[67], to prices for outstanding Open Access activities. Most importantly though is the international coordination of institutions that fund research: "We are committed to implement what is one of the most significant and ambitious changes to the research system and with the final plan now in place we look forward to more funders, from across the world, supporting the transition to full and immediate Open Access by joining and aligning with cOAlition S" says Marc Schiltz, President of Science Europe and co-initiator of Plan S[68].

In 2019 only one quarter of all scholarly literature in the sciences, social sciences and humanities is open access. There are some communities, such as High Energy Physics for example, with an Open Access adoption rate up to 90%[69], but – even though they show the feasibility - they are not representing the general trend. Plan S follows the rationale that it is now up to the funders to increase the adoption rate and to coordination their policies internationally.

"As a matter of fact, the discussion of OA has been going on since 20, even 25 years. This was mainly only driven by the science community. The science community itself – and that is why nothing has happened over the last 25 years – has not been able to transform the system into open access because firstly, they were completely scattered and secondly,

66 LERU (2019): Open Science and its role in universities: A roadmap for cultural change. Retrieved from: https://www.leru.org/files/LERU-AP24-Open-Science-full-paper.pdf as accessed 01 October 2019.

67 ALLEA revised version of the European Code of Conduct for Research Integrity. Retrieved from: https://allea.org/code-of-conduct/ as accessed 01 June 2019.

68 Coalition S press release 31 May 2019. Retrieved from: https://www.coalition-s.org/revised-implementation-guidance/ as accessed 01 October 2019.

69 Press release of CERN. Retrieved from: https://cerncourier.com/a/a-turning-point-for-open-access-publishing/ as accessed 01 October 2019.

they had to deal with very powerful and big multinational publishing companies that were very cleverly playing the different parties against each other."[70]

By October 2019 Plan S is endorsed by many international organisations in a big wave of support as well as national funding organisations from Europe, such as the Austrian Science Fund, the Academy of Finland, the French National Research Agency, the Polish National Science Centre, the Research Council of Norway, UK Research and Innovation, and many more. It is supported by the European Commission and the European Research Council. Non-European funders and agencies supporting include the Wellcome Trust, the Bill and Melinda Gates Foundation, World Health Organization, the Higher Council for Science and Technology in Jordan, National Science and Technology Council of Zambia amongst others. However, not all of them joined cOAlition S, and some even withdrew their support at a later stage, such as the Swedish Riksbankens Jubileumsfonden or the principal scientific adviser of the Government of India K. VijayRaghavan. The rationale for stepping away from Plan S differ. Jubileumsfonden explains its withdrawal in March 2019 as follows, pointing to the importance of cost transparency as well as the specificities of disciplines: "Our assessment is that the process is too fast to suit humanities and social sciences. This also means that we have left cOAlition S, but we continue to support their ambitions. Jubileumsfonden will continue to work towards an increasingly more Open Science, through funding immediate open access when this is viable, and by declaring all our costs for Open Science from the year 2020." Similarly, the decision of the Chief Science Advisor of India followed after an intensive national consultation period. Likewise, he still assured his intents for collaboration when announcing the withdrawal: "As we move along, I expect there will be overlap in our directions to open-access. However, our directions will be entirely determined by the interests of Indian academia and of India, for which our understanding of and collaboration internationally with groups such as Plan-S is important."[71] The main reasons for revoking Indian collaboration in cOAlition S are given as lack of support of the Indian scientific communities for a fast transition as well as fear of raising costs, if the government has to guarantee the funding for a primarily APC based Open Access business model, and additionally has to build repository infrastructures. Furthermore, in the same interview VijayRaghavan pointed to the need for more fundamental change in the science system, monitoring and rewarding scientific performance: "Publishers and access are important components, but the fundamental issue is what we think is the purpose of science and what the metrics of scientific success are." [72] With India ranking as 5th largest producer of scientific publications by 2018[73], cOAlition S loses a powerful actor in the international knowledge and publication markets[74].

Despite the decision of the Indian coalition partner, Plan S seemed to spur the developments in India from the start: "And then coalition S came […] discussions started in India after a month of the European initiatives with the Indian top science administrators. Particularly our principle scientific advisor, the one who addresses the Prime Minister and the government directly, he took a personal interest in open access for quite some time and he is now going towards making it a pan-India movement, a national-

[70] Interview 1, 7 January 2019.

[71] The Wire (26 October 2019): Interview with K. VijayRaghavan 26 October 2019. Retrieved from: https://thewire.in/the-sciences/an-interview-with-k-vijayraghavan-on-open-access-publishing as accessed 31 October 2019.

[72] Ibid.

[73] Ranking based on Elsevier Scopus data. Retrieved from: https://www.scimagojr.com/countryrank.php?year=2018 as accessed 31 October 2019.

[74] In India funders have enacted Open Access policies since 2014. See: Government of India, Ministry of Science & Technology (2014): DBT and DST Open Access Policy. Policy on Open Access to DBT and DST Funded Research. Retrieved from: http://www.dst.gov.in/sites/default/files/APPROVED%20OPEN%20ACCESS%20POLICY-DBT%26DST%2812.12.2014%29_1.pdf as accessed 31 October 2019.

wide initiative by having negotiations with these Journals, […] and creating a national-wide Open Access policy and infrastructure initiative."[75]

China, on the other hand, backs Plan S, however not by joining cOAlition S, but the Ministry of Science and Technology and two national science libraries issued supporting statements in December 2018. As longstanding Open Access advocates[76] (the Chinese Academy of Sciences CAS signed the Berlin Declaration on Open Access in 2003) and ranking number one in worldwide publication of scientific literature[77], China has particular interest in negotiating access to international publications of Chinese authors, as well as access to international journals of interest for their RPOs: "Therefore, we support libraries of research and educational organisations to actively seek large-scale transformation of their subscription journals to open access journals, where papers by their respective members as corresponding authors [...] should be made immediately open access when published and free of any APC [article-processing] charge."[78] This statement among others[79] shows how China is taking into the costs of access for the 2000 universities and other research performing organisations in the country, and it underlines the necessity of negotiating national deals with publishers. Every move China makes will have a huge impact on the scientific publishing markets, and the current direction pro Open Access (both green and gold) would certainly also support the goals of Plan S to reform the market.

Other funding organisations have been a bit less supportive of Plan S. The US Office of Science and Technology Policy (OSTP) announced that it will not sign Plan S in October 2018. Among several reasons its director explained one major concern in an interview: "One of the things this government will not do is to tell researchers where they have to publish their papers. That is absolutely up to the scholar who's doing the publication."[80] This argument, which is also brought forward by many researchers fearing to lose their scientific freedom, underlines the reluctance to intervene in existing markets. The United States of America are however pursuing their own national Open Science initiatives. With the 2006 Federal Research Public Access Act (FRPAA) publications from publicly funded projects should be made freely accessible no later than six months after publication. Similar objectives are pursued by the 2013 Fair Access to Science and Technology Research Act (FASTR), but FASTR would only affect facilities that spend more than $ 100 million a year on research. Large funders, such as the National Institute of Health NIH which complies since 2008, have since started to develop Open Access strategies and building repositories.

Whereas Argentina's Federal Ministry of Education, Culture, Science and Technology signed the "JOINT COMMUNIQUÉ. XI Joint Steering Committee Meeting of the Bilateral Agreement on Science and Technology between the European Union and Argentina"[81] on 7 June 2019 and announced that it would join cOAlition S as well as promote a regional initiative among

[75] Interview 6, 21 May 2019.

[76] Montgomery, L., X. Ren (2018): Understanding Open Knowledge in China: A Chinese Approach to Openness? In: Cultural Science Journal, 10(1), pp. 17–26.

[77] Tollefson, J. (2018): China declared world's largest producer of scientific articles. In: Nature, 553, pp. 390–390.

[78] Roussi, A. (2018): China backs Plan S. Research Research. Retrieved from: https://www.researchresearch.com/news/article/?articleId=1378740 as accessed 1 June 2019.

[79] Sayer, L. (2019): Open Access in China. Interview with Xiaolin Zhang of the National Science Library. Blog International Science Council. Retrieved from: https://council.science/current/blog/open-access-in-china-interview-with-xiaolin-zhang-of-the-national-science-library as accessed 1 June 2019.

[80] FYI Team. (2019, April 30): An Interview with OSTP Director Kelvin Droegemeier [Blog]. Retrieved from the American Institute of Physics website: https://www.aip.org/fyi/2019/interview-ostp-director-kelvin-droegemeier as accessed 01 June 2019.

[81] Joint Communiqué – XI Joint Steering Committee Meeting of the Bilateral Agreement on Science and Technology between the European Union and Argentina. Retrieved from: https://ec.europa.eu/research/iscp/pdf/policy/ec_rtd_jc-11th-jscm-eu-ar_062019.pdf as accessed 01 October 2019.

Latin American and Caribbean countries, many researchers as well as Open Access advocates in the country are alarmed and are not supporting this decision. They disagree with the implementation guidelines for Plan S, as it "ignores more than 20 years of widespread experience in open-access publishing in many developing nations, as well as Latin America's widespread ethos of free-to-publish and free-to-read research"[82], and they call for the promotion of more globally inclusive open access strongly supporting non-commercial publishing "while improving the quality of editorial processes and keeping their control within the scientific community". In Latin America "Scholarly communications are managed by the scholarly community, with its own journal platforms and repositories, and supported by public funds as part of the public infrastructure needed for research", says Dominique Babini in an interview.[83]

Further learnings from Plan S

Based on these briefly summarized reactions across the world, we see that for funders there are many different approaches and velocities towards open access to scholarly publications[84]. It will require extensive negotiations and international coordination efforts not only of funders, but also of science and research policy to align them so that international publishing markets and cultures of scholarly communication as well as reward and incentive systems can successfully transition towards Open Science. In the interview the European Commission's Special Envoy for Open Access emphasized the role of science counsellors at the EU delegations for the international coordination of Plan S:

"I came out of a meeting with all science counsellors recently, where I trained them about Plan S, so that they know its specifics. We asked them to discuss it with the people in the countries they are located, to see what is going on, to talk with people about Plan S, but also then to come back to me and to advise me what should be done. Also, to organize possible visits, which have already been done, to China, to India, where I met key people, decision makers, to see if they can join Plan S. So now that we have to go global, the role of the science counsellors is essential."[85] The **research and innovation counsellors** in the EU delegations, responsible for promoting STI cooperation between Europe and India and following closely policy dialogues on societal challenges like climate change, clean energy, sustainability or the digital transformation, have so far focused more on the "open to the world" paradigm. They were promoting and supporting access to European research and innovation funding to stakeholders in the respective regions, as well as access to training and mobility programs for researchers. Before the advent of Plan S not Open Science was not on the agenda. Several interview partners confirm the importance of personal engagement in political negotiations for Open Access or more broadly Open Science.

Plan S had another important dimension, though. cOAlition S has not only bundled existing engagement and brought it successfully to the policy arena, it has also – despite the many critics from research and publishing industry – spurred the political discussion in other regions. For many local Open Access advocates it was a **strong sign of support**, especially in countries where policy makers and funders were not aware of the importance of Open Access. Here once again, it is important to engage with the stakeholders already

[82] Debat, H., D. Babini (2019): Plan S: take Latin America's long experience on board. In: Nature, 573, pp. 495–495.

[83] International Science Council: Plan S and Open Access in Latin America: Interview with Dominique Babini. Retrieved from Science Council website: https://council.science/current/blog/plan-s-and-open-access-interview-with-dominique-babini as accessed 01 June 2019.

[84] Further information on funding bodies' OA policies can be gathered f.i. from Sherpa JULIET, ROARMAP and MELIBEA.

[85] Interview 1, 7 January 2019.

active in the field. An interview partner says: "I'm optimistic, and Plan S really attracted attention of researchers and policymakers in other countries, [well], in addition to countries where funders joined Plan S, also in other countries. So, you could really say that's it. It had a global impact. And I guess because it was a real strong statement like "enough is enough and we have to move faster". […] In many countries they are not aware of all technical details of Plan S, but I'm kind of confident that they will gather this knowledge in the process because in the countries where funders joined Coalition S we also have strong library consortia knowledgeable about these issues."[86]

Another interview partner points to an additional, yet less desirable effect Plan S has on the international discourse: "Plan S is for the first time - in the last 17 years that we are playing with the idea of open access, a practical commitment for implementation. […] I think it's really a crucial thing that happened in the last year but also is a bit disappointing, because we have been working on the idea of Open Science as a [broad change] for science towards collaborative, and new open innovation paradigms and then it's like, Plan S appears and all attention is back again in the publication system."[87]

Interestingly, Plan S gets also support from some of the **publishing industry** giants, like Springer Nature, as they share the concern about the complexity of too diverse approaches to Open Access and resulting governance models. In an interview Steven Inchcoombe of Springer Nature remarks: "There are many ways in which open access could be accelerated and its use more widely spread. Plan S outlines a particular approach. Other organizations are pursuing the same goals but not necessarily using the Plan S movement, such as DFG in Germany. Similarly, a very large amount of research being produced in China is published open access, and they've expressed strong support for OA2020 and some support for Plan S, but that doesn't necessarily mean that they will adopt the Plan S principles. Then you have the foundations like the NIH and NSF in the United States that see open access as important but don't want to set aside specific funding to support it and are relying on the continuation of funding from institutional libraries and are therefore more focused on the green open access side. There's a diversity of approaches. Springer Nature is ultimately a service provider to the research community, and the research community needs a more consistent approach so that they know how they're going to be judged, and what funding or policies they're going to be operating under."[88]

So, it seems the publishing industry can also benefit from clear regulations and criteria, common standards and so forth, especially if the industry seeks to re-use openly available knowledge to further develop their services and build their own knowledge bases.

The goal to internationally align Open Access policies has brought about another important issue: what librarians have long criticized was the lack of information about costs and thus impact of Open Access. Since most deals with publishers remained secret, there was no comparison on international level possible. Moreover, all related scientometric information like the number of citations, the reads, etc. remained in the property of the publishers and could only be accessed through yet again expensive interfaces, such as Web of Science or Scopus. Therefore, Plan S can only be successful if it also regulates the monitoring and documentation. International negotiation is one issue, but without creating an accessible evidence base about Open Access developments, it cannot be sustainable, most interview partners agree. There are already invaluable resources for the monitoring and comparison of a range of aspects related to Open Access and other dimensions of Open Science such

[86] Interview 13, 27 June 2019.

[87] Interview 9, 28 May 2019.

[88] International Science Council (2019): Interview with Steven Inchcoombe. Jan 2019. Retrieved from: https://council.science/current/blog/scholarly-publishers-also-need-a-more-consistent-approach-interview-with-steven-inchcoombe-of-springer-nature-on-plan-s-and-open-access as accessed 01 June 2019.

as Open Research Data, like OpenAIRE[89] and PASTEUR4OA[90] for an European perspective, or the Innovation Policy Platform by the OECD and the World Bank[91]; Furthermore there are databases that reflect the current status of open access journals, data repositories or open institutional policies (DOAJ[92], ROARMAP[93], OPEN ACCESS Map[94], SHERPA[95], etc.); Other platforms, that deal with STI metrics dedicated to Open Science, such as the Open Science Monitor[96] or the Federal RePORTER[97] (formerly StarMetrics) have a very specific focus or just a limited perspective due to the limits of indicator sets or available databases, which are not always open and reproducible. Furthermore, there is a growing body of scholarly literature discussing and monitoring the current status of OA[98]. Hence, the evidence base is growing and will be enriched by more and more transparency initiatives, like the one from the European University Association EUA on calculating the money Europe is spending every year on scientific literature[99]. However, it will be important to translate these complex findings to policy makers and science diplomats, so that they can build an understanding of the opportunities but also the limitations of Open Access to scholarly communication on a global scale.

[89] OpenAIRE. Retrieved from: https://www.openaire.eu/ as accessed 01 June 2019.

[90] Pasteur4OA. Retrieved from: http://www.pasteur4oa.eu/home as accessed 01 June 2019.

[91] Summary of international open science policies. Retrieved from: https://www.innovationpolicyplatform.org/www.innovationpolicyplatform.org/content/open-science/index.html as accessed 01 June 2019.

[92] Directory of Open Access journals. Retrieved from: https://doaj.org/ as accessed 01 June 2019.

[93] Register of Open Access repositories. Retrieved from: https://roarmap.eprints.org/ as accessed 01 June 2019.

[94] Open Access Map. Retrieved from: http://www.openaccessmap.org as accessed 01 June 2019.

[95] Sherpa. Retrieved from: https://v2.sherpa.ac.uk/ as accessed 01 June 2019.

[96] Open Science Monitor. Retrieved from: https://ec.europa.eu/info/research-and-innovation/strategy/goals-research-and-innovation-policy/open-science/open-science-monitor_en as accessed 01 June 2019.

[97] US Federal Reporter. Retrieved from: https://federalreporter.nih.gov/ as accessed 01 June 2019.

[98] See Piwowar, H., J. Priem, V. Larivière, J.P. Alperin, L. Matthias, B. Norlander, S. Haustein (2018): The State of OA: A large-scale analysis of the prevalence and impact of Open Access articles. PeerJ, 6, e4375. for overview and analysis.

[99] European University Association EUA (2019): 2019 Big Deals Survey Report. Retrieved from: https://eua.eu/resources/publications/829:2019-big-deals-survey-report.html as accessed 01 June 2019.

4.2 Open Research Infrastructures

At the International Conference for Research Infrastructures 2018[100], Carlos Moedas renewed his vision for science diplomacy: "Research infrastructures are the assets for science diplomacy"[101]. Science policy makers from around the world agreed: Sanja Damjanovic, minister of science in Montenegro, sees research infrastructures as a "route to mitigate tensions in the Balkans, reverse the brain drain and recover the tradition of technology development in Southern and Eastern Europe. The only way to bring back our people is to have a first-class research facility, Damjanovic said."[102] Mikhail Popov, deputy director at the Kurchatov Institute in Moscow noted that "Science collaborations can secure bridges between Russia and the EU."[103] Furthermore, research infrastructures are important pillars of innovation and therefore regarded as a "key [requirement] to compete in a globalised world"[104] by Wolfgang Burtscher, deputy director general for research and innovation at the European Commission. Hence, they have been at the centre of science diplomatic activities since a long time.

Amongst its set of recommendations, the European Open Science Policy Platform points to the necessity to ensure the scholarly **infrastructure is highly interoperable** and that **credit for research contributions is given to all participants in the research cycle**, as well as to ensure that hiring procedures and HR strategies, as well as research evaluation procedures in general reflect Open Science culture[105]. It is those cross-cutting issues which will be the core stepping stones for a successful implementation of Open Science. However, policy makers around the world face a double challenge: "how to increase the visibility and global impact of their scientific output, and how to improve access to scientific and technical information for their research and higher education"[106]. At the core of such deliberations are research infrastructures.

Research infrastructures are providing important resources and services for research communities. With Open Science come several additional requirements for infrastructures, namely that they are as open as possible, f.i. that the software is open sourced and the data and content (e.g. metadata, metrics, user contributions) created by and in the systems are published under an open license and made available online via open interfaces. In addition, open infrastructures follow open standards. This enables, among other things, interoperability and re-usability. A further important criterion is that the governance of open infrastructures provides for an explicit say of the communities attached to it. This includes appropriate opportunities for community input as well as involvement in decision-making processes.

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[100] International Conference for Research Infrastructures 2018. Retrieved from: https://www.icri2018.at/ as accessed 01 June 2019.

[101] Zubașcu, F. (2018): Are research infrastructures the answer to all our problems? Retrieved from Science|Business website: https://sciencebusiness.net/news/are-research-infrastructures-answer-all-our-problems as accessed 01 June 2019.

[102] Zubașcu, F. (2018): Are research infrastructures the answer to all our problems? Retrieved from Science|Business website: https://sciencebusiness.net/news/are-research-infrastructures-answer-all-our-problems as accessed 01 June 2019.

[103] Ibid.

[104] Ibid.

[105] OSPP (2018): Open Science Policy Platform Recommendations. Retrieved from the European Commission website: https://ec.europa.eu/research/openscience/pdf/integrated_advice_opspp_recommendations.pdf as accessed 01 June 2019.

[106] Schöpfel, J. (2015): Learning from the BRICS. Open Access to Scientific Information in Emerging Countries. Retrieved from: https://hal.archives-ouvertes.fr/hal-01586530 as accessed 01 June 2019.

Open research infrastructures range from those providing open access to publications, research data and research methods (repositories, workflow and notebook platforms, search and discovery interfaces etc.) to those providing access to large experimental services and facilities (e.g. high-performance computing, synchrotrons, observatories) or shared material resources and databases (e.g. protein or genome databases, biobanks). Furthermore, there is a call for research documentation and information systems to make their data available, too. Data sharing, and respective infrastructures are currently the focus of a global debate. Policy makers, research administrators and funders are pushing for more collaboration and sharing of resources, and one of the key issues for future RI funding is the potential shift away from funding projects to funding use of services provided – which brings about interesting options for industry and challenges for the preservation of knowledge commons. While industries and research actors alike understand the value of bases of shared common knowledge, they **call for internationally aligned clear scientific and legal standards for sharing and registering their data**.

The Beijing Declaration on Research data from 2019 lists the principles for making research data "as open as possible and only as closed as necessary [while making it] findable, accessible, interoperable and reusable (FAIR)". Furthermore, it is stated that "the stewardship of research data should avoid defaulting to the traditional, proprietary approach of scholarly publishing. Therefore, the adoption of new policies and principles, coordinated and implemented globally, is necessary for research data and the associated infrastructures, tools, services, and practices. The time to act on the basis of solid policies for research data is now."[107].

Decisions to place open research infrastructures for the global reuse of data and information high on the agenda are based on past experiences and historical success stories of highly beneficial translation of research outputs into innovation in its broadest sense in multiple fields due to large international collaborations. For example, in terms of the open sharing of data and methods see the Human Genome Project[108], for the successful synthesis of diverse maritime data see EMODnet[109] or the Elixir[110] model for a distributed research infrastructure engaging with industry. In these cases, the sharing of data and methods led and still leads to technoscientific breakthroughs and to socio-economic innovation.

The non-profit EGI Foundation coordinates a large computing infrastructure on behalf of national e-infrastructures and European Intergovernmental Research Organisations (EIROs) and supports Open Access and Open Data. Large research infrastructures themselves are also very actively promoting Open Science. Just to name a few examples: CERN launched its Open Data Portal in 2014, the SESAME synchrotron initiated an open knowledge transfer program and capacity building initiative, ESA run several open access and open data initiatives, and with Copernicus, there is open access to satellite images and data.

The Research Data Alliance (RDA)[111] represents the data-driven research community and was founded in 2013 by the European Commission, the American National Science Foundation and National Institute of Standards and Technology, and the Australian

[107] COdata (2019): Beijing Declaration on Research Data. Retrieved from: http://www.codata.org/uploads/Beijing%20Declaration-19-11-07-FINAL.pdf as accessed 12 November 2019.
[108] Human Genome Project. Retrieved from: https://www.genome.gov/human-genome-project as accessed 01 June 2019.
[109] EMODnet: The European Marine Observation and Data Network. Retrieved from: http://www.emodnet.eu/ as accessed 01 June 2019.
[110] Elixir: The European life-sciences Infrastructure for biological Information. Retrieved from: https://elixir-europe.org/ as accessed 01 June 2019.
[111] Research Data Alliance. Retrieved from: https://www.rd-alliance.org/ as accessed 01 June 2019.

Department of Innovation. Its Working groups and some national nodes are very active in disseminating knowledge and engaging public discussion about issues of data sharing and open research infrastructures. RDA is furthermore collaborating internationally with the Committee on Data for Science and Technology (CODATA) and World Data System (WDS). CODATA[112] was established in 1966 as an interdisciplinary committee of the International Council for Science. Its objectives are to compile, critical evaluate, store, and retrieve of data that is of importance to science and technology, and it has become an important actor in international data policy making. Similarly, the World Data System[113], which follows its predecessors the international Geophysical Year (IGY, 1957–58) and the World Data Centers (WDC), is still one of the largest international ventures for data sharing since its inception. It represents a paragon of open data diplomacy and science diplomacy. Even in the period of the Cold War it facilitated a global data collection network, exchange interfaces and scientific collaboration of hostile countries.

With increasing digitalisation and the availability of big data open, access to research infrastructures is advocated and supported in a wide range of countries. China promotes access to its research infrastructures beyond the host institutions with several awareness and bonus programmes, in South Korea there are several initiatives to open institutional knowledge on open access platforms complemented by targeted resources for specific user groups, and in New South Wales, Australia, a system of Tech-Vouchers is installed to encourage use of infrastructure from the broader innovation communities[114]. In the USA, data-sharing is increasingly promoted already from the advent of project design. The NIH, the US leading institution in data sharing advocacy, supports prospectively established data-sharing and is making large datasets available to the community, e.g. data from genome-wide association studies and autism spectrum disorder research[115]. These examples illustrate the push for more collaboration but are not necessarily aligned with the full spectrum of Open Science principles, or the principles listed in the Beijing Declaration.

Likewise, in Europe we find a multitude of programmes and initiatives dedicated to research infrastructures, which also promote Open Science in its broadest sense. The **European Strategy Forum for Research Infrastructures** was created by the European Council to "support a coherent and strategy-led approach to policy-making on Research Infrastructures in Europe"[116]. With 2019 it represents 28 Member States and 12 associated countries. Besides its role of hub for infrastructure funders, it also has the mandate to "explore mechanisms of better coordination of Member States' investment strategies in e-Infrastructures, covering also HPC, distributed computing, scientific data and networks". The **ESFRI Roadmaps** of 2018 and 2021 both emphasize the important role of infrastructures in the transition towards Open Science and in the development of "European Open Science Data Commons"[117]. The ESFRI roadmap includes an Open Access policy for

[112] CODATA. Retrieved from: http://www.codata.org/ as accessed 01 June 2019.

[113] World Data System. Retrieved from: https://www.icsu-wds.org/organization as accessed 01 June 2019.

[114] Dai, Q., E. Shin, C. Smith (2018): Open and inclusive collaboration in science: A framework. Retrieved from: https://doi.org/10.1787/2dbff737-en as accessed 01 June 2019.

[115] National Academies of Sciences, E., Affairs, P. and G., Information, B. on R. D. and, & Enterprise, C. on T. an O. S. (2018): Office of Science and Technology Policy 2013 Memorandum: Increasing Access to the Results of Federally Funded Scientific Research.; National Cancer Institute (2012): Advancing scientific progress through genomic data sharing and access. Retrieved from: http://epi.grants.cancer.gov/datasharing/ as accessed 01 June 2019.; NIH (2011): National Database for Autism Research. Data sharing. Retrieved from: http://ndar.nih.gov/ndarpublicweb/sharing.go as accessed 01 June 2019.

[116] ESFRI: European Strategy Forum for Research Infrastructures. Retrieved from: https://ec.europa.eu/info/research-and-innovation/strategy/european-research-infrastructures/esfri_en as accessed 01 June 2019.

[117] ESFRI Roadmap 2018. Retrieved from: http://roadmap2018.esfri.eu/ as accessed 01 June 2019.

infrastructures[118]. While the focus in the three O strategy of the EU Commission from 2016 was more on opening access to research infrastructures to researchers and innovation actors from outside Europe, with the launch of the European Open Science Cloud in October 2018 this focus shifted more to maintaining and creating open infrastructures. Yet, commitment to e-infrastructure for open data has a long tradition in the EU: several **European Research Infrastructure Consortiums (ERICs)** pioneered collaboration and open sharing of data and methods. For example, in the humanities, like DARIAH[119] or CLARIN[120]. **Horizon 2020** had implemented the Open Data pilot, and in the proposal for the coming framework programme **Horizon Europe** (2021-2027) Open Science will further be pushed[121]. The **European Open Science Cloud**[122] represents another approach to open infrastructures. The primary goal – besides increasing accessibility and visibility of European research data – is to make the sharing of research data easier for researchers. The federation of the vast but fragmented infrastructure landscape should also help to tackle the challenges due to limited resources and interoperability.

Open research infrastructures for data and methods are currently not only confronted with many pressing issues and global challenges but also bear a lot of opportunities for research and innovation, such as developing new models of governance, stewardship and for value creation with Open Science. Furthermore, research infrastructures will be the main negotiation area and playing field for the development of new standards for next generation evaluation frameworks, incentive and reward systems, and for skills development. Nevertheless, there is a lacuna in comparative knowledge of necessary properties in terms of what is recommended by experts and demanded by users, such as their attributes regarding metrics, incentives, human resources, but also their capacities for enhancing international collaboration and impacting innovation. Open infrastructures will bring about new ways of collaboration and will broadly impact the way we conduct research, assess quality and effect, and the ways knowledge transfer is happening. Moreover, considering the relationship of Open Science and intellectual property regimes in innovation will require international expertise. In terms of measuring quality and impact of open research infrastructures most attention is currently given to the availability and use of digital data sets[123]. We are already witnessing how recent policy shifts (funders and journals) are affecting the acknowledgment and citation behaviours in relation to research resources and infrastructures, and it is envisioned that these shifts will also put more emphasis on notions of "reproducibility" and "Open Science"[124]. There is evidence for a productivity benefit to data sharing, as it can double the publication output of research projects, as well

[118] ESFRI (2018): European Strategy Forum on Research Infrastructures Roadmap. Retrieved from: https://www.esfri.eu as accessed 01 June 2019.

[119] Digital Research Infrastructure for the Arts and Humanities (DARIAH). Retrieved from: https://www.dariah.eu/ as accessed 01 June 2019.

[120] Common Language Resources and Technology Infrastructure CLARIN. Retrieved from: https://www.clarin.eu/ as accessed 01 June 2019.

[121] SPARC Europe (2019): Open Science essential for new Horizon Europe funding programme. Retrieved from SPARC Europe website: https://sparceurope.org/open-science-essential-for-new-horizon-europe-funding-programme/ as accessed 01 June 2019.

[122] European Open Science Cloud. Retrieved from: https://ec.europa.eu/research/openscience/index.cfm?pg=open-science-cloud as accessed 01 June 2019.

[123] CODATA-ICSTI Task Group on Data Citation Standards and Practice (2013): Out of Cite, Out of Mind: The Current State of Practice, Policy, and Technology for the Citation of Data. In: Data Science Journal, 12(CIDCR1–CIDCR7); Costas, R., I. Meijer, Z. Zahedi, P. Wouters (2013): The value of research data–Metrics for datasets from a cultural and technical point of view. A Knowledge Exchange Report.; Costello, M. J. (2009): Motivating online publication of data. In: BioScience, 59(5), pp. 418–427.

[124] Stodden, V., F. Leisch, R.D. Peng (2014): Implementing reproducible research. CRC Press.; Willinsky, J. (2005): The unacknowledged convergence of open source, open access, and open science. 10(8), pp. 1396–0466.; Woelfle, M., P. Olliaro, M.H. Todd (2011): Open science is a research accelerator. In: Nature Chemistry, 3(10), p. 745.

as impact the citation rates of research papers[125]. Here the question is how to best link evaluations and policies of such infrastructures with incentives and reward structures, as well as which skills are necessary to master the sharing of data and methods for Open Science. Open Research Infrastructures therefore pose multimodal challenges, and openness has to be considered from technical architecture to international governance.

4.3 The largest experiment in Open Science Infrastructure governance – European Open Science Cloud

The European Open Science Cloud (EOSC) is a project of the European Commission to provide an open infrastructure for open research data and relevant meta-information. The project was launched in 2015 and should be completed by 2020. According to the High Level Expert Group on the European Open Science Cloud it is a support environment for Open Science with the objective to "accelerate the transition to more effective Open Science and Open Innovation in a Digital Single Market by removing the technical, legislative and human barriers to the re-use of research data and tools, and by supporting access to services, systems and the flow of data across disciplinary, social and geographical borders"[126]. The three-fold objective in other words is:

(1) to increase value of scientific data assets by making them easily available to a greater number of researchers, across disciplines (**interdisciplinarity**) and borders (**EU added value**) and (2) to reduce the costs of scientific data management, while (3) ensuring adequate **protection of information/personal data** according to applicable EU rules (e.g. REGULATION (EU)2016/679)[127].

In May 2018, the European Commission confirmed the plan for the development of a cloud solution. 600 million euros are available for this purpose by 2020. The official launch event for the European Open Science Cloud took place in November 2018 in Vienna. The Vienna Declaration on the European Open Science Cloud[128] was adopted by the ministers of the EU Member States present. The Declaration focuses mainly on the governance structure and summarizes the consultation process by highlighting steps and commitments, "agreed upon by the Member States in the format of various policy documents. It also emphasizes the need to actively support this joint effort to ensure smooth and successful implementation"[129].

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[125] Baynes, G. (2017): Collaboration and concerted action are key to making open data a reality. Impact of Social Sciences Blog.; Hahnel, M., J. Treadway, B. Fane, R. Kiley, D. Peters, G. Baynes (2017): The State of Open Data Report 2017. Retrieved from: https://doi.org/10.6084/m9.figshare.5481187.v1 as accessed 01 June 2019.

[126] European Commission (2016): First report of High Level Expert Group on the EOSC. Retrieved from: https://ec.europa.eu/digital-single-market/en/news/first-report-high-level-expert-group-european-open-science-cloud as accessed 01 June 2019.

[127] European Commission (2018): Prompting an EOSC in Practice. Final report and Recommendations on the European Open Science Cloud of the Commission 2nd High Level Expert Group [2017-2018] [High Level Expert Group Report]. Retrieved from: https://www.eudat.eu/sites/default/files/prompting_an_eosc_in_practice_eosc_hleg_interim_report.pdf page 33, as accessed 01 June 2019.

[128] Vienna Declaration on the European Open Science Cloud. Retrieved from: https://eosc-launch.eu/declaration/ as accessed 01 June 2019.

[129] Vienna Declaration on the European Open Science Cloud. Retrieved from: https://eosc-launch.eu/declaration/ as accessed 01 June 2019. Some observers of the EOSC doubt the ambitious time schedule of the EOSC will be feasible: "[…] we're at the beginning of that process. I think it will take longer than currently envisaged for the European Open Science Cloud to really work as intended. It's probably the most important initiative ever taken to try and coordinate a federated system across Europe, no matter what discipline you're from – but the process to put that in place really demonstrates how difficult that is." (Sabina Leonelli in interview). Sayer, L.: Early-career researchers respond to Plan S: Interview with Sabina Leonelli of the Global Young Academy. Retrieved from International Science Council website:

With the European Open Science Cloud (EOSC), which is expected to become a central **virtual environment** for all researchers to store, manage, analyse and re-use data for research, innovation and educational purposes from 2021 onwards, Europe is taking a pioneering step towards a truly fundamental shift not only in the way science is done, but also in the way science is operating and having an effect within society. The EOSC is expected to generate a deep change in the scientific environment to be more accessible, transparent, collaborative and closer to citizens. To this end, Europe is adhering to the **FAIR data principle**: findability, accessibility, interoperability, re-usability. In that regard, besides the EOSC, there are also interesting developments on the national level: "National Open Science Cloud" in the Netherlands, the "Open Research Data Infrastructure" in the UK, the "Australian Research Data Cloud", or the German Research Data Infrastructure (NFDI).

Furthermore, EOSC should become the better **alternative to private platforms and services**, from publishing corporations, but also Amazon or Google. "The main idea is not to impose a new super structure, but to use what is already there. So, there is no magical trick there except that it was the right idea with the right approach in the right moment. Ten years ago, it would have been too early, and in five years' time it would have been too late, because then all our data are managed by foreign companies" said one interview partner. The strategy not to recreate the lock-in effects currently hindering the fast transition to Open Access in the field of scholarly publications ties in with the more general European efforts to cut too strong dependencies with foreign corporations and to protect European consumers' data and privacy.

The European Open Science Cloud can also be regarded as experiment in creating new governance models that serves the idea of Open Science and Open Research Infrastructures, by federating existing and future research data infrastructures, "connecting them with a soft overlay and build upon existing large-scale EU scientific networks including ICANN, IETF, AIOTI, GÉANT and ELIXIR"[130]. Jean Claude Burgelman, then head of the office at the DG Research and Innovation responsible for the cloud said: "We did not want to create a separate institution, or a separate entity somewhere where all the data will be merged and then controlled by a few bureaucrats overlooking how and who gets access to it. […] It is a decentralized approach. […] We had to align all these institutions, the research infrastructures, the repositories, all the ministries, 18 Member States. Inevitably, that was a complex thing, but we managed."[131] Coordination and alignment of interests across many different types of stakeholders and governance levels is one of the biggest challenges for the EOSC.

Actors in EOSC form three different types: strategic, executive and the users/producers as stakeholders. In all actor groups there are also non-European individuals or representatives of institutions involved.

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https://council.science/current/blog/early-career-researchers-respond-to-plan-s-interview-with-sabina-leonelli-of-the-global-young-academy as accessed 01 June 2019.

[130] European Commission (2018): Prompting an EOSC in Practice. Interim report and recommendations of the Commission 2nd High Level Expert Group [2017-2018] on the European Open Science Cloud (EOSC) [High Level Expert Group Report]. Retrieved from: https://www.eudat.eu/sites/default/files/prompting_an_eosc_in_practice_eosc_hleg_interim_report.pdf page 14, as accessed 01 June 2019.

[131] Presentation by Jean Claude Burgelman on the Open Science MOOC (2019). Retrieved from: https://youtu.be/8N06jYFgoQQ as accessed 01 October 2019.

Figure 9: EOSC Governance Layers, reproduced from the EOSC Governance Framework github repository[132]

The current setup has the objective to create a governance and implementation model for 2020, when the piloting phase is over. An important aspect of the development of EOSC is the inclusion of stakeholders from the beginning. Those stakeholders are either participating in projects around the development of the cloud or are part of the stakeholder forum.

Primary Role	**Description**	**Typical Stakeholders**
Provider	Provides services, data or other resources (e.g. scientific instruments, training) into EOSC.	e-Infrastructures Information and computing service providers Academic Institutions and Research Libraries Research Infrastructures Virtual research environments and research projects Other Service Providers
Consumer	Will make use of services, data, or other resources from EOSC.	Learned Societies, Research Communities, Scientific and Professional Associations Research Infrastructures Research Producing Organisations e-Infrastructures, VRE, and Other H2020 Projects Academic Institutions and Research Libraries Enterprises General Public

[132] EOSC Governance Model. Retrieved from: https://europeanopensciencecloud.github.io/Governance/GovernanceModel.html as accessed 01 June 2019.

Decision-makers	Will be involved in the strategic direction, compliance and funding of EOSC.	National, Regional or Local Government Agencies Research Funding Bodies

Table 6: Types of European Open Science Cloud stakeholders. Table adapted from EOSC Governance Model github[133]

These stakeholders all follow different interests, still they share a common set of values based on the fundamental idea that the "underlying infrastructure and foundation of EOSC needs to be developed, owned and operated publicly. That platform will be extended and scaled. It will engage with private initiatives, but all will adhere to rules of participation and uphold the common values"[134], such as adhering to research needs, being community driven, inclusive and respectful of diversity. EOSC should be accessible to all "from large equipment, large computers & 'big data' to 'small data' & long-tail research", open by default, closed only where necessary. These values should support the creation of knowledge commons as well as the respectful exploitation of research output.

However, these values represent just a fraction of different rules, regulations, norms and standards, that all apply to the implementation and governance of the cloud. From the interviews we learn that from country to country the local governance differs. In some Member States the processes are mainly driven by funders or government agencies, in others by ministries, or by libraries and university associations. An interview partner recounts how EOSC stirred even unusual interest: "When the European Open Science Cloud was launched last year, the responsibility for it was transferred to the Ministry of Education. I was very surprised to find that the Ministry of Economy was very interested to participate in the working group on Open Science Cloud"[135].

[133] EOSC stakeholder types. Retrieved from: https://europeanopensciencecloud.github.io/Governance/GovernanceModel.html as accessed 01 June 2019
[134] EOSC Executive Board, European Commission (2019): European Open Science Cloud Strategic Implementation Plan (2019–2020): 5. Retrieved from: https://ec.europa.eu/info/publications/european-open-science-cloud-eosc-strategic-implementation-plan_en as accessed 01 October 2019.
[135] Interview 10, 28 May 2019.

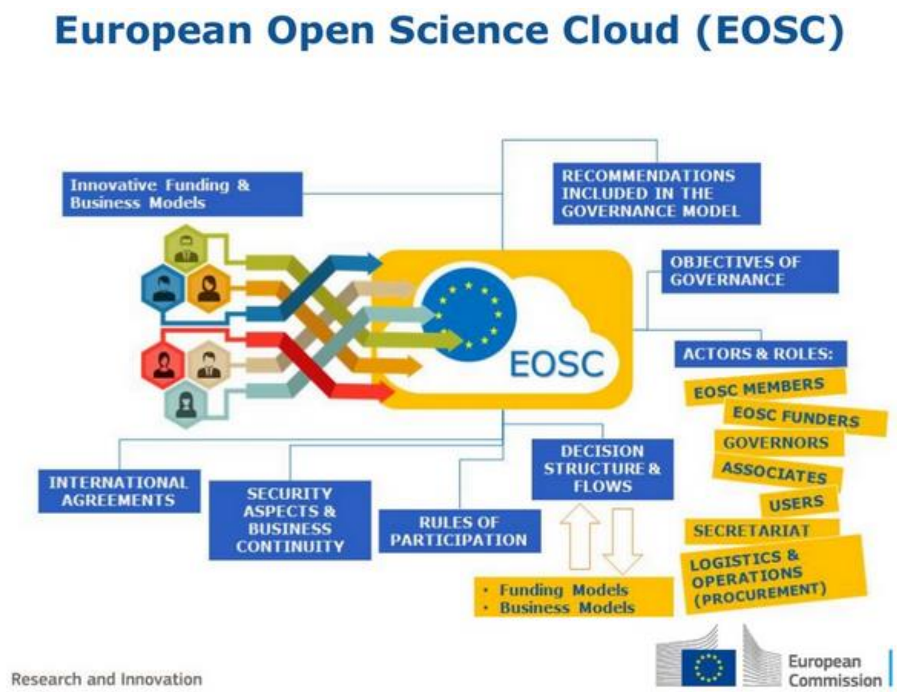

Figure 10: The multifaceted governance of the European Open Science Cloud. Slide copied from a presentation held by Carmela Asero (European Commission) @ SLA-Ready workshop in December 2016[136].

4.3.1 Open Science Diplomacy and the European Open Science Cloud

"The move towards open access is a worldwide endeavour. Member States have been part of this endeavour and should be supported in enhancing an open, collaborative research environment based on reciprocity at a global level. Open Science is a key feature of Member States' policies for responsible research and for open innovation. As new digital technologies become available, research and funding policies should adapt to this new environment."[137] The key aspect in this 2018 recommendation from the European Commission on access to and preservation of scientific information is "reciprocity at a global level".

Jean-Claude Burgelman reflects in a presentation[138] how difficult it was to get all 28 Member States on board for EOSC, and how it would not have been possible without the persistent support by the research communities, who created most impact in national lobbying for the cloud. Therefore, from his point of view, the focus now is mainly on the European needs and options, the realisation of the vision and not so much on the internationalisation of the cloud. On the other hand, there are many sceptical comments regarding the international dimension from other interview partners when it comes to discussing the modalities of access to the cloud regarding the **issue of reciprocity of**

[136] Presentation by Carmela Asero (2016). Retrieved from: https://www.sla-ready.eu%2Fsites%2Fdefault%2Ffiles%2Fcarmela_asero_european_open_science_cloud_eosc_sla-ready_workshop_brussels_15_dec_2016.pdf as accessed 01 June 2019.
[137] Recommendation from the European Commission (EU) 2018/790 of 25 April 2018. Retrieved from: https://www.eosc-portal.eu/sites/default/files/CELEX_32018H0790_EN_TXT.pdf point 12 as accessed 01 June 2019.
[138] Presentation by Jean Claude Burgelman on the Open Science MOOC (2019). Retrieved from: https://youtu.be/8N06jYFgoQQ as accessed 01 October 2019.

access. It was discussed publicly after the "Nica-Report" on the proposal for a regulation of the European Parliament and of the Council establishing Horizon Europe stated in an amendment that "Reciprocal open access should be encouraged in international S&T cooperation agreements and in relevant association agreements"[139] in November 2018. Since then, this issue is brought up mostly by representatives of economic affairs or innovation, be it ministerial, diplomatic or from innovation agencies. The main questions are: what does "reciprocity on a global level" mean – Access to my cloud for access to your cloud? - and what operationalisation in the form of access[140] and participation regulations[141] would be the best?[142] How to gain but also protect EU added value? Connected to these questions are the types of international policy partnerships required to realise reciprocity? Whereas on the one hand, there are examples and best practices from international research infrastructures[143], which can serve as role models, there is on the other hand the need to negotiate with international partners, if "wide access" - the "broadest possible gateway to scientific data and digital services provided by the e-Infrastructure to Users, wherever they are based"[144] – is not an option.

"We will ensure a discussion and probably a visit will be the next step to discuss with the right people in the ministry of science and technology, and the national science foundation. We need to explain what is behind, where we are going to ensure that our partner can converge towards the same kind of legislation. Because if we make all our data publicly available and nothing is coming from them, we create a situation where we offer a lot of information for free without reciprocity, reciprocal access to their data. We should be aware of that. If we do not have the same interests, then we should not make it available for people based in this country, when we do not have reciprocity. This has to be discussed in the joint committee and the high-level committees,"[145] says a European science diplomat in our interview. For this kind of negotiation for the European Open Science Cloud – and similarly for Plan S – it will be important to **build upon existing international collaborations**, either by scientific communities, international representative bodies, or successful international research infrastructures, as several interview partners highlight.

Both the technical and the service layer of the EOSC provide many opportunities for industry to participate. This participation will be guided by a set of criteria, which is currently developed within the EOSC governance scheme. Again, this area might also benefit from the expertise of international economic relations professionals, especially

[139] Nica, Dan (November 2018): Report by MEP Dan Nica on the proposal for a regulation of the European Parliament and of the Council establishing Horizon Europe – the Framework Programme for Research and Innovation, laying down its rules for participation and dissemination. Retrieved from: http://www.europarl.europa.eu/doceo/document/A-8-2018-0401_EN.html as accessed 01 June 2019.

[140] European Commission (2016): European Charter for Access to Research Infrastructures Principles and Guidelines for Access and Related Services. Retrieved from: https://ec.europa.eu/info/files/charter-access_en as accessed 01 June 2019.

[141] EOSC pilot: Roadmap for the development of rules of participation. Retrieved from: https://eoscpilot.eu/news/eosc-rules-participation-overview as accessed 01 June 2019.

[142] One potential option to operationalise a limitation in access would be geo-blocking – or "geo-walling" as one critic put it, which would in fact undermine the idea of global open access and open science. See: Hinchliffe, L. J. (2019, November 14): Can Geowalling Save Open Access? Retrieved from The Scholarly Kitchen website: https://scholarlykitchen.sspnet.org/2019/11/14/can-geowalling-save-open-access/ as accessed 15 November 2019.

[143] European Commission (2016): European Charter for Access to Research Infrastructures Principles and Guidelines for Access and Related Services. Retrieved from: https://ec.europa.eu/info/files/charter-access_en as accessed 01 June 2019.

[144] European Commission (2018): Prompting an EOSC in Practice. Final report and Recommendations on the European Open Science Cloud of the Commission 2nd High Level Expert Group [2017-2018] [High Level Expert Group Report]. Retrieved from: https://www.eudat.eu/sites/default/files/prompting_an_eosc_in_practice_eosc_hleg_interim_report.pdf pate 29, as accessed 01 June 2019.

[145] Interview 14, 22 November 2018.

when it comes to the necessity of **defining a clear and resilient intellectual property regime considering all re-use options** as well as **data protection policy** for the cloud, which work on global level. Part of these criteria will also be the access to metadata and subsequent transparency of e.g. service contracts etc., which are still discussed at the time of completion of this report[146].

We were also interested what kind of impact European activities around the development of EOSC create in other regions. Even though it might be too early to assess the success of the initiative, and only a few interview partners reacted, there are two dimensions we can highlight. First, EOSC pushes interest towards Open Science in general, especially in countries that are not forerunners, because they see that such a huge project is taking the open principles seriously and translates and enacts them into such a complex socio-technical platform. Second, because it triggers and resituates questions about private-public partnerships for the advancement of science in society, for example: why does a government not own research information data, even if it pays for the service to collect and maintain it.

An Open Access Programme Manager summarized in our interview the position towards EOSC from her experiences: "Sure, the launch of the European Open Science Cloud created a lot of momentum and discussions in other parts of the world, but open data availability was an issue that was discussed there long before. These topics were very high on the agenda of the Global South or non-European countries even before Horizon 2020, open data pilots. Looking at pan-African efforts, China and some Southeast Asian countries, we see a lot happening in infrastructure openness. […] I haven't seen EOSC mentioned in Chinese presentations about Open Science. In Africa, there is a willingness to see how collaborations could happen and whether in Africa an Open Science Cloud would be launched, or national Open Science clouds that would somehow collaborate with the European Open Science Cloud, so definitely in African policy discussions, it plays a role. And there is an African Open Science Policy Platform, which very strongly promotes this European Open Science Cloud agenda. And those European experts who collaborate with Africa always mention the European Open Science Cloud as an inspiration […], so we could say that in Africa it plays a role as pro argument for having Open Science in place, but I haven't really seen any actual steps of [harmonizing] with European Open Science Cloud or like really collaborating with European Open Science Cloud initiatives. But also, maybe it's a little bit too early to say because even in Europe we're still struggling to define its governance."[147]

The other important aspect that triggered reflection of national activities and provided inspiration for shifts in data policies is described in the interview by an Indian innovation policy expert: "We have lost an opportunity, we have lost all ownership over what we call our own output, right? […] you don't want to repeat this mistake as a global scientific community, the governments and the scientific community have to own the data that they produce. Not to give away the rights to somebody. This is exactly what is happening now. We may now [fight] all the publishers to get back the rights in the form of open access and Open Science, but what we are missing is we are doing the same mistake, or if not now in the future, we are going to the same mistake of leaving out all of our other data, like for example [technology-related] data."[148] The European Open Science Cloud will be internationally observed for its capacities to bring together high quality services with open and reusable metadata for monitoring the research system.

[146] EOSC Pilot Deliverable Final EOSC policy recommendations, July 2019. Retrieved from: https://eoscpilot.eu/sites/default/files/eoscpilot-d3.6-v2.7_0.pdf as accessed 01 October 2019.
[147] Interview 13, 27 June 2019.
[148] Interview 6, 21 May 2019.

At the International Conference for Research Infrastructures 2018 Wolfgang Burtscher, then deputy director general for research and innovation at the European Commission, said that policy makers are "not aware of the societal benefits of research infrastructures"[149]. If Europe would like to change this for Open Science and its infrastructures, then it will be of utmost importance to create awareness for the benefits and challenges in the international policy arena. The question hereby is, if the inception of the European Open Science Cloud – should it really become the global frontrunner in large scale, inclusive, Open Science infrastructure – is not the right time to start the international policy dialogue with the support of diplomacy, or whether it makes more sense to prepare the governance framework in detail and then reach out to test it in international partnerships.

[149] Zubașcu, F. (2018): Are research infrastructures the answer to all our problems? [Blog]. Retrieved from Science|Business website: https://sciencebusiness.net/news/are-research-infrastructures-answer-all-our-problems as accessed 01 June 2019.

4.4 Excursus 3: Dutch de-facto governance practices (Ewert Aukes, Jan 2019)

4.4.1 Issues in the Dutch OS policy arena

With such a large number of actors, also many different issues are discussed on various interfaces between scientists and science politicians. First, talks with people involved in the policy arena suggest that OS is not (yet) a coherent issue. In some ways, it may even be a container term. The topics of Open Science, Open Access, Open Data, Citizen Science and rewards and incentives for scientists are emphasised to different degrees and lumped together in different ways. For some, OS is the overarching topic, others talk about specific elements of OS. The discussions about OS also differ in character depending on the policy level. Given the uncertain development of OS and its implications for individual scientists, the national debate circles around potentially negative repercussions for scientists' daily practices. On the EU level, discussions are much more general and strategic and revolve around visions and possibilities of OS. In general, though, OS is "about sharing, cooperating, open practices" (NWO representative).

4.4.2 Institutionalization of rules and procedures

Furthermore, OS is seen by many as a policy arena with currently few institutionalized rules and procedures. The Big Deals and OA rules for scientists are exceptions confirming that rule. In the field of OD, initial steps have been taken to institutionalize best practices with Green Route repositories including datasets at all universities. However, the fact that there are three actors dealing with research data management raises the question whether this is the optimal organization of this OS element. In addition, according to a KNAW representative, OD may present more challenges in the future due to the increased involvement of private parties in scientific research. In technical research, e.g. when patents or commercial stakes are involved, private parties are less interested in sharing data. The involvement of private parties in research leads to an entanglement of objectives, e.g. commercial and knowledge-generating, which in turn complicates the introduction of fully Open Science. Nonetheless, the nature of science infrastructure necessary for effective and efficient scientific collaboration is diversifying. Whereas localized science infrastructures such as particle accelerators had to be realized previously, nowadays these infrastructures are joined by concerns about digital infrastructures.

As a KNAW representative mentions, it is not (yet) possible to learn about Open Science from a handbook. The emerging state of the topic means that there is no systematized approach yet. It is a topic-in-negotiation. Learning about OS is currently only possible by talking to people who are involved with it, carefully hearing both positive and negative opinions. This also includes scientists from different disciplines and participants in the National Platform Open Science.

4.4.3 Interfaces in the Dutch OS policy arena

The OS policy arena is characterized by many interfaces at which OS issues are negotiated between different types of actors. These are the representative organizations of the NWO and KNAW on national level, and their European representative bodies Science Europe and ALLEA – as well as the Open Science Policy Platform OSPP. Finally, the issue of OS is promoted and discussed globally in the Global Research Council and International Science Council, where counterparts may take up the issue and with a kind of trickle-down effect stimulate debate in their home countries.

4.4.4 Conclusion of the situational analysis in the Netherlands

This country study has discussed the relatively recent phenomenon of Open Science as a policy arena and has fleshed out its institutions, actors and practices in the Netherlands. It is an exploratory study that presents starting points for more in-depth study. We see that Open Science's currently high position on the science policy agenda enables real-time observations about the further development of the issue. It is basically a policy field in the making. Relatively low activity in the domain of laws and regulations reflects this, with the cabinet ambition of making OS the standard as a first step in that direction. Other institutionalization processes include the uptake of OS requirements in funding rules. Given the international and networked character of science, it is not prudent for the Netherlands to move swiftly ahead of other countries in this field. Unilateral action holds harm potential for the Dutch scientific community, and this is a much-voiced concern. With its ambition to be an Open Science pioneer, the challenge for the Netherlands is to dose its innovation speed to remain ahead, but not too far.

While the repercussions in the international science policy arena are rather clear, interviewees often had a hard time linking Open Science with matters of foreign policy. The link between OS and a potential foreign policy effect was reflected on as "interesting" or "unanticipated", i.e. respondents had not been aware of a link before or had not thought about a potential link. It is certainly not seen as conditional in either direction, e.g. the one necessitates the other or vice versa. Conversely, both are perceived as largely separate fields (KNAW representative). One aspect which actors easily agree on is the fact that science and scientific collaboration as a principally apolitical effort has the ability of transcending political divides. Examples brought up in this respect relate to collaborations during World War II and Cold War periods. Some even go so far as to say scientific collaboration may prevent war (a.o. KNAW representative).

4.5 Interfaces

From the detailed analysis of the de-facto governance issues of Plan S, the European Open Science Cloud and the Dutch situational analysis based on conversations with relevant stakeholders we learn that interview partners do not see interfaces between local Open Science activities and foreign policy in general, and Dutch Science diplomacy efforts in particular. Although there might be many overlapping issues, especially when it comes to sharing information, guidance and explore technological challenges as well as industrial opportunities[150]. Furthermore, actors from the diplomacy field described international scientific collaboration as "apolitical in principle", which will not hold true as soon as one immerses in issues of multi-level policy making and distributed governance models of Open Science – as was already demonstrated and will be laid out in more detail later in this report. While issues of international scientific coordination might transcend partisan politics, they are still highly politicized in the interests of multiple stakeholders. So, even if Open Science activities are based on the principle of solidarity and cooperation for the creation of knowledge commons on which society and economy can then rely, they are highly competitive, as they operate not at interfaces of a platonic "pure science", but rather at interfaces of local and global knowledge economies. Certainly, the diplomatic concept of "the universal language of science" allows to "maintain open channels of communication in the absence of other viable foreign policy approaches, ensuring the EU maintains its

[150] See also Tomalová, E., E. Černovská, E. Aukes, J. Montana, E. Dall (2020): Water Diplomacy and its Future in the National, Regional, European and Global Environments. In: Young, M., T. Flink, E. Dall (eds.) (2020): Science Diplomacy in the Making: Case-based insights from the S4D4C project.

presence at the highest level of international scientific endeavour, and ensuring the EU has access to research performed outside Europe"[151].

Policy ambitions of making Open Science standard scientific practice have diverse competitive dimensions on their agenda: global rankings of higher education institutions, commercialization of scientific results via patents and technology, researcher mobility and brain drain, and many more. Therefore, if Science diplomacy is envisioned to act in behalf of national interests and regional cooperation, it can help to establish the right interfaces necessary to tackle the issues listed above. When Commissioner Carlos Moedas pointed to specific European research cooperation projects[152], such as the Synchrotron-Light for Experimental Science and Applications in the Middle East (SESAME)[153], CERN or ESA[154], or the Global Research Collaboration for Infectious Disease Preparedness (GloPID-R)[155], he did not stress the potential of Open Science within those initiatives, rather he repeatedly connected "Openness to the world" with international cooperation and the inclusion of foreign countries in the European funding schemes (e.g. Ukraine[156] and Tunesia[157]).

What are then the concrete interfaces of and for European Open Science Diplomacy?

As already indicated several times, the case study identified only very few formal interactions of EU research policy and representatives of EU foreign relations, such as the European External Action Service EEAS around Open Science. Interactions identified were happening at the level of the Directorates Generals for Research and Innovation and Communications Networks, Content and Technology (including their staff in European Delegations) and foreign policy bodies or research institutions. For example, the group of **R&I Counsellors in the Delegations of the European Union** were asked to help prepare Plan S negotiations. Beyond that, discourse in the European Commission on Open Science and Science diplomacy was not extended to formally include other DGs, such as the DGs Environment or Energy and certainly not DG Competition.

An important instrument for the alignment of international research cooperation are the **Joint Steering Committees on Cooperation on Science and Technology** between the European Union and other countries. As already mentioned before, it was announced (and criticized by Open Access advocates) in June 2019[158] that the EU and Argentina agreed to a cooperation on Open Science. This event was co-prepared by the **Director for International Cooperation at the Directorate General for Research and Innovation**

[151] Moedas, C. (2016): Science Diplomacy in the European Union. Science & Diplomacy, 5(1). Retrieved from: http://www.sciencediplomacy.org/perspective/2016/science-diplomacy-in-european-union as accessed 01 June 2019.
[152] Ibid.
[153] See also Rungius, C. (2020): SESAME – a synchrotron light source in the Middle East: an international research infrastructure in the making. In: Young, M., T. Flink, E. Dall (eds.) (2020): Science Diplomacy in the Making: Case-based insights from the S4D4C project.
[154] ESA: A brief history of the European Space Agency. Retrieved from: http://www.esa.int/About_Us/Welcome_to_ESA/ESA_history/The_ESRO_Convention_and_juste_retour as accessed 01 June 2019.
[155] GLOPID-R: The Global Research Collaboration for Infectious Disease Preparedness. Retrieved from: https://www.glopid-r.org/ as accessed 01 June 2019.
[156] European Commission (20 March 2015) Ukraine Joins Horizon 2020 to Work with EU in Science and Research. Retrieved from: http://europa.eu/rapid/press-release_IP-15-4640_en.htm as accessed 01 June 2019.
[157] European Commission (1 December 2015): Tunisia Joins Horizon 2020, the EU's Research and Innovation Programme. Retrieved from: http://ec.europa.eu/research/index.cfm?pg=newsalert&year=2015&na=na-011215 as accessed 01 June 2019.
[158] Joint Communiqué – XI Joint Steering Committee Meeting of the Bilateral Agreement on Science and Technology between the European Union and Argentina. Retrieved from: https://ec.europa.eu/research/iscp/pdf/policy/ec_rtd_jc-11th-jscm-eu-ar_062019.pdf as accessed 01 October 2019.

of the European Commission, furthermore the **EU Head of Delegation in Argentina** and the Argentinian Ministry of Education and, Culture, Science and Technology. In June 2019 Argentina announced that it will join Coalition S, supporting **Plan S** and expressed interest in "promoting a regional initiative on this topic among the countries from Latin America and the Caribbean."[159] In reference to this event two aspects can be highlighted, which illustrate the scope of Open Science in cooperation. First, the joint planning focused on Open Access, but not on Open Science, therefore other important areas of cooperation, like bioeconomy, marine research and health research, as well as intellectual property development and innovation transfer were not discussed in the light of openness and sharing. There was one exception though, the successful conclusion of a cooperation arrangement on **data access and satellite data sharing** under the **Copernicus programme**.

Second, based on shared values and trust the **EU-CELAC Common Research Area**[160]**,** might also serve as an interface for Open Science activities in the future. However, transatlantic cooperation between Europe and Latin America on Open Science is already supported on other levels. A good example of such an interface is the **cooperation program for researchers** "Enlighten your research - LatinAmerica2Europe", which is organised in 2019 by RedCLARA[161] and GÉANT[162] with support from national research and education networks NRENs in Latin America and Europe, PRACE[163], RICAP[164] and OpenAIRE[165]. The goal of the program is to support the incorporation of "Open Science platforms, high performance computing, data storage data transfer tools, and/or trust and identity services into [the] research process" and to "increase the use and awareness of e-infrastructure resources in various fields of research. The goal of this new EYR-LatinAmerica2Europe is to provide access and support for network, compute, storage and trust and identity resources to meet the growing data and collaboration needs of research. It also aims to inspire new and understand existing collaborations between Latin America and Europe"[166].

A rather untouched interface seems to be the **Joint Programming Initiatives JPI,** which are a voluntary, structured cooperation program for Member States to formulate common research objectives and Strategic Research and Innovation Agendas (SRIA) to address major societal challenges. Led by the Member States, instruments include e.g. joint calls, so-called fast track activities, knowledge hubs, task forces etc. For example, the JPI on

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159 European Commission (7 June 2019): EU and Argentina to Cooperate on Open Science. Retrieved from: https://ec.europa.eu/research/iscp/index.cfm?pg=argentina as accessed 01 October 2019.

160 The implementation of the Common Research Area (CRA) between the EU and the Latin American and Caribbean countries is based on three pillars: mobility of researchers, access to research infrastructures and jointly addressing common challenges. See the 2018 Roadmap for EU-CELAC S&T cooperation. Retrieved from: https://ec.europa.eu/research/iscp/pdf/policy/celac_roadmap_2018.pdf as accessed 01 June 2019.

161 RedClara. Retrieved from: https://www.redclara.net/index.php/en/ as accessed 01 June 2019.; Interview partner Valeria Arza, of the Argentinian National Scientific and Technical Research Council CENIT, says that in Latin America organisations like RedClara are driving the progress towards Open Access. The governments are supporting, but the real impetus comes from these associations and infrastructures born in universities and libraries.

162 GÉANT a pan-European data network for the research and education community connecting national research and education network. Retrieved from: https://www.geant.org/ as accessed 01 June 2019.

163 Partnership for advanced computing in Europe PRACE. Retrieved from: http://www.prace-ri.eu/ as accessed 01 June 2019.

164 RICAP: The Iberoamerican Network of Participatory Science. Retrieved from: http://cienciaparticipativa.net/the-ricap/?lang=en as accessed 01 June 2019.

165 OpenAIRE: European Open Science Infrastructure, for open scholarly and scientific communication. Retrieved from: https://www.openaire.eu/ as accessed 01 June 2019.

166 GÉANT: Call for proposals for "Enlighten your research - LatinAmerica2Europe" (2019). Retrieved from: https://www.geant.org/News_and_Events/Pages/Enlighten-Your-Research-Latin-America2Europe.aspx as accessed 01 November 2019.

Climate proposed a set of policy recommendations for the implementation of Open Science at both internal (i.e. JPI Climate network governance) and external (i.e. JPI Climate network activities) level already in 2015[167].

The need for alignment and cooperation of Member States is one of the recommendations of the Open Science Policy Platform and necessary to turn advocacy into political action. In our interview a member of the European Open Science Policy Platform, explains: "We plan to organize an OSPP meeting […] with the Member States in order to tell them about the need to align policies and coordinate initiatives. […] It will be important to have the economic players on board, too, to really commit money to change the system on an international level. That is really difficult because you need a lot of, a lot of coordination"[168]. The advice mechanism of the **Open Science Policy Platform** for the European Commission does not include a foreign policy dimension, even though the composition of experts shows that it was designed for a multiple-stakeholder discourse. The OSPP collects advice from several **High-Level Expert Groups**, as listed below

- HLEG on EU Open Science Cloud (I and II)
- HLEG on Altmetrics → Next generation metrics
- HLEG on Careers & Skills
- HLEG on Rewards
- HLEG on Future of Scholarly Communication
- HLEG on FAIR Open Data
- HLEG on Indicators

Furthermore, the OSPP is informed by many more sources: There are interactions between EU Member States and associated countries initiated by the EU commission (**Mutual Learning Exercise** Open Science), and in **ERAC workgroups** such as the ERAC for Open Science and Innovation, but not involving any representatives of foreign relations or diplomacy.

Nevertheless, even without the inclusion of professional diplomats there is a lot of Science diplomacy happening. The proposal for the next European framework programme for research and Innovation, **Horizon Europe,** has triggered a lot of responses and led to the forming of alliances to promote Open Science, some of which also included or even were mainly comprising of Open Access publishing corporations, such as an international consortium led by Frontiers[169]. The advocacy letter of this group was directed to the Industry, Research and Energy **ITRE Committee of the European Parliament,** i.a. to prevent the reciprocity principle that was proposed for new Open Access policies[170].

Since several years there is a steady increase in symposia, conference tracks and even dedicated **meetings and conferences**[171], which are organised mostly by international representative bodies like the International Science Council (e.g. CODATA 2019[172] is collocated with a high-level policy workshop "Implementing Open Research Data Policy and Practice"), research organisations or infrastructures. In particular, those organised by

[167] JPI Climate, Guidelines on Open Knowledge. Retrieved from: http://www.jpi-climate.eu/media/default.aspx/emma/org/10862502/JPI+Climate+Guidelines+on+Open+Knowledge.pdf as accessed 01 June 2019.
[168] Interview 9, 28 May 2019.
[169] Frontiers Science News (2018): Horizon Europe: Safeguarding the EU's role as champion for Open Science. Retrieved from: https://blog.frontiersin.org/2018/11/15/horizon-europe-european-parliament-open-science/
[170] See the Report by MEP Dan Nica November 2018. Retrieved from: http://www.europarl.europa.eu/doceo/document/A-8-2018-0401_EN.html as accessed 01 June 2019.
[171] Such as the International Open Science Conference Berlin https://www.open-science-conference.eu/ or the Nordic Open Science conference https://www.vr.se/english/just-now/events/all-events/calendar-events/2018-08-23-nordic-open-science-conference.html
[172] International Science Council: CODATA 19. Retrieved from: https://council.science/events/codata-2019

international science policy organisations nearly always include dedicated programs to bring together policy makers, research administration, researchers and infrastructure providers (academic, non-profit or commercial).

In general, **Model Open Access policies** and **implementation roadmaps**, such as proposed by Plan S are typical interfaces in that regard, aligning international stakeholders' interests, or divorcing them. The implementation of **Plan S** and its many supporters demonstrate the strong international networks at play, most of which were initiated by and built on personal relations and informal connections, as some interview partners recalled. Furthermore, Plan S now has "**ambassadors**", active scientists, who should "act as local points of contact for discussions and advice about Plan S and its implementation. Ambassadors will also listen to the concerns of the research community and relay these back to cOAlition S"[173]. The goal here is to better bridge research communities and policy, not so much the connection to other societal domains. However, the foreign research policy dimension and geopolitics are represented in the composition of the ambassadors' group: there are representatives from each continent. This fact is clearly pointing to future ambitions of cOAliton S to become a global initiative.

In general, **research infrastructures** typically gather together diverse stakeholders and require a broad range of multi-level negotiations, such as standards, protocols, governance and cost sharing, ownership, access, …. Recently several communities of practice have started targeted initiatives on open research infrastructures, such as The Global Sustainability Coalition for Open Science Services (SCOSS)[174] or Invest in Open Infrastructure (IOI)[175], both of which are designed to serve as international policy interfaces. Their aims are similar, sustainably securing open infrastructure services across the world, be it with funding, materials or expertise, and "creating a more interconnected network of services that works more closely together". A specific type of policy interface in this context is a **mapping instrument**, such as an online monitor based on selected indicators: IOI wants to "establish a framework for surveying the global landscape of Open scholarly infrastructure, making assessments based on functionality, usage, health and financial needs. Funding recommendation will be made based on this assessment. The second function will be to coordinate and direct funding, derived from institutions, agencies and foundations, to services — using the framework as a guide"[176].

Monitoring and indicator frameworks could also be turned into interfaces for science diplomacy. Even if Europe now develops and puts into place new indicator frameworks and toolboxes for Open Science, they have to be discussed negotiated beyond national and European interests[177]. This might be particularly important for questions of definition of checks and balances for "reciprocity" and the criteria for commitments of participants. Furthermore, European indicator frameworks will also be increasingly aligned with international reference frames like the Sustainable Development Goals, and – if they should be successful – feed into international research funding databases, and existing documentation infrastructures. However, an interview partner reminds us that indicator development and monitoring should not be left to policy actors alone: "We cannot leave

[173] Ambassadors of cOAlition S. Retrieved from: https://www.coalition-s.org/ambassadors/ as accessed 01 October 2019.
[174] SCOSS: The Global Sustainability Coalition for Open Science Services. Retrieved from: http://scoss.org/ as accessed 01 October 2019.
[175] Invest in Open Infrastructure. Retrieved from: https://investinopen.org/ as accessed 01 October 2019.
[176] Invest in Open Infrastructure (2019): Invest in Open Infrastructure: A Concept 0.2. Retrieved from Invest in Open Infrastructure website: https://investinopen.org/docs/statement0.2.html as accessed 01 October 2019.
[177] Wouters, P., I. Rafols, A. Oancea, L. Kamerlin, B. Holbrook, M. Jacob (2019): Indicator frameworks for fostering open knowledge practices in science and scholarship. (Independent Expert Report No. 10.2777/445286). Retrieved from: https://op.europa.eu:443/en/publication-detail/-/publication/b69944d4-01f3-11ea-8c1f-01aa75ed71a1/language-en/format-PDF as accessed 15 November 2019.

this to the nation states, especially with the SDGs. This might be a very cynical view: left of the nation states there will be cherry-picking of data, there will be at least procedures that mean that the data aren't necessarily as transparent as they might be. So, when we report on the SDGs or on Sendai or when we discuss large-scale and necessary scientific endeavours, we need to be, you know, a little bit less of Realpolitik and a little bit more international cooperation."[178]

As already described in detail before, a good example of science diplomacy interfaces can be found in the design process of the governance of the **European Open Science Cloud** that brought together not only representatives of participating countries, but also a diverse range of stakeholders. With EOSC being still more a concept under negotiation than a fully-fledged infrastructure, processes of organisational and technological closure can be observed "in the wild". Besides the quest to find the right legal vehicle to run EOSC, it could also be a (role) model for future endeavours in how to govern the collaboration between end users (science and innovation community), service providers (archives and repositories, developers, intermediaries, operators), funders and policy makers. Participation for those stakeholders in the process is facilitated via the experts in the **executive and advisory boards, working groups, co-creation calls, webinar and workshop series, and stakeholder forum** events such as symposia and conferences. All those measures are directed towards facilitating focused cooperation, and creating a truly federated, collaborative and open research infrastructure and a lively European community however they are focusing primarily on the European perspective.

Another important dimension of the EOSC as interface was addressed in the interview by a rector of a Eastern European university: "Open Science and such infrastructures help us to counter the ongoing brain drain with better access to excellent research. It is also important for education, to establish our country as place for third level of education. When students and professors can already access high quality information. […] There is this trend of student mobility from the East or Far East, to study in Europe. Many of them cannot afford to go to the UK, NL or Germany. So, for countries like Moldova open access to data would also help to establish the country as attractive place for higher education."[179]

More generally, we should not forget the internationally highly mobile **students** trained in Open Science. This is a currently rather untapped and potentially very effective interface for the transition towards Open Science in terms of **human resources and skills**: Europe's higher education system, as well as its publicly funded research performing organisations, are training the next generation of researchers. In many fields, such as physics, psychology, molecular biology, Open Science principles are already or becoming standard scientific conduct, as well as integral aspect of training in research integrity. Foundations such as Wellcome Trust, and civil society organisations, like Wikimedia[180] organise special Open Science trainings with the student mobility and their function as multipliers in mind. When those professionals leave Europe for other world regions, they take with them a culture of Open Science.

At the same time, it is to decide if the EU is "open to cooperation on a global scale," as Deputy Director General Wolfgang Burtscher (DG Research) put it[181]. This would require different types of interfaces – even though some of the mentioned above are explicitly

[178] Interview 5, 15 May 2019.

[179] Interview 10, 28 May 2019.

[180] Open Science Fellows program of Wikimedia Germany. Retrieved from: https://en.wikiversity.org/wiki/Wikimedia_Deutschland/Open_Science_Fellows_Program as accessed 01 June 2019.

[181] Zubașcu, F. (2018): Are research infrastructures the answer to all our problems? [Blog]. Retrieved from Science|Business: https://sciencebusiness.net/news/are-research-infrastructures-answer-all-our-problems as accessed 01 June 2019.

open to non-European participation. Creating a framework for open research and innovation infrastructures in Europe is not the same as expanding this to the global level. This global view – which is yet to be developed – would need to rely on Science diplomacy skills, especially as new types of organisations, models for cooperation and funding are needed. When Carlos Moedas says: "Research infrastructures are the assets for science diplomacy,"[182], adding that only Europe has understood so far that research infrastructures and their contexts are political endeavours, as they are commonly invisible to policy makers and public. Therefore, it seems that the first interfaces for a global political discourse on open research infrastructures will be negotiations of **standards and protocols**. At first sight such negotiations look quite technical, but in them a lot of socio-technical decisions are made, which will be leading the way to how the infrastructures can be used and how will benefit from them. Such negotiations do not only include technical standardization of data exchange formats, network architecture and alike. They also tackle issues of collaboration and governance, like which activities will be logged for further analysis, what kind of access will be provided to whom, how are the costs shared and monitored, what kind of procurement procedures will be necessary, what kind of legal entities are needed for maintenance, just to name a few. The vision of globally accessible research data commons – always resonating with the EOSC – needs an implementation framework that builds on robust interfaces between the research and the policy system that can deliver on the promises made.

Many of the interfaces described here are not visible or accessible to local or regional Open Science grassroots movements or advocates, as both the co-founder of AfricArXiv[183] and the founder of OpenScienceMooc[184] reflect in a discussion: "Working here on the ground we have to make sure that more people are aware of the large-scale changes happening around the world politically. […] Before however they need to learn how to empower themselves to become part of that change. […] And then if you want, why not take that to the next level? There are people there on the ground, you know, like you said [ ] and OECD and UN and UNESCO all working on these things, and I think as long as we sort of have a common picture in mind of where we want to be at both levels, then we're good." One of the issues here seems to be the intersectional communication: "I feel the communications are there, yes, but there's not much cross-sectioning, cross-communicating. There're few individuals going to these big scale United Nations events, and then also vice versa, there are not a lot of crosscutting interactions between the levels".[185] Therefore, if "diplomacy is the political level of advocacy" as one interview partner put it, there is still a lot to do to bring the levels together and coordinate actions for better effects.

182 Ibid.

183 AfricArXiv. Retrieved from: https://info.africarxiv.org/ as accessed 01 June 2019.

184 OpenScienceMooc. Retrieved from: https://opensciencemooc.eu/ as accessed 01 June 2019.

185 Interview 7 and 8, 21 May 2019.

5. Relevance and use of knowledge

The case study was guided by 2 horizontal perspectives: 1) a content/procedural perspective: how can/does Open Science help foreign policy-making, and 2) a thematic perspective: Open Science as topic of foreign policy (though those perspectives might be overlapping to some extent). Even though we found only marginal links between the European Open Science policy actors and official EU-level or national level foreign policy actors, as well as only peripheral links between international Open Science advocacy organisations and foreign policy actors, we need to emphasize the high demand for science diplomacy by our interview partners from the international research cooperation system. While analysing the empirical material, another horizontal perspective was added to the list:

- Knowledge about Open Science
- Open Science knowledge for diplomacy
- Diplomatic knowledge, skills and resources for Open Science

5.1 Knowledge about Open Science

From desk research and stakeholder interviews we conclude that a big challenge today is first and foremost go gather valid and balanced knowledge about the uptake of Open Science, its impact and its potential. While this seems to be true also for the international exchange and transparency of research information in general – most of which is stored in proprietary data bases – it is particularly true for Open Access and Open Data. Many current research information systems (CRIS) are still waiting to be updated with Open Science details, such as whether a publication is Open Access, whether there is an embargo, etc. Furthermore, only recently libraries as well as funders started assembling and sharing their data on costs and benefits of subscription and Open Access contracts with publishers. It requires national and international high efforts to bring this information together and make it comparable and interpretable. This kind of knowledge is closely tied to research infrastructures and CRIS, as many of those are also owned by publishing or content service industries, so that data for monitoring publicly funded scientific performance in general often must be bought back from such outlets. Therefore, many advocates claim that Open Science needs open infrastructures, otherwise we are iterating the same procedures eternally that we wanted to abolish. Others call for more evidence of the socio-economic impact and translation of scientific research that has been made open, e.g. in cooperation with industry or the public sector. But we certainly do not only need facts and figures, nor just metrics or altmetrics, we also need best practices, success stories, and stories of failure so that stakeholders can engage in mutual learning, which is the basis for international coordination of efforts.

5.2 Open Science knowledge for diplomacy

Open Science has already proven very useful in tackling global challenges at several occasions, e.g. health crisis like Ebola or Zika, in the aftermath of natural disasters like earthquakes or hurricanes, or for the fight against climate change. When fast action at the interface of science, technology and foreign policy is needed, Open Access to publications and data is vital.

Speed is everything in times of an outbreak, emergency respond teams have to be set up across borders, as well as research teams that must agree on standards and protocols to share crucial information when tested and available. Right now, in most cases the dissemination of data and results is "sporadic at best. In the case of influenza, an international consortium of researchers called GISAID established a framework for good practice in 2006[186]. Largely thanks to this, during the 2009 H1N1 influenza outbreak, the US National Center for Biotechnology Information created a public repository that became a go-to place for the community to deposit and locate H1N1 sequence information4. By contrast, the publishing of sequence information in the early stages of the 2012 Middle East respiratory syndrome (MERS) outbreak in Saudi Arabia highlighted uncertainties about intellectual-property rights, and the resulting disputes hampered subsequent access to samples"[187]. Two Ebola outbreaks since 2014 have also triggered a range of international measures for data sharing and Open Science, with many international organisations like the WHO now restructuring their research strategies[188].

These examples show that "Open Science and Openness to the world"[189] do not only refer to expanding European knowledge markets, but also to tacking grand challenges sustainably and by international scientific cooperation. Furthermore, Open Science means that science diplomats themselves can get access to information needed – be it scientific results, contact points to experts, or better insights in research system monitoring. Open Science also requests to better communicate and translate findings into public knowledge, so science diplomats might also be able to collect policy briefings, educational resources etc. Finally, evidence on the productive entanglements of science commons and commodification based on scientific results, on the socio-economic benefits would help diplomats to bring Open Science on the agenda together with environment, culture and trade issues.

5.3 Diplomatic knowledge, skills and resources for Open Science

On the other side, Open Science coordination would greatly benefit from expertise in foreign policy while planning and implementing international coordination, building infrastructures, and negotiating new Open Access models. Since "Open Science is not happening in a vacuum" (Interview), instead it is part of a broader global Open Culture movement on the one hand, and on the other hand happening at the same time as security policies, new trade regulations, legal frameworks and ethical standards – e.g. ethical artificial intelligence – are negotiated. In all of those areas Europe is still trying to define its role and function on the global parquet. Whereas Europe is not the frontrunner in those mentioned areas, it is when it comes to Open Science and with it the potential of alternative routes to markets and public goods. Respondents to the S4D4C survey[190], ranked the following purposes of Science diplomacy as high/rather important:

- International collaboration for scientific purposes (83%)
- Developing partnerships for addressing global challenges (69%)
- Strengthening the international competitiveness of their country/the EU (68% of respondents: highly or rather important; more important in EU countries: 75%)

[186] GISAID. Retrieved from: https://www.gisaid.org/ as accessed 01 June 2019.

[187] Yozwiak, N. L., S.F. Schaffner, P.C. Sabeti (2015): Data sharing: Make outbreak research open access. In: Nature News, 518(7540), p. 477.

[188] Goldacre, B., S. Harrison, K.R. Mahtaniand, C. Heneghan (2015): WHO consultation on Data and Results Sharing During Public Health Emergencies. Retrieved from WHO website: https://www.who.int/medicines/ebola-treatment/background_briefing_on_data_results_sharing_during_phes.pdf as accessed 01 June 2019.

[189] Moedas, C., Directorate-General for Research and Innovation (European Commission) (2016): Open innovation, open science, open to the world. Retrieved from European Commission website: https://op.europa.eu/en/publication-detail/-/publication/3213b335-1cbc-11e6-ba9a-01aa75ed71a1 as accessed 01 June 2019.

[190] Degelsegger-Márquez, A., T. Flink, C. Rungius (2019): What it takes to do science diplomacy. Practices, identities, needs and challenges of science diplomacy practitioners. Baseline analysis and needs assessment. (No. Deliverable 2.3). Retrieved from S4D4C website: https://www.s4d4c.eu/wp-content/uploads/2019/03/S4D4C_WP2_D2.3_ZSI.pdf as accessed 01 June 2019.

Whereas all 3 purposes could be regarded under the light of changes brought by Open Science, the latter 2: partnerships for addressing global challenges as well as strengthening international competitiveness contain specific aspects of foreign relations and diplomatic expertise. In the interviews for this case study international Open Science actors wish for more support of diplomacy actors in

- Assembling and managing multi-level policy stakeholder discussions across borders, while identifying strengths, gaps and opportunities
- Providing the bigger policy picture and socio-economic context for negotiations
- Coordinating the sharing of costs and burdens of sustainable maintenance (e.g. of data infrastructures)
- Assembling expertise for planning and negotiating the socio-economic factors (e.g. how to best bring together openness and IPR, setting ethical standards, ...)
- Bridging localization with internationalization: Aligning open strategies with other national and international activities, understanding local and global impact
- Incentivizing policy actors to support information syndication, open knowledge bases and evidence-based policy making

6. Issues of multi-level policy-making

6.1 Changing stakeholder constellations

Open Science-related policy-making is multi-level by nature: As this report demonstrates – for example in the chapter on stakeholders – policy making involves a variety of actors, institutions, infrastructures. Matters of opening science on international scale with a foreign policy dimension – such as sharing of data – became particularly important during the period of cold war and a time of international secrecy, arms races and the quest for technological supremacy (Krige & Barth, 2006; Turekian, 2018). Some of the still very active international advocates of Open Science were founded in that period: the Committee on Data for Science and Technology (CODATA; established in 1966)[191], the International Network for the Availability of Scientific Publications (INASP)[192] based on earlier efforts and founded in 1992, and the World Data System (WDS)[193], which was established in 2008, based on the 1958 foundation of the World Data Centers and the Federation of Astronomical and Geophysical Data Analysis Services. All these initiatives co-driven by the International Council for Science (ICSU – now part of the International Science Council)[194] were certainly intervened with Science diplomacy long before the term was born, however the diplomatic dimension was often kept under the radar.

From the late 1980s on, the focus changed to tackling grand challenges by assembling the right data and analytical expertise, and with the foundation of the Intergovernmental Panel on Climate Change (IPCC, 1988)[195] the global policy dimension of the scientific study of climate change was at the heart of the organisational design. The Human Genome Project[196] – which could be regarded as another one of the pioneering international Open Science projects – attracted a lot of political interest and debate, produced internationally used protocols and procedures for open workflows and sharing data, used preprint servers

[191] COdata. Retrieved from: http://www.codata.org/ as accessed 01 June 2019.

[192] INASP. Retrieved from: https://www.inasp.info/ as accessed 01 June 2019.

[193] International Council for Science – World Data System. Retrieved from: https://www.icsu-wds.org/ as accessed 01 June 2019.

[194] International Science Council. Retrieved from: https://council.science/ as accessed 01 June 2019.

[195] International Panel on Climate Change. Retrieved from: https://www.ipcc.ch/ as accessed 01 June 2019.

[196] Human Genome Project. Retrieved from: https://www.genome.gov/human-genome-project as accessed 01 June 2019.

and provided Open Access to publications, and even demonstrated that international cooperation on scientific commons[197] can be successful without consolidated funding and involving commercial actors. These initiatives show how governance can be achieved jointly by scientists and policymakers from multiple countries. Besides scientific collaboration, governance tasks include the design, financing, management and maintenance of associated infrastructures and the sorting of legal frameworks and insecurities of exploitation and licensing. The mentioned organisations illustrate the growing importance of scientific collaboration in international relations, but they were not yet operating under the label of Open Science, nor Science diplomacy.

Even though data sharing, and activities related to Open Research Data predate Open Access advocacy, it was Open Access, which finally kicked off a global Open Science movement and draw more attention of policy makers to the necessities of transnational coordination[198]. Before the establishment of preprint servers in the 1990s[199] and the advent of coordinated Open Access declarations and manifestos in the early 2000s, policy actors were only marginally visible in both European and global debates, which were mainly ignited as well as fuelled by stakeholders from the science and research systems, such as librarians and researchers and their international representative bodies[200]. Stakeholder landscapes have changed over time, now involving many more national and international experts and Open Science advocacy groups and consortia in universities and academies. The field started to professionalize, i.e. with dedicated conferences and the installation of Open Access contact points in research performing organisations. Relatively new – since the mid 2000 – is the intensive involvement of the publishing industry as well as information service providers, because Open Access became a new model for expanding knowledge markets.

Ever since calls for Open Access to publicly funded research became more frequent and culminated with the Budapest Declaration (2002), the Bethesda Statement and the Berlin Declaration (2003), and it became apparent that there is demand for big changes in the system of scholarly communication, research policy makers started to approach experts (from research, funders, or libraries) to advise on how to best foster and expand access to scholarly research[201]. The European commission adopted an Open Access policy for its funding schemes already in its 7th Framework Programme for Research and Technological Development (2007-2013), covering ca. 20% of the research funded. From 2014 onwards with the new framework Horizon 2020, the Open Access policy covered 100% of funded research. This policy requests all projects to be required to make their peer-reviewed journal articles openly accessible, free of charge. Moreover, the EC introduced an Open Data pilot in Horizon 2020 which was later mainstreamed across all thematic programmes in 2017. This Open Data policy aims to make the research data generated by funded projects accessible with as few restrictions as possible, following the motto: "As open as

[197] In February 1996 the participants at the International Strategy Meeting on Human Genome Sequencing released the Bermuda Principles. The principles assert that "all human genomic sequence information, generated by centres funded for large-scale human sequencing, should be freely available and in the public domain". Suber, P. (2019): Declarations in support of OA - Open Access Directory. Retrieved from Open Access Timeline website: http://oad.simmons.edu/oadwiki/Declarations_in_support_of_OA as accessed 01 June 2019.

[198] To be historically correct: even earlier there was the Free and Open Source movement and in parallel to the growing public visibility of Open Access the call for Open Education and Open Educational Resources intensified globally.

[199] See for example the preprint Server arXiv. Retrieved from: https://arxiv.org/ as accessed 01 June 2019.

[200] In other world regions, this was different, e.g. in Latin America, where transnational OA initiatives were pushed early on also by science policy makers, see also page 157 of this report

[201] Suber, P. (2019): Declarations in support of OA - Open Access Directory. Retrieved from Open Access Timeline website: http://oad.simmons.edu/oadwiki/Declarations_in_support_of_OA as accessed 01 June 2019.

possible, as closed as necessary"[202]. These polices have since inspired many national and international funders[203] and will be continued in Horizon Europe, the 9th European framework programme. There, the pillar for basic research and infrastructure was even called "Open Science" in an earlier proposal for the text[204]. The programme also highlights further coherence across participating countries by the way of monitoring impact and development: "Accelerating the transition towards Open Science, by monitoring, analysing and supporting the development and uptake of Open Science policies and practices, including the FAIR principles, at the level of Member States, regions, institutions and researchers, in a way that maximises synergies and coherence at EU level."[205]

6.2 Governance challenges

However, with those new top-down governance aspects also come challenges and questions: which Open Access models are the best for the European research landscape, and can this be decided universally? How do we know about the impact of Open Access and Open Research Data, which monitoring infrastructures need to be developed? How to best govern transnational open infrastructures? What incentive and reward systems have to be established relying on which kind of assessments? These questions are among the currently most debated governance issues concerning Open Science policy implementation, and all of them clearly point to the international and collaborative character of their answers.

Not only since Open Access has been declared as the "future of academic publishing" in Europe (Finch et al., 2013), a rising dominance of the business model of the **gold route to Open Access** is observed, and Open Access journals have been flourishing, providing novel and huge revenues to commercial publishers and scientific societies or associations. Many of those are hosting "high impact" journals, which are obligatory passage points for researchers, who have to follow the "publish or perish" imperative. Studies demonstrated the unparalleled rise both of subscriptions and of Open Access costs at the same time when several big corporate publishers presented themselves as "Open Science Advocates". This resulted in uproar by several communities, e.g. proposing to boycott those publishers[206], but also led several institutions and national consortia to re-negotiate or even end their contracts with those publishers[207].

The preference for the gold model of Open Access in European policy making has been criticised a lot, and stakeholders from research communities, libraries as well as providers of alternative publishing models have repeatedly – lately in the consultation about the implementation plan of Plan S - pushed for the green model and the right to self-archiving[208]. Several nation states have already included the right to self-archiving of

[202] Horizon 2020 funding guide on Open Access. Retrieved from: http://ec.europa.eu/research/participants/docs/h2020-funding-guide/cross-cutting-issues/open-access-data-management/open-access_en.htm as accessed 01 June 2019.

[203] It remains unclear if European policy makers were inspired by at that time already existing and evaluated policies and strategies, as in Latin America.

[204] European Commission: Horizon Europe – the next research and innovation framework programme. Retrieved from: https://ec.europa.eu/info/designing-next-research-and-innovation-framework-programme/what-shapes-next-framework-programme_en as accessed 01 June 2019.

[205] European Parliament: P8_TA(2019)0396, Programme implementing Horizon Europe***I. Retrieved from: http://www.europarl.europa.eu/doceo/document/TA-8-2019-0396_EN.pdf as accessed 01 June 2019.

[206] The Cost of Knowledge. Retrieved from: http://thecostofknowledge.com/ as accessed 01 June 2019.

[207] See for example Project Deal in Germany https://www.projekt-deal.de/ or the Big Deal Cancellation tracker by SPARC: https://sparcopen.org/our-work/big-deal-cancellation-tracking/ as accessed 01 June 2019.

[208] See also the chapter on de-facto governance issues the section on Plan S. Besides the dominance of the gold model of OA, also other principles were criticized in the consultation phase of Plan S, i.e. some researchers

published scientific papers in their legal frameworks. For example, in 2018 Belgian copyright law was changed to allow authors of scientific articles funded with public money to "retain the right to make their article available in Open Access even if otherwise stipulated in their contract with the publisher"[209].

6.2.1 *Socio-technical frameworks*

Creating the right **legal frameworks** in Europe is still mostly a national effort but needs to be reflected in international exchange of best practices and analysis of failures and critique. For Open Access this exchange is currently happening but is – as our interview partners recount – based rather on individual initiatives or personal relationships than on systematic exchange between nation states. Whereas the design of Open Access (and Open Science) policies in universities and other research performing organisations is regularly reflected in meetings and conferences[210], and documented by reports of international representative bodies and umbrella organisations, as well as by internet platforms collecting information on policies[211], the documentation and comparison of national policies is not easily facilitated[212]. The same is true for the legal frameworks needed to build, sustainably run and monitor transnational open research infrastructures and defining coherent data sharing policies across borders and diverging domestic laws, e.g. when it comes to decide about data ownership, privacy regulations and secondary use. Another issue already lurking is the implementation of strict data localization regulations in some countries, such as China or Russia, and how this will affect scientific cooperation and data transfer. Some of these questions have been tackled by practitioners and are currently finding their ways into academic literature about Data Diplomacy[213], but we could not identify any formal involvement of foreign policy experts or diplomats in the Open Research Data debate. Data diplomacy seems to be executed either by researchers, infrastructure experts or representatives of international data societies or policy bodies, such as CODATA or the WHO[214]. Negotiations of data or infrastructure **standardisation and protocols** – as happening for example in the Research Data Alliance RDA[215] or the Internet Engineering

presumed a loss of scientific freedom by not being allowed to choose the publication outlet freely. Furthermore, some researchers were sceptical about the applicability of OA to scientific monographs, and the respective increase of costs to publish them. See: Harnad, S. (2012): Why the UK should not heed the Finch report. Impact of Social Sciences Blog.; Eve, M. P. (2018): On the practical implementation of Plan S [Blog]. Retrieved from Open Access website: https://eve.gd/2018/10/03/on-the-practical-implementation-of-plan-s/ as accessed 01 June 2019.

[209] Open Access Belgium: Belgian copyright law amended in favor of open access to scientific articles. Retrieved from: https://openaccess.be/2018/09/13/belgian-copyright-law-amended-in-favor-of-open-access-to-scientific-articles/ as accessed 01 June 2019. Such regulations are now enacted in many European countries, such as France, Austria, Germany…

[210] Such as Open Access Days, International Library Association conferences, etc.

[211] Register of Open Access repositories. Retrieved from: https://roarmap.eprints.org/ as accessed 01 June 2019.

[212] Even publishers Open Access policies are documented here in SHERPA. Retrieved from: http://sherpa.ac.uk/romeo/index.php as accessed 01 June 2019.

[213] Boyd, A., J. Gatewood, S. Thorson, T.D. Bowman (2019): Data Diplomacy. In: Science & Diplomacy, 8(1). Retrieved from: http://sciencediplomacy.org/article/2019/data-diplomacy as accessed 01 October 2019.

[214] Murillo, A. (2015): Data Diplomacy: Political and Social Dimensions of Data Collection and Data Sharing | CODATA Blog. Retrieved from Codata_blog website: https://codata.org/blog/2016/01/10/data-diplomacy-political-and-social-dimensions-of-data-collection-and-data-sharing/ as accessed 01 June 2019.
Rosen Jacobson, B., K.E. Höne, J. Kurbalija (2018): Data Diplomacy Report. Retrieved from DiploFoundation website: https://www.diplomacy.edu/sites/default/files/Data_Diplomacy_Report_2018.pdf as accessed 01 October 2019.

[215] Research Data Alliance. Retrieved from: https://www.rd-alliance.org/ as accessed 01 June 2019.

Task Force IETF[216] - could also be regarded in the light of science diplomacy practised without the involvement of diplomats.

"Whenever there's science, wherever there's science, there's a data component. There's this big driver for Science diplomacy, for cooperation and coordination of data through the Sendai framework on the one hand, or the SDGs on the other. And so, there's lots of activities there, but there are also real concerns because of the role of the nation's states"[217] says one interview partner.

European **copyright policies** – The European Copyright Directive was adopted in 2019[218] – do follow European Open Science strategies. Besides entertainment and content industries blocking Open Science efforts, representatives of research, cultural heritage and education systems have actively lobbied for an open-friendly copyright design. There are now copyright exceptions for text and data mining (art 3, 3a), facilitation of digital, cross-border teaching (art 4), digital preservation across borders (art 5), digitisation of out-of-commerce works and collective licensing (art 7-9a), and for achieving public interest by putting works in the public domain (art 10b). Open Access was protected in articles 11 and 13 by the exclusion of scientific publications from the copyright and making it possible to share them online; and by preventing that not-for-profit scientific and educational repositories and platforms have to run upload filters[219]. The lobbying for Open Science has been mainly organized by international science organisations, such as SPARC[220], LIBER[221] or EIFL[222] or similar NGOs, Science Europe[223] and the Member of European Parliament Julia Reda[224].

Another important component of the efficient coordination of the transition towards Open Science is a robust monitoring system of the developments in Europe. **Monitoring Open Science** should include policies, practices like the adoption of the FAIR principles and infrastructures across nation European states and even better around the word. Several of such monitoring platforms already exist, mostly hosted by NGOs or Open Science related initiatives, such as the Registry of Open Access Repository Mandates and Policies (ROARMAP), Sherpa-Romeo, Sherpa-Juliet, the Directory of Open Access Journals, OpenAIRE and many more.

With ROARMAP for example, it is possible to visualize alignment to Horizon 2020 policies of individual countries.

216 Internet Engineering Task Force. Retrieved from: https://www.ietf.org/ as accessed 01 June 2019.

217 Interview 5, 15 May 2019.

218 European Parliament, & European Council: DIRECTIVE (EU) 2019/790 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 17 April 2019 on copyright and related rights in the Digital Single Market and amending Directives 96/9/EC and 2001/29/EC (2019). Retrieved from: http://www.europarl.europa.eu/doceo/document/TA-8-2019-0231_EN.html as accessed 01 June 2019.

219 SPARC Europe: A new Copyright Legislation for Europe. How will this impact Open Access? Retrieved from: https://sparceurope.org/a-new-copyright-legislation-for-europe-how-will-this-impact-open-access/ as accessed 01 June 2019.

220 SPARC Europe. Retrieved from: https://sparceurope.org/ as accessed 01 June 2019.

221 LIBER Europe. Retrieved from: https://libereurope.eu/ as accessed 01 June 2019.

222 EIFL. Retrieved from: https://www.eifl.net/ as accessed 01 June 2019.

223 Science Europe. Retrieved from: https://www.scienceeurope.org/ as accessed 01 June 2019.

224 Blogpost of former MEP Julia Reda. Retrieved from: https://juliareda.eu/eu-copyright-reform/text-and-data-mining/ as accessed 01 June 2019.

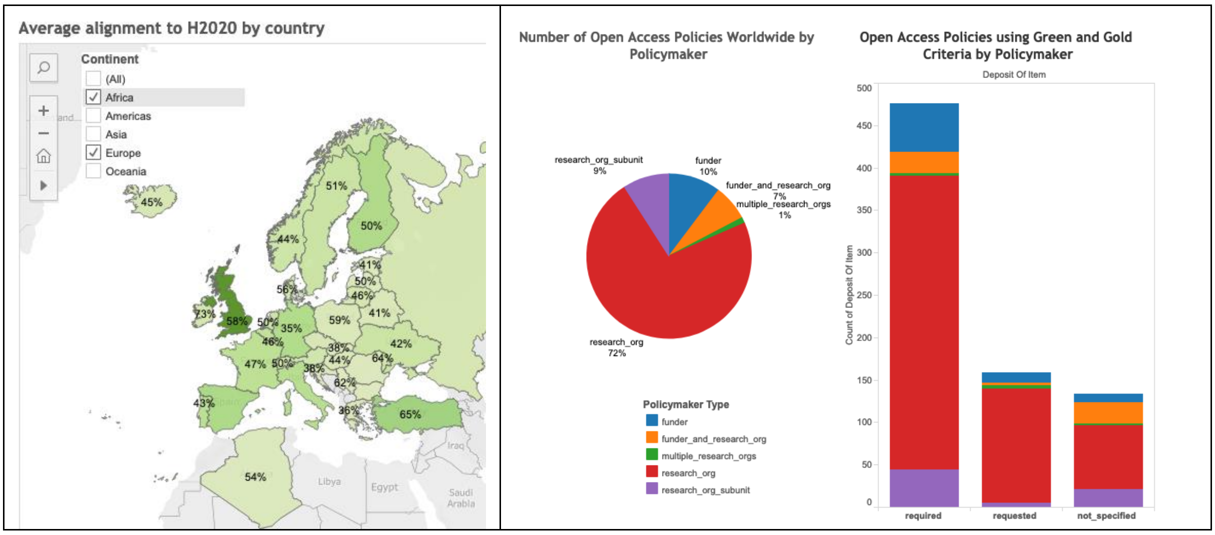

Figure 11: Screenshots from ROARMAP, left: Alignment of countries with H2020 Open Access policy, rights: OA policy by type of policy maker, status of OA mandate by policy maker. (http://roarmap.eprints.org/ 28 June 2019)

In spring 2018, the European Union published the Open Science Monitor (OSM), which should become a central tool for measuring the progress of Open Science in Europe. As much as the creation of a European "Open Science Monitor" is urgently needed, the disappointment in the Open Science community was that the data and methods underlying the instrument were not completely openly accessible. This is because some of the data and methods originate from the Elsevier/SCOPUS data set, or similar proprietary systems, which can only be further processed and evaluated by the owners themselves and some selected research groups[225]. The organisations responsible for the Monitor explained that they do not yet have enough open data sources to measure Open Science, and the European Commission assured that with the establishment of the European Open Science Cloud, monitoring will become easier. Until then, "we are dependent on actors giving access to data sources, which are useful for the tracking and monitoring of Open Science practices"[226].

The issue here is that **monitoring infrastructures** are powerful actors in policy negotiations and grassroots Open Science activists feel, that too much power still lies with individual corporations that monopolise both the data for indexing scientific knowledge and the evaluation of scientific performance. How difficult and politically questionable it is to conduct balanced and critical research on science - let alone cost and benefit calculations - based on these closed data sources has already been noted several times. All too often, distortions lying within the data (e.g. dominance of Anglo-American publication organs, discrimination against certain subjects and publication formats, ...) up to the distribution of research funds have been reproduced and reinforced a highly biased view on the global science system. It should therefore be in the interest of nation states with a developed STI system to build alliances for open research information systems based on open research infrastructures, and to be involved in the development of internationally valid and balanced metrics. So far, we could not identify any formal diplomatic or foreign policy dimension in

[225] The Lisbon Council, ESADE Business School, CWTS Leiden University, & Elsevier (2018): Open Science Monitor Methodological Note. Retrieved from European Commission website: https://ec.europa.eu/info/sites/info/files/research_and_innovation/open_science_monitor_methodological_note_april_2019.pdf as accessed 01 June 2019.

[226] Open Science Monitor website. Retrieved from: https://ec.europa.eu/info/research-and-innovation/strategy/goals-research-and-innovation-policy/open-science/open-science-monitor/about-open-science-monitor_en as accessed 01 June 2019.

ongoing initiatives for Open Science monitoring – there are clearly other priorities, such as bringing together data on Climate Change, collecting information on SDG compliance and so forth, but it would be important to learn from open data advocacy in those domains for the transnational collaboration of research information systems.

6.2.2 Different velocities and exclusive concerns

When Moedas called for more openness and diplomacy to improve the European science and innovation system as well as finding solutions for pressing societal problems in 2015, some policy makers in Member States or associated countries were feeling blindsided. Some have just tediously transformed their national research system to a performance-based funding model, that builds on international competition and patents rather than on cooperation and openness. Whereas others might have thought that the EC is moving rather slowly: in 2017 Aarhus University in Denmark initiated a novel Open Science platform together with leading industry to collaboration on "industrially relevant basic research. Researchers and companies from all over Denmark publish all their results and data on the innovative Open Science platform, where the information is available free of charge to everyone interested".[227] There is a danger that a system with a universal vision is trying too hard to integrate multiple velocities into processes and thus creates asymmetries. On the other hand, there is an armada of industries, from Google[228] and Amazon[229] downwards now increasingly involved in co-shaping and harvesting the knowledge economy, so policy makers are obliged to counter the privatization of publicly funded research or at least turn this kind of commodification from shareholder benefits to public benefits.

The European Research Area ERA already serves as a good instrument in balancing those differences, as it is binding to Member States (Lisbon Treaty) even if the implementation of the roadmaps is going slower than originally intended. The OECD report "Making Open Science A Reality"[230] already stated "Open Science policies should be principle-based but adapted to local realities". Therefore, the science diplomacy skills needed revolve around bringing together the right stakeholders to carefully design roadmaps, knowledge transfer and feedback loops. Multi-level Open Science policy making should be based on best practices and examples how the strict duality of open versus closed, cooperative versus competitive can be relaxed towards a better understanding of the dynamics and co-constructive effects of knowledge / science commons and related resources. This should also include a broad understanding of contextual matters, such as digitalisation, cybersecurity, (higher) education systems and local (socio-political) cultures. The novel concept of Data Diplomacy is already integrating some of those matters, however it is not yet mature enough to tackle Open and FAIR data realms.

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[227] Patent Free Campus. Retrieved from: http://scitech.au.dk/en/about-science-and-technology/current-affairs/news/show/artikel/aarhus-universitet-og-industrien-aabner-patentfri-legeplads/ as accessed on 01 June 2019.

[228] Google Scholar. Retrieved from: https://scholar.google.com/ ; Google Dataset Search. Retrieved from: https://toolbox.google.com/datasetsearch as accessed 01 June 2019 etc.

[229] For example Amazon Web Services. Retrieved from: https://aws.amazon.com/de/ ; and Amazon Mechanical Turk. Retrieved from: https://www.mturk.com/ as accessed 01 June 2019, etc.

[230] OECD (2015): Making Open Science a Reality. OECD Science, Technology and Industry Policy Papers No. 25.

6.3 Issues of multi-level policy making: conclusions

The stakeholder landscape in the Open Science theatre has changed dramatically in the last 30 years. From dedicated institutions advocating data sharing and access to scientific information in the second half of the 20th century, via grassroots initiatives and first open infrastructures of open access in the 1990s, the establishment of global collaborations with the goal to create science commons such as the Human Genome Project at the turn of the Millennium, towards a broad, already hardly comprehensible variety of advocacy actors on international and national level, policy implementing organisations such as funders and research organisations, to the increased involvement of publishing and content service industries in the 2000s and 2010s. And the journey continues, some interview partners would even say it is just the beginning. Even though grassroots bottom up principles sometimes clashed with policy top down strategies and regulations, the entanglement of all levels currently leads to complex but increasingly robust policies and infrastructures for the transition towards Open Science. Whereas there is less and less resistance and opposition to Open Access to Scholarly Publications and it has become more a matter of negotiating the models, there is still a lot of scepticism towards the realisation of Open Research Data and respective infrastructures. A big challenge seems to be the bridging and coordination of international national and research field interests, all of which are represented in different velocities, with different stakeholders, in different arrangements. Even though most of the described processes happen on the level of international scientific cooperation, science diplomacy aspects are mostly perceived by actors not from the domain of foreign relations, but from the research domain, even though some of the topics, e.g. Plan S, received quite a lot of attention by international news media and science media.

With Open Science being part of a bigger, global movement of Open Culture, which also includes the development of Free and Open Source Software, access to cultural heritage, and the promotion of participatory and inclusive policies and commons, it also represents a positive political agenda. This is not immediately comprehensible: where some see it as a risk to invite free riders to parasitize our knowledge markets, others regard it as fundamentally neoliberal exploitation of public knowledge, and again others see it as necessary fundament for scientific integrity and sustainable knowledge production. Best practices show that there might be aspects of all three perspectives assembled in success stories, it is just a matter of setting the right priorities. In the next years to come, with all the challenges of making Open Research Data a reality, it will therefore be vital to find sound ways of international coordination, that is aware of asymmetries and different local realities and capable of dealing with it in a productive way.

7. How is the case changing our understanding of Science diplomacy?

From the discussion of the de-facto governance issues and the various stakeholders and interfaces this report concludes that

- European Open Science priorities are seen internationally rather positively, commitments and partnerships are increasing, but the implementation is still cautious.
- Open Science is rarely on the diplomatic agenda, and science diplomacy is only marginally used for international orchestration and coordination, even though advocates would welcome the involvement of foreign policy actors.
- Pressing issues, like the harmonization of standards and legal frameworks for the exchange of data ('data diplomacy'), as well as new opportunities for innovation have not yet been discussed in the light of diplomatic action for Open Science.
- The rare instances of involvement of diplomatic institutions has mostly been triggered by local advocates and is often not sustainable.

Open Science strategies, in particular Open Access policies and Open Data infrastructures are not yet regarded as central topics, action points or instruments of- and for science diplomacy in foreign policy realms. Their potential link was reflected in most case interviews as "inexistent", "unanticipated", but "interesting" and "improvable". So, the push for putting the bundle of Open Science (and Open Innovation) topics on the diplomatic agenda is rather unidirectional, and still remaining rhetoric, tracing back to the original quotes of Carlos Moedas[231], and occasional mentions in literature on innovation diplomacy[232]. Actors at Open Science and Science diplomacy interfaces have a rather asymmetrical awareness of scientific and diplomatic issues. Whereas on the one hand stakeholders from the research systems as well as stakeholders from research policy organisations call for more diplomatic support for the international development and coordination of Open Science in our case interviews, persons acquainted with diplomacy realms, as well as persons working in foreign relations were on the other hand rather hesitant to either give examples of international Open Science collaboration or imagine the necessities of international cooperation for a transition to Open Science.

In view of the fact that Europe and other world regions are currently very actively implementing far-reaching changes in the research system based on Open Science principles, it will be important to not only accompany and support them from a foreign policy position, but also to understand the potential and the challenges of Open Science for regional and international interests – especially those going beyond science and research towards culture and innovation systems. Furthermore, issues of international orchestration of Open Science deserve more attention. Just as large international scientific infrastructures or organisations, such as CERN or SESAME, need the political backing, the implementation of e.g. open access infrastructures as well as policies - so that they can enfold their benefits and challenges can be tackled - need international policy alignment

[231] Moedas, C., Directorate-General for Research and Innovation (European Commission) (2016): Open innovation, open science, open to the world. Retrieved from European Commission website: https://op.europa.eu/en/publication-detail/-/publication/3213b335-1cbc-11e6-ba9a-01aa75ed71a1 as accessed 01 June 2019.

[232] Carayannis, E. G., D.F.J. Campbell (2011): Open Innovation Diplomacy and a 21st Century Fractal Research, Education and Innovation (FREIE) Ecosystem: Building on the Quadruple and Quintuple Helix Innovation Concepts and the "Mode 3" Knowledge Production System. Journal of the Knowledge Economy, 2(3), pp. 327–372.

(national Open Science roadmaps, data exchange policies …) sometimes even synchronisation (responsible performance metrics, big deal negotiations, ….).

Future science diplomacy efforts with and for Open Science should therefore include planning of the following actions:

1. Understanding and mediating the benefits (and challenges) of Openness
2. Bringing together and managing multi-level, multi-national, multi-format stakeholder negotiations

Moreover, since Open Science is such a cross-cutting issue, other science diplomacy efforts should always consider this dimension in their fields of action (e.g. how could data be best shared openly and immediately when epidemics spread or crisis hit regions ….).

1. Understanding and mediating the diverse benefits and challenges of Open Science

To many policy makers it may seem rather risky and naïve to promise better science and innovation with Open Science in a time of increased resource scarcity and global competition. To others it may seem inherently paradox to promote openness at the same time as enforcing intellectual property regimes, counting patents to measure STI performance, as well as enforcing strict regulations of governance of access to personal information on content and media corporations. How can science be described as main driver for competitive advantage in our knowledge economies, and simultaneously be shared openly with the world?

The main reason why European Union policymakers (and other advocates) adapted and reformulated Open Science concepts into political strategies is twofold: 1) they are foreseeing better commercial exploitation of research results to speed up and scale up investments in innovation and the creation of new markets[233] and 2) they are understanding that global challenges such as climate change, hunger and peace can only be tackled in collaboration and based on high quality evidence, which partly comes from science. It seems diplomats are well suited to cope with such issues of competition and cooperation. In that regard Science diplomacy is defined as facilitator for the "openness to the world" while attending to Europe's interests[234].

When asked about potential roles and functions of science diplomats in the global Open Science arena, our interview partners put forward the following suggestions. In order to make sense and grasp an opportunity of this presumably paradox strategy, science diplomats could **take the position of mediating the cross-border exchange of experiences of - and the development of**

- National open access and open infrastructure strategies and policies in line with European and national STI policies (and other wider agendas, such as the Sustainable Development Goals). This also means learning from political processes in other world regions, especially from Latin America and its successful, long standing Open Access policy and infrastructure coordination.
- Legal frameworks and necessary conditions for sustainable knowledge economies, science commons and their commercial exploitation (licensing, clearing, public-

[233] This neo-liberal adaptation of Open Science has also been criticized, for its shift of the power game and the "Open-Washing" of inequalities. See: Mirowski, P. (2018): The future(s) of open science. In: Social Studies of Science, 48(2), pp. 171–203; Tkacz, N. (2014): Wikipedia and the Politics of Openness. University of Chicago Press.

[234] Moedas, C., Directorate-General for Research and Innovation (European Commission) (2016): Open innovation, open science, open to the world. Retrieved from European Commission website: https://op.europa.eu/en/publication-detail/-/publication/3213b335-1cbc-11e6-ba9a-01aa75ed71a1 as accessed 01 June 2019.

private partnerships, …) For example, how to best balance European and national copyright legislative to accommodate scientific data sharing and secondary (re-)usage rights of scientific publications? How to advocate innovation building on Open Science, learning from best practices?[235]
- Support open monitoring infrastructure and grounds for international or regional consortia to negotiate new deals with publishers as well as develop new open access publishing models strongly rooted in regional STI specialization domains.
- Options to tackle issues of brain drain and widening participation in European STI regimes, including initiatives to develop skills and trainings for knowledge sharing and re-use, and thus knowledge transfer.
- New incentive and reward systems in science. Closely linked to initiatives for open monitoring infrastructures, diplomatic entities could enable or support grants or residency programmes for Open Science scholars and practioneers tackling grand societal challenges in cooperation with regional research and education organizations.

2. Bringing together and managing multi-level, multi-national, multi-format stakeholder negotiations

Since one of the biggest concerns by advocates was that Open Science is still a too fragmented political debate and its implementation is not discussed and coordinated enough across nation states, consequently its uptake is too slow, and its socio-economic potential is thus narrowing. With new political pressure in the system, e.g. the commitment of G7[236] or all European Member States in 2016[237] to make Open Access a reality by 2020, as well as the implementation of Plan S the political debate has gained momentum. However, as stated by several stakeholders from the science system, even though the political will to international cooperation has been stated several times in various instances, the implementation of this new dimension to science diplomacy is still in the beginning. In Europe the problem is that most political activities and dialogue are organized top-down from Brussels, and there is not much systematic political pursuit between the Member States and associated countries. On a global scale – even though all continents are eagerly

[235] Entrepreneurship building on Open Science and science/digital commons is mostly still in its infancy or unrecognized by politics, similarly to the field of Open Data. Missing is the connection of ideas with markets, especially in the creation of services around open tools and instruments, or data sharing. Regions and neighbouring countries could develop strategies to link activities within their complementary areas of specialization, announce prizes for best open science business ideas for public or hybrid goods, and thus foster regional cooperation. A famous example for a best practice is the Human Genome Project. The public and private money invested, has already been multiplied many times over in revenues of genome-based research and biotechnology, and triggered uncountable improvements in health. See: Drake, N. (2011): What is the human genome worth? In: Nature, news.2011.281.; Gitlin, J. M. (2013): Calculating the economic impact of the Human Genome Project. Retrieved from Genome.gov website: https://www.genome.gov/27544383/calculating-the-economic-impact-of-the-human-genome-project as accessed 01 June 2019.

[236] The G7 established an Open Science Working Group (OSWG) in 2016 to share expertise, best practices and to develop Open Science principles together. See: G7 Science and Technology Ministers (2016): Tsukuba Communiqué: G7 Science and Technology Ministers' Meeting in Tsukuba, Ibaraki 15-17 May 2016. TRENDS IN THE SCIENCES, 21(8), 8_72-8_75; G7 Science Ministers (2017): G7 SCIENCE MINISTERS' COMMUNIQUÉ. Retrieved from: http://www.g7italy.it/sites/default/files/documents/ANNEX%204_WG%20Open%20Science/index.pdf as accessed 01 June 2019; G7 Science Ministers (2017): Annex 4: Expert Group on Open Science. Retrieved from: http://www.g8.utoronto.ca/science/2017-annex4-open-science.html as accessed 01 June 2019.

[237] Ministerie van Onderwijs, C. en W. (2016, April 4): Amsterdam Call for Action on Open Science—Report—Government.nl [Rapport]. Retrieved from: https://www.government.nl/documents/reports/2016/04/04/amsterdam-call-for-action-on-open-science as accessed 01 June 2019.

observing European Open Science activities – there is even less exchange between nation states, with exception of Latin America[238].

The present case study on (the infancy of) Open Science Diplomacy teaches us how science diplomacy and international science cooperation could and should overlap, as they could share the same objectives and would reasonably complement each other. With Open Science the main political priority is to get as many on board as possible, to share benefits as well as responsibilities by balancing or bridging many global rifts, such as developed / emerging knowledge economies in Global North and South, centralized / federated science systems, hence also international organisations / domestic science policy within more or less democratic governance, market orientation and intellectual property regulations / science and knowledge commons, English / multilingual systems and local languages, cheap and high bandwidth internet access / expensive and low bandwidth internet, slow / rapid uptake of Open Science, and many more[239].

Here, Open Science advocates need to "harness diplomatic actions and skills"[240] or cooperate with diplomats to broker and push for a sustainable transition across borders and socio- as well as geo-political interests. In the Open Science arena, the link from scientific conduct and research performance to transnational impact and innovation potential in international cooperation still must be highlighted. Policy makers and research administrators not only want evidence for the benefits and limits of Open Science, they also need opportunities to meet with stakeholders from research, civil society and industries to negotiate priorities and strategies for an Open Science transition – and all of this in the light of a highly dynamic global development.

The roles and skills of science diplomacy are to create such (formal or informal) settings, bringing together and managing multi-level, multi-national, multi-format stakeholder negotiations, sometimes even under pressure e.g. because of a health crisis[241]. The diplomatic capacity to bridge international and national interests, the diplomatic tools to work with and reduce imbalances, the diplomatic channels to assemble, inform and advise policy makers, all these options are only marginally exploited for the global transition to Open Science until today. Open Science Diplomacy is much more than international research cooperation or "soft power"[242] information brokerage, as it has the potential to maximize political added value.

As Open Science is not a delicate political topic, one that has to be masked or hidden behind other actions, respective diplomacy can be very straight forward, not having to carefully avoid even its own unmasking. On the contrary, Open Science will only unfold its potential, when it is harnessed and negotiated as international research policy agenda that must cope with many asymmetries and insecurities. Moreover, a point all interview partners agree on: since Open Science impact stretches beyond academic realms and intervenes in culture and innovation systems, the "foreign perspective" needs to integrate this awareness. Being part of a much larger, global Open Culture movement Open Science

[238] In Open Access initiatives Latin America is also cooperating with other areas, such as with South Africa, see: Schöpfel, J. (2015): Learning from the BRICS. Open Access to Scientific Information in Emerging Countries. Retrieved from: https://hal.archives-ouvertes.fr/hal-01586530 as accessed 01 June 2019.

[239] This is very similar to science diplomacy for other cross-cutting issues such as the implementation of the Sustainable Development Goals, see: Saner, R. (2015): Science Diplomacy to support global implementation of the Sustainable Development Goals (SDGs) (Policy Brief No. 1; p. 4). UN-DESA.

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is more than just a science issue and has as normative framing the potential to change or even disrupt traditional cultural and socio-economic relations.

Measures for Future Open Science Diplomacy

If Open Science Diplomacy is defined as international political cooperation for the advancement of the transition towards Open Science, then actors in that domain will need the following measures in place:

- Points of contact and designated communication channels. Every state and organisation have their own ways of building outward relations, it might be through a science advice mechanism, via expert committees, spokespersons, etc., however, for future activities it will be important to designate a point of contact for (inter-)national or organizational Open Science coordination.
- Elaborated evidence and accessible information (including facts and figures from national and international Open Science activities) e.g. in the form of policy briefs and expert / country reports building on the understanding as there is neither one unique model of Open Science nor a unique set of metrics, but there are many shades that require robust local and international cooperation
- Open and transparent documentation systems and robust scientific analysis are the basis for any elaborated evidence.
- Training sets and materials for (science) diplomats and Open Science advocates with information about options of mutual support (including critical reviews of limitations and challenges)

Only with these and similar measures in place, the motto “open to the world” can manifest itself beyond the integration of more non-European actors in European Science funding.

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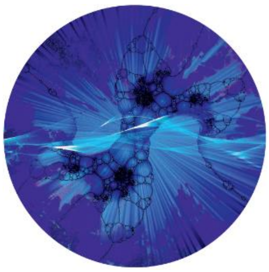
List of Interview Partners

Interview Nr	Governance Level of the interviewee	Country	Type of actor	Date of Interview	Format	Inter-viewer
1	EU	EU	Public administration	January 2019	Tel	KM
2	National	ES	Public administration	April 2019	Tel	KM
3	National	AT	Public administration	May 2019	F2F	KM
4	EU	EU	Public administration	May 2019	Tel	KM
5	International	FR	Non-governmental	May 2019	Tel	KM
6	National	India	Political	May 2019	Tel	KM
7	International	UK	Scientist	May 2019	Tel	KM
8	International	DE	Scientist	May 2019	Tel	KM
9	EU	ES	Scientist	May 2019	Tel	KM
10	National	MD	Public administration	May 2019	Tel	KM
11	National	AR	Scientist	June 2019	Tel	KM
12	EU	EU	Public administration	June 2019	Tel	KM
13	International	UA	Non-governmental	June 2019	Tel	KM
14	National	NL	Diplomatic service	October 2018	F2F	EA
15	National	NL	Public administration	October 2018	F2F	EA
16	International	DE	Non-governmental	June 2019	F2F	KM
17	National	NL	Science support / admin	November 2018	F2F	EA
18	International	AT	Non-governmental	June 2019	F2F	KM
19	National	NL	Science support / admin	January 2019	F2F	EA
20	National	NL	Science support / admin	January 2019	F2F	EA
21	International	BE	Private Sector	June 2019	Tel	KM

22	EU	EU	Diplomatic service	November 2018	F2F	AD
23	National	AT	Diplomatic service	November 2018	F2F	AD

USING SCIENCE FOR/IN DIPLOMACY
FOR ADDRESSING GLOBAL CHALLENGES



7. SESAME – a synchrotron light source in the Middle East: an international research infrastructure in the making

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1. Introduction

SESAME is short for "Synchrotron-light for Experimental Science and Applications in the Middle East" and is the first synchrotron light source in the Middle East of about 60 synchrotrons worldwide. It was developed under the auspices of the United Nations Educational, Scientific and Cultural Organization (UNESCO) and is now a multinational, interdisciplinary and independent research facility located in Allan in the Balqa governorate of Jordan northwest of the capital Amman towards the Syrian borderline. While the beginnings of SESAME reach back until the 1990s, the first two beamlines were installed in November 2017 (X-ray spectrum) and in April 2018 (infrared spectrum, IR). The research facility was opened on May 16th, 2017 and different groups from the region have started to conduct research at the beamlines.

SESAME was initiated in the late 1990s with the intention to foster scientific cooperation in a region of the world that has been torn by perseverant conflicts. The project is built on the idea that science can help to overcome barriers and cultural differences on the uniting ground of science and research. In that regard, SESAME is a paramount example to study the general research interest of S4D4C: How can science diplomacy foster international cooperation and help to tackle global challenges? And what can we learn from the example of SESAME about inducing and making use of research infrastructures for the benefit of international relations, intercultural understanding and economic and technological development within and beyond Europe? From that point of view, SESAME classifies as an example of "science in diplomacy" taking into account global challenges mainly in the form of peace and intercultural understanding. Needless to say, this case implicates as well a good deal of "diplomacy for science" (political activities to support international scientific cooperation) on the concrete level of implementation.

Within the terminology of S4D4C SESAME is considered primarily an instrument driven science diplomacy case, as opposed to science driven or foreign policy driven cases. Instruments driven cases refer to science diplomacy configurations that originate in funding mechanisms, science collaborations, or infrastructures. Therefore, this study takes particular interest in the funding structures and the contribution of institutional stakeholders and in that regard especially the role of the EU in comparison to other stakeholders. At the same time, this case shows also aspects of a science driven case. Science driven cases are science diplomacy configurations that originate in scientific or technological developments and as a consequence of their advancement involve and/or affect inter- or transnational cooperation or regulations (Open Science, FET flagships, specific expertise in a field of research): SESAME' primary goal is to serve a scientific purpose in the form of a users' synchrotron facility and in doing so it involves international actors and requires unique forms of international cooperation. By contrast, foreign policy driven cases are finally science diplomacy configurations that depart from political intentions or concerns usually with an international context (climate change, cyber security, and infectious diseases) and as part of that they involve scientific knowledge or advice. Therefore, the role of science in science driven cases is confined to the provision of knowledge to solve or regulate collective problems, which is not the focus of interest in this case.

Given this blending of an instruments and a science driven science diplomacy configuration, particularly two aspects are of relevance for the general research interest. First, since the structure has a fairly young history (1990s) and is still in the phase of development, the case provides the *opportunity to explore the critical transition phase from vision to reality* more closely. How does a project like SESAME come into being – what is crucial to master the steps from an initial idea to a research site with own routines and sustainable procedures? Furthermore, and as part of that, we can learn about the intentions and motives behind the initiation of such a project and we can ask: How do they maybe affect the success and further evolution of it? What are the main drivers and resources that carry such a project from the beginning to continuity and how does this change during the course of its advancement? What was the initial spark and which structures had to be developed to carry the idea into a physical reality? What conditions and circumstances might have been major challenges or obstacles?

Besides this interest in the evolution of SESAME as a fairly unique science diplomacy case, it also provides us with the opportunity to learn about science diplomacy on a more conceptual level. The discussion of science diplomacy is mostly led on rather general and associative understandings of science and diplomacy[1,2]. By contrast, SESAME provides a real-world example to study those concrete interactions and practices on the social micro level that we otherwise would broadly summarize and *synthesize* under the label science diplomacy. Therefore, this case study is also suitable to break the conceptions of science and diplomacy within the concept down to the level of individual building bricks. SESAME is a research site designed to bring together scientists from different regions and backgrounds not only in order to conduct research, but also in order to establish contact and communication channels that would otherwise not be possible. In this sense, SESAME provides an *analytical* case study (in contrast to synthetic), which allows our general imagination of science as a means for peace building to be examined and dissected on the "atomic" level of social practice and communication.

Similarly, the research interest in research infrastructures of this report is tailored to a science diplomacy perspective. It does not provide an understanding of SESAME as a technical facility as such. Therefore, it cannot do justice to the project of SESAME in all its dimensions and achievements. Finally, this report is not meant to reproduce the most prominent or dominant narratives about SESAME and to prove them either right or wrong. The story of SESAME often has been told as a story of hope and promising peace building effort in the Middle East. Yet, our due task is not to pick and choose a certain angle. Neither can we assess the "real" peace building outcomes of SESAME. There is not one single truth to be told about SESAME. There are many. The task here is to illustrate the narratives that constitute the project as a discursive and material reality, to highlight contradictions and variations and finally to work out how the external narratives may interact and impact the inner logic of the research site against the background of our specific science diplomacy research interest. In that, SESAME provides an institutionally clearly demarcated structure to study aspects of science diplomacy in a unique setting and as an example for bottom-up science diplomacy initiatives by scientists. Ultimately, we have observed immense commitment and endurance by an international group of scientists and staff from around the world to establish this research infrastructure under extraordinary conditions and to advance it into a success story. At the same time, it does not come as a surprise that the case of SESAME also absorbs and echoes the conditions and conflicts it came to address and transform[3].

[1] Royal Society (2010): New Frontiers in Science Diplomacy: Navigating the Changing Balance of Power. London: Science Policy Centre, The Royal Society.

[2] Ruffini, P.-B. (2017): Science and Diplomacy. A New Dimension of International Relations. Springer International Publishing.

[3] We would like to express our deep-felt gratitude to the members and associates of SESAME for the support, trust and willingness to share their perspectives and experiences with us, anonymity granted.

2. Case study background

2.1. Case description and context of the case

SESAME is an international research centre under the auspices of UNESCO that runs a third-generation synchrotron radiation facility (in short: *synchrotron*) in Allan, Jordan[4]. SESAME is the first synchrotron in the Middle East and in an Arab country and the first synchrotron ever that was meant to be composed of modules that were shipped and reconstructed to a different country[5]. A synchrotron is a technically highly sophisticated light source that enables to study matter at the molecular structure such as proteins, crystals or viruses. Synchrotrons have become a substantial, highly automatized state-of-the-art device in order to conduct cutting-edge research in a large variety of disciplines[6]. Synchrotron radiation user facilities have decisively advanced scientific understanding in the life sciences and material sciences in the last decades and allow for a great variety of experimental applications at different wavelengths in the spectrum of light.

Synchrotron light sources are not only technically sophisticated, but costly large research infrastructures. Therefore, these facilities are typically run by public, state-owned or even intergovernmental research (funding) organizations. The vast majority of the approximately 60 currently operational synchrotrons worldwide are located in industrialized countries.

Figure 12: Distribution of synchrotrons with operational MX beamlines worldwide in 2016[7]

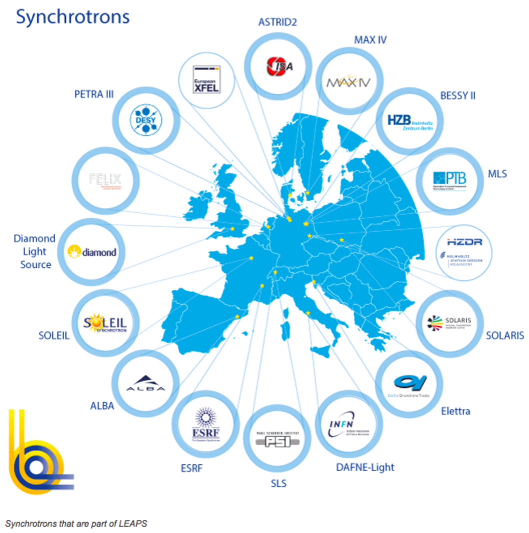

Figure 13: Distribution of major synchrotron facilities across Europe that are part of LEAPS[8] (League of European Accelerator-based Photon Sources)

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[4] The location was chosen due to the fact that scientist from all other member countries could travel to Jordan without restrictions, while this was not the case for most of the other member countries.

[5] Interview 3

[6] Owen, R., J. Juanhuix, M. Fuchs (2016): Current advances in synchrotron radiation instrumentation for MX experiments. In: Archives of Biochemistry and Biophysics, 2016, 602, pp. 21-31.

[7] Ibid.; Image retrieved from: https://ars.els-cdn.com/content/image/1-s2.0-S0003986116300716-gr1_lrg.jpg

[8] LEAPS: European Facilities. Retrieved from: https://www.leaps-initiative.eu/synchrotrons/european_facilities/

The United States alone own more than 10 synchrotron facilities (with different technical properties and applications, however), so does Japan. The biggest share of facilities worldwide rests in Europe (namely Germany, France, Switzerland, the UK, Italy, Sweden, Russia, Denmark, Netherlands and Spain; see Figure 12[9]). Similarly, most industrialized countries dispose of at least one synchrotron radiation user facility or have access to one, while there are only very few facilities in the less technologized regions of the world (Figure 12). Namely Brazil and Taiwan started to design own synchrotrons in the late 1980s and dispose of internationally competitive machines, at the time of research (2019)[10]. Lately, they were followed by Singapore, India, Thailand and Poland that inaugurated their own synchrotrons during the last two decades. Iran and Armenia have announced their intention to build own facilities but have not realized these plans so far (see grey pins in Figure 14). Turkey is currently building its first IR-FEL facility (operating in the infrared-spectrum)[11].

Figure 14: Synchrotrons across Europe and the Middle East[12]

Figure 15: Distribution of synchrotrons that offer X-ray radiography

Against the background of the uneven distribution of synchrotrons worldwide (Figure 12; Figure 15), the initiation and successful realization of SESAME as the first operational synchrotron in the Middle East is fairly exceptional. This is true not only with regards to its location, yet even more so with regards to its member composition. Currently, the member countries of SESAME are Jordan, Turkey, Israel, the Palestinian Authority, Pakistan, Iran, Cyprus and Egypt, none of them possessing a synchrotron by themselves (Figure 16).

[9] The map shows the distribution of synchrotrons that run macromolecular crystallography (MX). MX is a specific synchrotron technology that operates in the X-ray spectrum and allows to study proteins and viruses. MX accounts for only about half of the existing synchrotron facilities worldwide, but represents a fair proxy for the distribution of operational synchrotrons worldwide. cf. Owen, R., J. Juanhuix, M. Fuchs (2016): Current advances in synchrotron radiation instrumentation for MX experiments. In: Archives of Biochemistry and Biophysics, 2016, 602, pp. 21-31.

[10] Interview 3; Smith, C. L. (2012): Synchrotron Light and the Middle East: Bringing the Region's Scientific Communities Together Through SESAME. In: Science & Diplomacy, 1(4).

[11] TAC: TAC Synchrotron Radiation Facility (SR) Project. Retrieved from: http://tac.en.ankara.edu.tr/sr/

[12] Lightsources.org: Light sources of the world. Retrieved from: https://lightsources.org/lightsources-of-the-world/

Figure 16: Member countries of SESAME[13]

SESAME has been modelled on the example of CERN mainly with regards to its founding ambition and political vision[14]. CERN is the European Organization for Nuclear Research, founded in 1954 to foster trust, international cooperation, and open up room for building mutual understanding across the borders of (formerly) conflicted parties on the common ground of scientific interest and research. Technically and scientifically, there are major and evident differences between CERN and SESAME. Most prominently, CERN is geared towards fundamental research in high-energy physics and it has become the largest particle accelerator in the world spearheading ground breaking research and innovations. By contrast, SESAME is designed as a synchrotron *user facility* that provides technical units for a still sophisticated, yet rather standardized set of experimental applications. Regarding its purpose, SESAME is structurally better to be compared with synchrotron user facilities such as SOLEIL in France or Diamond Light Source in the UK (Figure 13). However, SESAME comes only at a tiny fraction of CERN (and of the other named synchrotrons SOLEIL and DIAMOND) with regards to almost every structural, financial and technical aspect (number of beamlines and experimental stations, staff, resources etc.).

Just like CERN, SESAME has been founded on the vision to increase international cooperation between scientists in a conflict-affected region[15]. And similar to CERN, SESAME has been founded under the auspices of UNESCO, therefore being instituted as an intergovernmental organisation from the very beginning. According to the research site's own account "SESAME will foster closer links between peoples with different traditions, political systems and beliefs, in a region where better mutual understanding is much needed."[16] Additionally, the intention behind SESAME is not only to establish new links and channels of communication between Arab countries, Israel, Iran, Turkey, Cyprus, Pakistan and others on scientific grounds, but also to promote scientific excellence, education and

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[13] SESAME: Members and Observers of SESAME. Retrieved from: http://www.sesame.org.jo/sesame_2018/about-us/members-sesame

[14] Smith, C. L. (2018): Science Beyond Boundaries: SESAME and the International Cooperation. In: S. Abousahl, W. Plastino (Eds.): International Cooperation for Enhancing Nuclear Safety, Security, Safeguards and Non-proliferation–60 Years of IAEA and EURATOM, pp. 175–185. Berlin, Heidelberg: Springer Verlag.

[15] Stein, J. A. (2002): Science, technology and European foreign policy: European integration, global interaction. In: Science and Public Policy. 29(6), December 2002, pp. 463–477.; Krige, J. (2005): Isidor I. Rabi and CERN. In: Physics in Perspective, June 2005, Volume 7, Issue 2, pp. 150–164.

[16] SESAME (2010): An international centre for research and advanced technology under the auspices of UNESCO. Retrieved from: SESAME website

technological development in the Middle East and therefore to represent a driving force also for the economic development in the region[17].

2.2. Research interest and methodological approach

Synchrotrons such as SESAME are captivating technologies from a scientific point of view. They produce mesmerizing insights on the smallest scale of the mechanisms of life that would otherwise not be perceptible to the naked eye. While the focus of this report is obviously not on the technological aspect of synchrotrons, I would like to provide a general and brief understanding of the technology in the following section to give a general idea of its relevance today (Section 2.1). However, this report is primarily interested in SESAME as an example of science diplomacy and therefore looks at the inner workings of the international research centre with the explicit ambition of using science to further intercultural understanding. On the one hand, this case is therefore theoretically demarcated by the institutional and member structure of SESAME. On the other hand, our research interest has to go beyond these institutional limits in taking a look at the more encompassing actor network around SESAME. We look at SESAME both as an institutional structure and ask furthermore, how it is related to (and embedded in) the global synchrotron community, to academia and researchers in the region and in Jordan. Which actors and/or networks have been in support of SESAME and which structures have been potentially affected by SESAME, already? How do the aspirations behind SESAME act out and are tangible for researchers in the region? What is the character of the governance system and what kind of power relations can we observe? Since SESAME has been in the process of its establishment, its institutional structure has changed and evolved only recently. As part of our interest in the actors and governance structure it seems necessary to take a closer look at the evolution of SESAME in the next chapter, before elaborating on the current constitution and actor relations in chapter 4.

We have applied a threefold methodical approach to do the research for our case study. We started out with desk research taking into account a number of lengthy and rich accounts on SESAME by involved parties. These publications cover mainly the evolution of SESAME. They are provided by former directors of the SESAME Council and therefore contain insights from an invaluable first-hand experience. However, those publications are only few, while there is a growing number of articles that takes an interest in SESAME as an example of science diplomacy. They usually take a journalistic perspective, while there is almost no academic research being done and published about the research site itself. As a second line, we generated own data. We talked to actors from all involved stakeholder groups (Council members and committee members, the current president, the director and members of the directorate level, engineers and beamline persons responsible, scientific users, administration staff and one of the founding fathers of SESAME); only with some were we able to record the interviews usually of more than 1.5 hours (5 in-depth interviews, unfortunately only 4 are in the consortium data base). Thirdly, as part of our data acquisition and in order to gain a personal impression, we have visited the facility and we have attended one of the yearly user's meetings in Amman, Jordan (December 2018). Furthermore, we visited the Council meeting in December 2018 at the premises of UNESCO in Paris and had the chance to talk to a number of Council representatives (Member States and observers status).

[17] Smith, C. L. (2012): Synchrotron Light and the Middle East: Bringing the Region's Scientific Communities Together Through SESAME. In: Science & Diplomacy, 1(4).

2.3. Technical background of the case

A synchrotron is a type of particle accelerator that is built to produce very brilliant light. Synchrotron light is electromagnetic radiation that is obtained when forcing accelerated particles on a curved path. For this purpose, usually electrons are accelerated to almost light speed and the energy levels of these particles are further built up to the range of several Giga electron volt (GeV)[18] in a storage ring. The particles are forced on a curved path by magnetic fields and the synchrotron light can be channelled off by insertion devices into subsequent laboratory instruments. Synchrotron light is sought for its exceptionally high brilliance and intensity (also called brightness). The wavelengths of synchrotron radiation range from ultraviolet, infrared to X-rays, therefore: invisible light (these wavelengths are much shorter than those of visible light).

Synchrotrons have been originally constructed for basic research in high-energy physics, but they have become an important and rapidly developing experimental research device in many disciplines until today. Synchrotron light has been produced since the 1950s first with the intention to conduct research on the structure of particles. Synchrotron light is employed in many different laboratory applications (e.g. spectroscopy, microscopy, diffraction experiments etc.) across many disciplines and research fields in the natural sciences, namely medicine, biology, material science and archaeology[19].

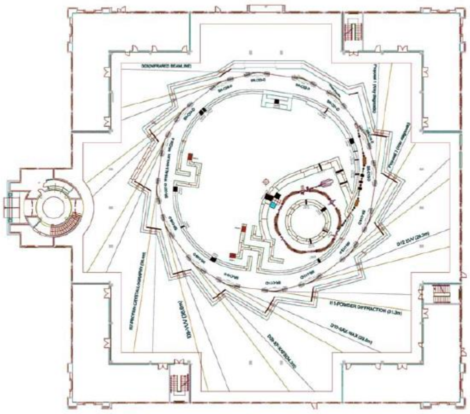

Figure 17: Schematic outline of the SESAME synchrotron facility with storage ring[20], photo of storage ring, December 2018.

The energy level and the scope of synchrotron light source facilities varies widely depending on the intended purpose and desired wavelengths of the light: it varies from a circumference between several meters up to a few kilometres. SESAME's synchrotron spans a circumference of 133 meters and operates currently on 2,5 GeV. In that, it compares with the ANKA synchrotron in Karlsruhe, Germany, the Canadian Light Source or Solaris in Krakow, Poland. International top-notch synchrotrons such as ESFR

[18] Standard unit of measure in high energy physics for determining the energy of accelerated particles.

[19] To get a more expert impression about the functioning of synchrotrons, please refer to the various introductory material online. On SESAME specifically please refer to http://www.sesame.org.jo/sesame_2018/about-us/information-material

[20] SESAME (2010): An international centre for research and advanced technology under the auspices of UNESCO. p. 4.

(circumference of 844m), APS (at Argonne National Laboratory, 1104m) or PETRA III (at DESY, 2304m) operate on 6 to 8 GeV and usually offer between 30-50 experimental stations and beamlines. While SESAME does not keep up with these facilities, it is nevertheless internationally competitive in terms of the quality of the two experimental beamlines that are currently provided[21].

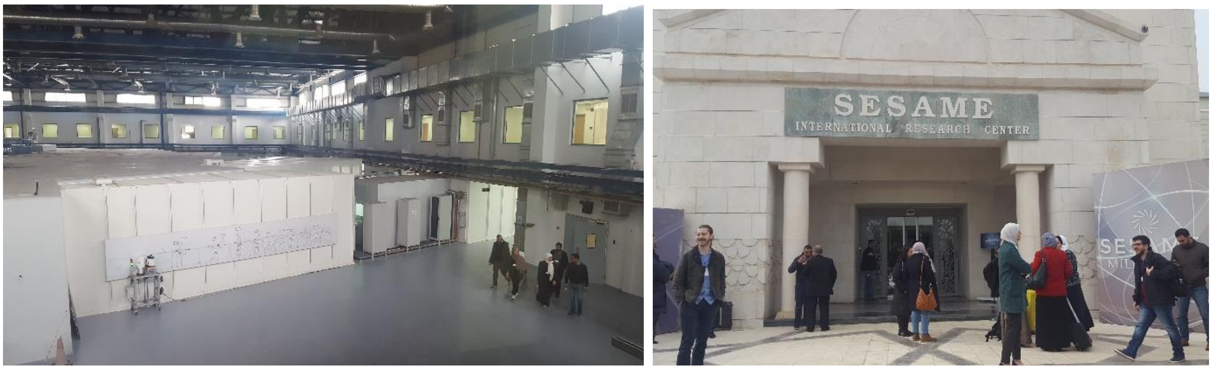

Figure 18: The SESAME facility entrance (right) and storage ring (left), Dec 2018 (photos taken by Charlotte Rungius).

3. History and Evolution

SESAME is a rare and telling science diplomacy example particularly with regards to its evolution. We distinguish three phases in the evolution of SESAME: 1. identification phase (general promotion of vision and search for support), 2. institutionalization phase or interim phase (initiation of the institutionalization process; inauguration of the Council of SESAME; search for structural support), and 3. maturity phase (physical realization of the research site; construction of building, installation of beamlines, the running of a synchrotron user facility). We have based our evidence mainly on the in-depth accounts of those who have been in charge of its establishment and operation. Herwig Schopper is former Director General of CERN as well as DESY (German Electron Synchrotron) and was integral part of the project. He provided a comprehensive description of SESAME's history[22]. Furthermore, Chris Llewllyn Smith, following Herwig Schopper as president of the SESAME Council has similarly provided a report on the history, ambitions and the challenges in SESAME's young past[23]. We have enriched this data basis on the evolution of SESAME with interviews that we conducted with staff and stakeholders.

3.1. 1st Phase (1980s-1999): Identification Phase

The evolution of SESAME can be regarded as the product of two different lines of initiatives that have coincided[24]. On the one hand, the idea for a synchrotron light source in the

[21] Interview 4

[22] Schopper, H. (2017): The light of SESAME: A dream becomes reality. In: RIVISTA DEL NUOVO CIMENTO. 40(4), pp. 199–239.

[23] Smith, C. L. (2018): Science Beyond Boundaries: SESAME and the International Cooperation.

[24] Interview 4

Middle East dates back to the 1980s[25], when several countries started to develop an interest in designing and building national synchrotrons[26]. The Pakistani physicist and Nobel Prize winner Abdus Salam first promoted SESAME. Salam was an advocate for the idea of international collaboration, science and technology transfer and a general enhancement of scientific efforts. He "proposed the creation of an 'Arabian Gulf University' at Jeddah in Saudi Arabia, which included a synchrotron light source as part of the plan"[27]. But initiatives to design (national) synchrotrons e.g. in Saudi-Arabia or Bahrain did not take hold.

On the other hand, SESAME also traces back to the initiative of a few distinguished high-energy physicians from the US and Germany, namely and most importantly Herman Winick (SLAC[28]) and Gustaf Adolf Voss (former director of DESY[29]), who were both members of the BESSY I[30] (German synchrotron in West Berlin) advisory committee in 1997. As such they learnt about the plan to shut down the facility in the 1990s in the wake of German Reunification[31]. BESSY I should be decommissioned due to the establishment of a more powerful one at a different location in Berlin-Adlershof, what was previously East Berlin. Since it would have been too costly to maintain both facilities and since the old facility would therefore not be used anymore, Winick and Voss made the case for recycling the Berlin synchrotron BESSY I. The relevant parts of BESSY I were the 0.8 GeV second-generation storage ring and injector system[32]. It would have been the first time ever that a synchrotron was recycled. However, initially it was not intended to ship it to the Middle East. There were plans to send it to Eastern Europe, to Poland or Romania[33].

Winick and Voss revived Salam's vision[34] and promoted the idea to donate parts of BESSY I to the Middle East. But the first approach towards the Middle East and North Africa (MENA) region did not show any interest in the project[35]. This is where another important group joined the process. Only two years earlier the committee for Middle Eastern Scientific Collaboration (MESC) was founded, consisting of scientists around CERN who wanted to embrace Arab-Israeli collaboration. Initiators were the physicists Sergio Fubini and Eliezer Rabinovich[36]. It was at a MESC seminar in November 1997 in Turin (Italy) where Voss' and Winick's idea aroused great interest among the 31 scientists from Israel and the Arab

[25] Khan, S. A. (1999): Salam's bright idea. In: Physics World (Letters to the Editor). 12(11), p. 15.

[26] Interview 3

[27] Schopper, H. (2017): The light of SESAME: A dream becomes reality. In: RIVISTA DEL NUOVO CIMENTO. 40(4), p. 15

[28] SLAC is short for "Stanford Linear Accelerator Center" and it is a U.S. Department of Energy (DOE) Office of Science laboratory operated by Stanford University.

[29] DESY is short for "Deutsches Elektronen Synchrotron" and is located in Hamburg, northern Germany.

[30] In operation from 1982 until 1999, West Berlin based BESSY I (Berlin Electron Storage Ring Company for Synchrotron Radiation) was Germany's first electron storage ring facility
HZB (2019): Die Historie der Berliner Elektronen-Speicherring Gesellschaft für Synchrotronstrahlung (BESSY). Retrieved from: https://www.helmholtz-berlin.de/zentrum/locations/campus/historie/bessy/index_de.html as accessed 17 June 2019.

[31] Schopper, H. (2017): The light of SESAME: A dream becomes reality. In: RIVISTA DEL NUOVO CIMENTO. 40(4), pp. 199–239.; Interview 3, 2018

[32] Einfeld, D., S. S. Hasnain, Z. Sayers, H. Schopper, H. Winick (2004): SESAME, a third generation synchrotron light source for the Middle East region. In: Radiation Physics and Chemistry. 71(3–4), p. 694. https://doi.org/10.1016/j.radphyschem.2004.04.130

[33] Interview 1; Interview 4

[34] Schopper, H. (2017): The light of SESAME: A dream becomes reality. In: RIVISTA DEL NUOVO CIMENTO. 40(4), p. 201.

[35] Ibid.

[36] Ibid. pp. 200-201.

States that were present. A steering group was established in order to organize the work, chaired by Herwig Schopper who had just retired as Director General of CERN.

At a meeting of this group in the following year, more concrete plans were made and it was decided to reach out to potential international partners[37]. After an informal confirmation that BESSY I was to be decommissioned and a first positive response to the idea of donation to the Middle East, Schopper and Fubini reached out to UNESCO. Federico Mayor, Director General of UNESCO at that time, confirmed his support. This was an important cornerstone since considering the troubles of the region, UNESCO seemed to be the only way of running such a project. Up from the beginning SESAME was thought of as following the CERN model, also promoting science while at the same time bringing people from different nations together and serving as a peacemaking project[38].

3.2. 2nd Phase (1999-2008): Institutionalization Phase

Mayor's support led to a first consultative meeting of MENA and Mediterranean governments at UNESCO Paris in June 1999, where the project was much appreciated and as a result the Interim Council (IC) was established. The function of the Interim Council was the development of a proposal for the establishment of the organization that could be submitted to UNESCO[39]. In the beginning, it consisted of 12 members[40] and four advising committees (technical, scientific, training, finance)[41]. Between 1999 and 2001 the Interim Council held nine meetings[42] until it was transformed into the SESAME Council in 2003. The major task in this phase was to find an appropriate location and host country, to organize the shipping and to prepare the technical design.

Schopper describes the procedure of finding a location for the research facility comprehensively[43]. Of the 12 sites offered by seven SESAME members (Armenia, Egypt, Iran, Jordan, Oman, Palestine and Turkey)[44] none was really suitable. Many different kinds of obstacles got into the way, e.g. financial problems of the Palestinian National Authority, structural conditions of an Armenian building or Iran's entry requirements[45]. Eventually, there was a decision for Jordan in a competition between 5 remaining countries, among them Egypt. "Jordan was the most promising country as far as free access by all scientists was regarded"[46]. It seems that it is more of a lucky coincidence that SESAME could finally win over Jordan as its physical home, since there was no contact to the Jordanian

[37] SESAME: 2004: FOUNDATION OF A SYNCHROTRON LIGHT SOURCE IN THE MIDDLE EAST. Retrieved from: http://sesame.org.jo/sesame_2018/about-us/historical-highlights/2004-foundation-of-a-synchrotron-light-source-in-the-middle-east

[38] Schopper, H. (2017): The light of SESAME: A dream becomes reality. In: RIVISTA DEL NUOVO CIMENTO. 40(4), p. 205.

[39] Ibid. p. 206.

[40] The 12 members were Armenia, Bahrain, Cyprus, Egypt, Greece, Iran, Israel, Jordan, Morocco, Oman, Palestinian Authority and Turkey. After the determination of the site's location, Armenia, Morocco and Oman left the IC (Schopper 2017, p. 206).

[41] Einfeld, D., S. S. Hasnain, Z. Sayers, H. Schopper, H. Winick (2004): SESAME, a third generation synchrotron light source for the Middle East region. In: Radiation Physics and Chemistry. 71(3–4), p. 695.

[42] Khan, S. A. (2003): The Middle East Synchrotron is Launched. In: AAPPS Bulletin (News), 13(2), pp. 35–36.

[43] Schopper, H. (2017): The light of SESAME: A dream becomes reality. In: RIVISTA DEL NUOVO CIMENTO. 40(4), pp. 199–239.

[44] Ibid. p. 212.

[45] Ibid. pp. 212-213.

[46] Ibid. p. 213.

government, which was a large setback according to Schopper. Schopper reports that he had asked a former student and friend of his, Isa Khubeis, in his role as Vice-President of Al-Balqa Applied University at Allan for help, who invited him for dinner. Surprisingly HRH Prince Ghazi Bin Muhammad showed up at the dinner. He led the Governing Board of the same university and was advisor to HM King Abdullah II. This is how Schopper got his chance to present the project to the King. He was able to convince him of the idea of SESAME and received a written confirmation of the King's commitment[47]. At an Interim Council meeting in April 2000 the site in Allan, offered by Jordan, was officially chosen and confirmed as the location of the facility.

As Schopper reports in his article, the whole project was at risk when the German Federal Ministry of Education and Research wanted the components to be dismantled until the end of 1999. It was only by the generous financial support of Kiōchirō Matsuura, who had just recently followed Mayor as Director General of UNESCO, that SESAME's story did not end there. Giving USD 400.000 he provided two thirds of the needed money, which he took from a sum given by the Japanese government to his own disposal. Another $200.000 donation was made available by Russia and Sweden. Thus, the components could be shipped to Jordan in June 2002 where they were stored until the construction of the building was ready for them to be installed[48]. The building itself was decided to be a recreation of the ANKA (Angströmquelle Karlsruhe), a synchrotron light source facility in Karlsruhe (Germany) in order to shorten the needed time and to save the effort of conceptualizing it from scratch[49].

Furthermore, a "White Book" was presented in April 2002 proposing an energy increase to 2 GeV and a circumference of 120m. These enormous changes to the initial design required a larger building, which led to the duplication of the ANKA building that was mentioned before. In order to compensate for the rising costs of such changes to the original plans, new ways of financing were established. While trying to get some components as gifts from other facilities, the European Union was asked to finance the main ring. The EU was prepared to fund the ring only insofar as the electron energy would be further increased so that SESAME could keep pace with other newly build synchrotron facilities worldwide. As a consequence, a "Yellow Book" was set up that took into account these new requirements[50]. Finally in 2004, the decision was made to build "a completely new 2.5 GeV main storage ring, with straight sections that can accommodate insertion devices [...], thereby making SESAME a competitive third-generation light source, while retaining the BESSY I microtron and booster synchrotron, which provide the first two stages of acceleration"[51].

The SESAME research center formally came into existence in 2004. Prior to that, the UNESCO's Executive Board officially had to accept the proposed statutes that had been prepared by the Interim Council in May 2002[52]. According to UNESCO rules at least six governments had to accept the statutes and join the council for SESAME to be formally founded. On January 6 2003 Matsuura could announce that this requirement had been fulfilled. Bahrain, Egypt, Israel, Jordan, Pakistan, Palestine and Turkey had become the

47 Ibid. p. 214
48 Ibid. p. 207-208.
49 Ibid. p. 214-215.
50 Ibid. p. 221–222.
51 Smith, C. L. (2018): Science Beyond Boundaries: SESAME and the International Cooperation, p. 178.
52 Schopper, H. (2017): The light of SESAME: A dream becomes reality. In: RIVISTA DEL NUOVO CIMENTO. 40(4), p. 210.

founding members of SESAME[53]. On the same day, His Majesty King Abdullah of Jordan laid the cornerstone of the building[54] and the SESAME Council held its first meeting thereby superseding the Interim Council. Herwig Schopper was elected as President of the permanent council with Khaled Toukan (Jordan) and Dinçer Ülkü (Turkey) as Vice-Presidents.

Even though SESAME has achieved the formal status of an international research center under the auspices of UNESCO, it still seems to owe its formation and maybe even its continuance to the exceptional dedication of a number of individuals, generally scientists by training. This makes SESAME a prominent example for a "bottom-up" science diplomacy case. SESAME is clearly the result of strategic thinking and a good deal of sensitivity for timing and political circumstance. But most importantly, the compassion, commitment, and determination of a number of individuals, mainly scientists in high ranking or directing positions within the science system were the essential drivers at the early stages of the project.

3.3. 3rd Phase (2008-2017): Maturity Phase

The official opening of the building was in November 2008. The first successful electron beam was produced on 14 July 2009[55]. At the same time, with Chris Llewellyn Smith another former Director General of CERN took over the Presidency of the SESAME Council. Under his lead a strategic plan was set up to structure the work to come and install the equipment in the so far empty building as he describes it in a recent article of his[56]. The plan "revealed that […] construction would cost much more than previously assumed, and it became clear that it would not be possible to obtain all the funding from outside without first obtaining a substantial part from the Members"[57]. In 2012 the four member countries Iran, Israel, Jordan, and Turkey each contributed USD 5 million to the capital budget. Following, the EU funded CERN with the same sum to construct the magnet system for SESAME. Also Italy gave EURO 3.35 million since 2014[58]. Following these contributions the installation started and was finished in November 2017. During that time, in 2014, the roof collapsed due to heavy snowfall but fortunately the shielding wall inside the hall protected the machine. One year later the damage was repaired without further impairments. On 16 May 2017, His Majesty King Abdullah II of Jordan officially opened the SESAME research facility "in the presence of the Directors General of CERN, IAEA and UNESCO, the European Commissioner for Research, Science and Innovation, senior representatives of the SESAME Members and Observers"[59].

Within recent years, SESAME has succeeded in operating its first two beamlines (one in the infrared and the other one in the X-ray spectrum; IR and XFAS) and in opening up the

[53] Einfeld, D., S. S. Hasnain, Z. Sayers, H. Schopper, H. Winick (2004): SESAME, a third generation synchrotron light source for the Middle East region. In: Radiation Physics and Chemistry. 71(3–4), p. 210. Initial observers were Oman, UAE, Morocco. Later Cyprus and Iran joined as members, as well as France, Germany, Italy, Japan, Kuwait, Portugal, Russia, Sweden, UK, USA and EU as observers (Schopper 2017, p. 210).

[54] Khan, S. A. (2003): The Middle East Synchrotron is Launched. In: AAPPS Bulletin (News), 13(2), pp. 35–36.

[55] SESAME (2010): An international centre for research and advanced technology under the auspices of UNESCO.

[56] Smith, C. L. (2018): Science Beyond Boundaries: SESAME and the International Cooperation.

[57] Ibid. p. 179.

[58] Ibid. p. 179.

[59] Ibid. p. 181.

research facility to the community of scientists on a regular basis. This year marks the first scientific publication that results from research conducted at SESAME. Yet, SESAME's future as a fully-fledged synchrotron laboratory with a number of more beamlines is still to come. The building allows for 11 up to 18 more beamlines besides the currently installed two ones[60]. Two more beamlines are currently under construction (Figure 8); two more are being designed at the moment[61]. The ones being currently designed are the BEATS (BEAmline for Tomography at SESAME) beamline, as well as a soft X-ray beamline[62].

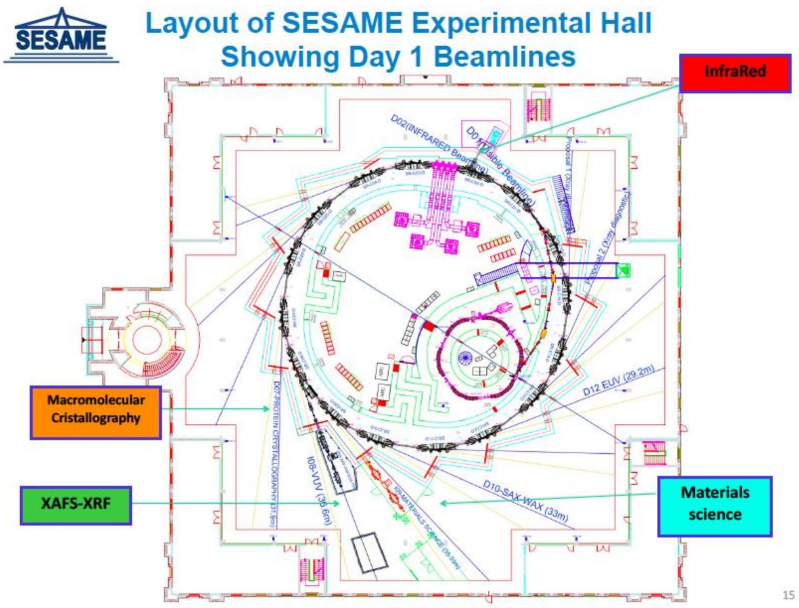

Figure 19: SESAME beamlines that are currently operational (XAFS-XRF and InfraRed) and under construction (Material science and Macromolecular Cristallograhpy)[63].

Besides, a facility consists not only of well-engineered technical units, but, just as importantly, it requires the development of a users community (researchers) and the administrative routines in dealing with them. In support of that, the surrounding (research) infrastructure has to be developed, including spaces where scientists can gather and exchange. This includes building a guest house (soon to be finished) and a conference venue where researchers can stay during their experiments, work and meet each other. A conference venue may also be an important asset to attract the wider research community apart from conducting research at the site. In addition to that, there was an initiative to collect money for building a cafeteria in 2015, which has not yet been realized. SESAME started a public fund raising referring to the important role "played by the CERN cafeteria during the Cold War where Europeans, American and Russian scientists could meet and

[60] SESAME (2010): An international centre for research and advanced technology under the auspices of UNESCO.

[61] Interview 4

[62] EEAS (2019): Sesame Becomes the World's First Large Accelerator Complex to be Fully Powered by Renewable Energy. Retrieved from: https://eeas.europa.eu/headquarters/headquarters-homepage/58793/sesame-becomes-world%E2%80%99s-first-large-accelerator-complex-be-fully-powered-renewable-energy_en

[63] Paolucci, G. (2016): SESAME: A Concrete Science for Peace Project in the Middle East. presentation slides.

messages were conveyed to governments thus bringing important results"[64]. Finally and most crucially, SESAME is putting effort in promoting the relevance of synchrotron technology for various disciplines and research in the region as well as to support the development of competence in order to exploit the facility's research potential, e.g. through trainings and user's meetings[65].

In general, the idea of SESAME is not the result of a plan or strategy by political actors. Neither was the project born at a singular instance or place, from where it was brought into being on a straight-line roadmap. The evolution of SESAME, both as a vision and in its current institutional and physical realization, is an ongoing contingent process that could have failed, faded out or taken different tracks at several junctures. Its history is described most appropriately as an encounter of circumstance, creativity, and coincidence. SESAME depended on the right people who met at the right places during the right times: the occasion of German re-unification propelled the plan to build a new synchrotron that would replace an old synchrotron that could be "refurbished" for the first time[66]; a few international, renowned and synchrotron-experienced scientists that had both the intuition that a synchrotron was missing in the Middle East and were acquainted with the proceedings in Germany; and finally the supportive network and example of CERN that could provide a role model, to name but the most crucial conditions. SESAME stems from a "bottom up" initiative by scientists. It was only later that the idea of SESAME resulted in an institutional framework and could rely on a more and more formalized structure and support on the international and national level.

4. Stakeholder Landscape and Character of Relationships

4.1. Institutional Structure

SESAME is an intergovernmental scientific centre owned by its members and resting under the auspices of UNESCO. From an institutional point of view, this constitutes SESAME as an independent and self-responsible international organization. UNESCO serves as the legal depository of the statutes of SESAME. SESAME's core governing body is the SESAME Council (subsequently referred to as "the Council"), which came into existence on April 15th, 2004 and holds regular meetings twice a year with the representatives of the member countries and observer countries/observer institutions. Countries that are "members of SESAME" are in fact members of the Council. The executive bodies of SESAME are the directorate and the administrative, scientific, and technical offices. The advisory committees are formally established at the Council as well. The Advisory Committees constitute important operational links between the Council and the development of the facility and the running of research activities on the ground.

64 Sharing Knowledge Foundation: The Foundation launches an appeal for donations for the creation of a cafeteria at SESAME – Jordan. Retrieved from: https://www.sharing-knowledge.org/foundation-sesame-jordan-cafeteria-skf/

65 Interview 4; Interview 5

66 Interview 3

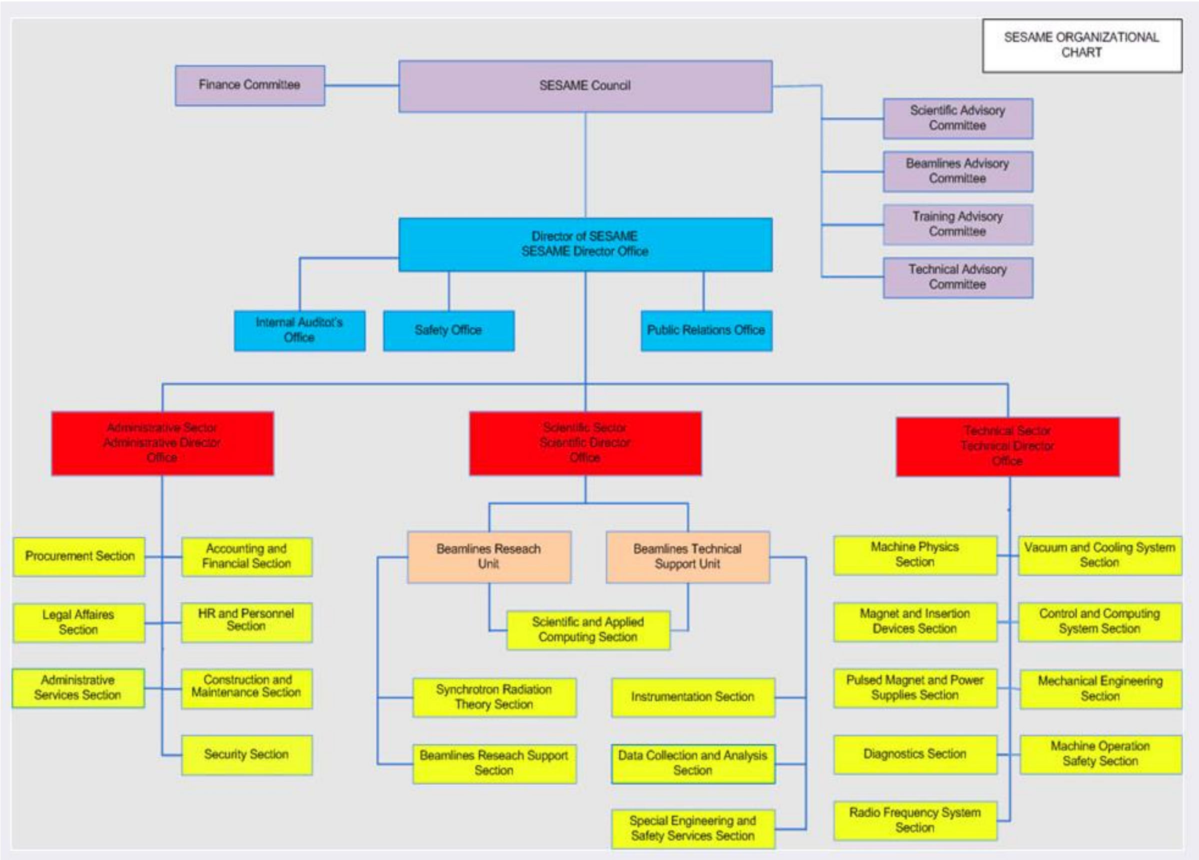

Figure 20: Organizational Chart of SESAME as of 2019[67]

4.2. Composition of the SESAME Council (Member and Observer States)

There are two different forms of institutional membership (in the Council): members and observers. The status of membership of SESAME has been awarded to countries only, while countries and intergovernmental organizations have obtained observer status. Currently, SESAME consists of eight full member states (as of 2019). These are: Cyprus, Egypt, Iran, Israel, Jordan, Pakistan, the Palestinian Authority and Turkey. Furthermore, SESAME enjoys the support of a number of observer countries; these are (as of 2017) Brazil, Canada, China (People's Republic of), France, Germany, Greece, Italy, Japan, Kuwait, Portugal, Russian Federation, Spain, Sweden, Switzerland, the United Kingdom, and the United States of America. Also, the European Organization for Nuclear Research (CERN) and the European Union (EU) also obtained observer status.

[67] SESAME: Organizational Chart of SESAME. Retrieved from: http://www.sesame.org.jo/sesame_2018/about-us/sesames-structure/organization-chart-of-sesame

Members and Observers of the Interim Council (1999-2004) / "Potential Initial Members and Observers of the Council foreseen under Article II.3 of the Statutes" (since 2004) – Original Members+Obersevers	Armenia	Potential Member
	Bahrain	left 04/2017
	Cyprus (1)	
	Egypt (2)	
	France	
	Germany	
	Greece	
	Iran, Islamic Republic of (3)	
	Israel (4)	
	Italy	
	Japan	
	Jordan (5)	
	Kuwait	
	Morocco	Potential Member
	Oman	Potential Member
	Pakistan (6)	
	Palestine (PLO for the benefit of the Palestinian Authority) (7)	
	Russian Federation	
	Sudan	Potential Member
	Sweden	
	Turkey (8)	
	United Arab Emirates	Potential Member
	UK (United Kingdom of Great Britain, Northern Ireland)	
	USA (United States of America)	
Countries or institutions that joined later as observers only	Canada	12/2016
	China	
	Brazil	09/2013
	EU (European Union)	04/2015
	Portugal	
	Spain	
	Switzerland	
	CERN	12/2017
	States that did not become members or have been members, but are not anymore	
	Current member states	
	Current observer states (or insitutions)	
Sources: http://www.sesame.org.jo/sesame_2018/about-us/coop-arrangementsendorsements/mouscollaborative-agreements accessed last time on April 11th, 2019; SESAME/DEADSEA/31-C/17-12, SESAME/AMMAN/30-C/17-03		

Figure 21: SESAME's members and observers (own graphic)

This division of membership between members and observers allows for an institutional setting, in which countries that are intended to actively participate in SESAME i.e. to use the research facility (target countries) obtain different rights and obligations than those supporting the centre. The most important formal obligation of active member countries in contrast to supporting countries or supporting institutions is the yearly financial contribution, while observers have no formal obligations[68]. Given the fact that UNESCO is an intergovernmental body and given the Statutes of SESAME it can be concluded that the only major sanctioning mechanism of "non-compliant" members consists in the eventual exclusion from the Council and revocation of membership. Since membership is voluntary

[68] SESAME: Members and Observers of SESAME. Retrieved from: http://www.sesame.org.jo/sesame_2018/about-us/members-sesame

and there seems rather too little than too much pressure from the national political levels, this sanctioning is in fact a weak and insufficient instrument to explain for anyone's membership.

We conclude that countries that choose to be active members of SESAME have been able to stipulate sufficient "intrinsic" motivation within their countries, i.e. identified the appertaining national interest of their membership in SESAME or dispose of a strong and convincing proponent in the national research infrastructure that is able to encourage the obligatory authorities to commit the required budget and political will. This also holds for the observer states. E.g. the German Ministry for Education and Science was described as very hesitant to support the facility project from the very beginning. It never stepped in due to its assessment that the project would be too risky and at one point even wanted to stop the export of equipment to Jordan[69]. By contrast, German science organizations acting independently from the government have been the main driving force behind the support and membership in the Council of Germany.

SESAME has been trying to reach out to and affiliate more member countries, especially from the Maghreb and the Gulf[70]. For instance, there were concrete negotiations with Iraq and an interest of the country to join in November 2013, yet Iraq has not become a member due to discord about its required yearly financial contribution[71]. Furthermore, Armenia, Morocco, Oman and the United Arab Emirates were initially part of the Interim Council, but did not make the transition into the current formal membership (since 2004) due to both financial and political reasons. Since 2004, membership is tied to the yearly contribution. Bahrain was one of the formal founding member countries, but is not a member any more. Bahrain's membership ceased in April 2017 after the country had not contributed its financial share since 2005[72]. This means that the country has most likely only contributed its initial first year share. Before Bahrain's exclusion, the country had been formally asked to re-engage with SESAME by the Council. Saudi Arabia is not part of SESAME due to Iran's membership[73]. This might be one of the reasons why the United States are not engaging more strongly in SESAME on the governmental level.

4.3. Agency and Representation in the Council

As far as it has been revealed to us, none of the representatives in the Council (therefore, also not the president of the Council) receive any salary on behalf of SESAME. They contribute in their positions on a non-stipendiary basis or as part of their official affiliation such as the liaison officer of UNESCO, Clarissa Formosa-Gauci. Representatives of member countries and observers as well as members of the advisory committees typically participate and contribute on behalf of their main employing institutions. Representatives of the member countries usually work either in high-ranking positions as professors and directors at universities, academies or synchrotron facilities in their country or in the respective ministries for Education, Research and Innovation. A considerable share of delegates is furthermore closely affiliated with the national atomic energy agencies in the respective countries. Only few countries with observer status are represented by an official

[69] Interview 4

[70] Paolucci, G. (2016): SESAME: A Concrete Science for Peace Project in the Middle East. p. 22.

[71] SESAME/DEADSEA/25-C/14-13

[72] SESAME/AMMAN/30-C/17-03

[73] Worldcrunch: SESAME: A New Accelerator Of Science And Middle East Peace. Retrieved from: https://www.worldcrunch.com/tech-science/sesame-a-new-accelerator-of-science-and-middle-east-peace

envoy or the ambassador to the UNESCO (diplomatic corps) in the Council. We have found that it speaks for the authentic engagement of a country if the representative is participating on a regular and long-term basis (is not replaced often), takes a personal interest in the project and is affiliated with a scientific institution in his or her home country. We found that there was a considerable personal engagement and concern with advancing matters at SESAME from representatives that were sent by research institutions. However, the Council meetings are not open to the public and therefore insights were restricted also to us.

It cannot be overstated that the outlook of SESAME depends to a great extent on the various institutional affiliations and the scientific expertise of individuals, who serve at any of the permanent and honorary positions in the institutional setting of SESAME, mainly in the Council and the directorate. They bring in their professional international networks and expertise and in that have made possible the establishment of an international research infrastructure from scratch. Most importantly, this certainly applies to the former and current presidents of the Council that have also served as former directors of CERN. Undoubtedly, they have contributed and still contribute an invaluable asset of experience, expertise and network (we will take a closer look at them in the next sections).

4.4. Advisory Committees

The advisory committees are formally a part of the Council. They have played (and still play) a significant role in the planning, technical support and active international promotion of SESAME throughout its establishment. Most importantly, they seem to form crucial junctures to feed in external technical expertise from the international synchrotron light source community. In particular, the Scientific Advisory Committee (SAC) and its respective chairs have advanced the makeup and outreach of SESAME considerably. Since 2018, the SAC is chaired by Esen Ercan Alp, a senior scientist of Turkish descent and a long serving physicist at the Advanced Photon Source at the Argonne National Laboratory in the US.[74] Prior to him, the position has been carried out by Professor Zehra Sayers from 2002 to 2018,[75] a biophysicist and director of the foundations development at Sabanci University, Istanbul. Sayers has served not only with her international expertise but also with great passion and commitment that is certainly required to execute the task in the phase of institutionalization and construction of the synchrotron. She was awarded the Rammal Award 2017 for her outstanding contribution, "from collaboration at the political level and at the construction of the facility to getting the science going by ensuring high quality exciting projects of young and experienced scientists from the region".[76] Sayers has given several TED talks about her commitment to SESAME. In these talks it becomes evident that working with synchrotrons has touched upon her life and this is from where she draws her motivation. According to her, SESAME became "a very big passion in my life",[77] the fascination for "making the invisible visible" that she discovered also during the influential experience of working in Hamburg at DESY as a young PhD scholar (also a

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[74] TASSA: A Conversation with Esen Ercan Alp. Retrieved from: http://www.tassausa.org/Newsroom/2014/item/2061/A-Conversation-with-Esen-Ercan-Alp

[75] Preservation of the Academic heritage in the Middle East: CV Prof. Dr. Zehra Sayers. Retrieved from: http://www.akademikmiras.org/en/destekleyen-akademisyen/30/prof-dr-zehra-sayers

[76] Euro Science: Rammal Award 2017 goes to Dr. Zehra Sayers. Retrieved from: https://www.euroscience.org/news/rammal-award-2017/

[77] TEDx Talks on Youtube: A journey from the visible to the invisible: Zehra Sayers at TEDxSabanci University. Retrieved from: https://www.youtube.com/watch?v=dohcpJddNGQ, time stamp 5:53.

station in the academic life of Esen Alp). She describes the working atmosphere at a synchrotron as a very energizing and inspiring one: "synchrotrons have a special atmosphere or environment of their own"[78]. She articulates the urge to give back something to the next generation of scholars and to leave something behind.

Similarly, the Technical Advisory Committee (TAC) and the Training Advisory Committee (TrAC) are staffed with international personnel that dispose of considerable expertise and specialization in the field of synchrotron physics. Amor Nadji, a current member of TAC, is Director of Accelerators and Engineering at the SOLEIL synchrotron user facility close to Paris, France and Professor Javad Rahighi, currently the chair of (TrAC), is Professor of experimental physics at the Institute for Research in Fundamental Sciences in Tehran, Iran.[79] It may have been a blessing in the constitution of SESAME that synchrotron technology is still such a fairly exquisite and specialized area of expertise so that careers in this "world" are often international and networks span globally. The TAC has worked towards building expertise to use synchrotrons in the region and has therefore organized workshops and trainings at other facilities in Europe and beyond.

4.5. Permanent Staff

Permanent staff at the SESAME research site is still fairly limited to around 45 people[80]. It is mainly composed of technical engineers, management and staff required to run the facility and the two beamlines. Permanent staff is not to be confused with the users (researchers) that come to SESAME to conduct experiments[81]. Permanent staff is truly international. It is recruited both from the local area, from the Middle East region and from the international (synchrotron) community beyond the Middle East in accordance with SESAME's vision. For example, the two responsible beamline scientists of the two currently operational beamlines are Messaoud Harfouche (formerly serving at the Paul Scherrer Institute in Switzerland, XAFS/XRF beamline) and Gihan Kamel from Egypt (previously having been trained in Italy and serving in Egypt; since 2000 the only woman in the permanent staff at SESAME; IR Beamline). If we decide to understand science diplomacy as the creation of bonds between people with different backgrounds on a concrete level (as a crucial aspect of the abstract aim to contribute to peace and mutual understanding), it is during the daily business. This includes the daily encounters of internationals who spend a lot of time together, they share commitment and effort to reach common aims[82]. This was described as very strong to us. It is also based on the high individual motivation and openness to a common cause.

However, the staffing level is thin also due to budget restrictions, especially the insecurities about the member contributions[83]. Responsible positions are sometimes even equipped with a 50 % position such as the one of Scientific Director. It is intended that "in the long run, the position of Secretary of the Council will move to SESAME. In the meantime, it will be held by Clarissa Formosa Gauci who has de facto been carrying out the tasks incumbent

[78] Ibid. time stamp 10:17.

[79] We have found no evidence that the Advisory Committee for Beamlines is currently active or in place.

[80] Interview 4; Interview 5

[81] Users are organized in the SESAME Users' Committee. This committee consists of one representative for each member country (http://old.sesame.org.jo/sesame/users/sesame-users-committee-suc/membership.html)

[82] Interview 5

[83] Interview 5

on this position ever since the creation of SESAME in 2004 and before this during part of the period of the Interim Council."[84] The director of SESAME, Khaled Toukan, serves on a non-renumerative basis. Khaled Toukan is also the president of the Jordan Atomic Energy Commission and held several positions as minister for science and education in Jordan governments. This provides SESAME with invaluable backing in its host country and it shows that science diplomacy is not necessarily a matter of "in between" (in between different organizations, between scientist and diplomats), but it is maybe even just as much a matter of personal union.

4.6. Institutional Environment and Support from Observer Institutions (incl. the EU)

Even though SESAME owes its initiation to a small number of individual physicists, it would not exist without the on-going support of key international and supranational institutions and its incorporation into this institutional environment. The main institutions in this environment are UNESCO, CERN, IAEA and the European Union. UNESCO has lent the institutional framework, formal recognition and the official reputation as an international science diplomacy endeavour to SESAME[85]. The IAEA and the Jordan Atomic Energy Commission are similarly important to provide scientific support and also has helped to provide necessary political backing within Jordan. CERN had a major impact on the technical evolution of the synchrotron and provided the constitution and *raison d'etre* of SESAME with a prominent and successful role model. The EU has made numerous financial contributions and enabled contributions of equipment and exchanges by experts from other institutions and member countries through its allocation mechanisms. It joined the project not before the late institutionalization phase, however. Recently, SESAME has joined LEAPS (League of European Accelerator-based Photon Sources) as an associate member and in that it has also taken a step forward to the next level of affiliation to the forming self-governance of European synchrotrons[86].

CERN has not only served as a role model and provided the overall institutional setup (institutional structure, Statues) but also lent a strong and easy to grasp narrative to the project. This immaterial contribution should not be underestimated. It was invaluable for the understanding and promotion of SESAME by the international community and the public.[87] This kind of support by CERN has contributed credibility to its mission and development and it has encouraged commitment by other stakeholders. Furthermore and much more tangible, it has also equipped SESAME with machinery components, technical services and expertise in the construction of the storage ring. "CERN's contribution was hugely beneficial, and working with CERN's experts provided wonderful training experience for SESAME staff. The voluntary support from the Members also encouraged Italy to provide EUR 1 million in 2014, which was used to procure accelerating cavities; this was followed by further Italian contributions, so far amounting to a total of EUR 3.35 million of which the most recent part is being used to build a hostel for SESAME users."[88]

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84 SESAME/AMMAN/27-C/15-14

85 UNESCO: Science Centres and Organizations. Retrieved from: http://www.unesco.org/new/en/natural-sciences/science-technology/science-policy-and-society/science-diplomacy/science-centres-and-organizations/

86 https://www.leaps-initiative.eu/partner_initiatives_amp_associates/associate/ ; Physics Today: Europe's user facilities find strength in numbers. Retrieved from: https://physicstoday.scitation.org/do/10.1063/PT.6.2.20190123a/full/

87 There is almost no media article that does not introduce SESAME with a reference to CERN.

88 Smith, C. L. (2018): Science Beyond Boundaries: SESAME and the International Cooperation. p. 180.

CERN's support for SESAME was also made possible through the European Union, which provided CERN with EUR 5 million to "lead the procurement of the magnet system for the main ring in collaboration with SESAME"[89]. The magnets are key components of a synchrotron. They have been designed by the technical team from SESAME in the first place, while scientists from CERN provided a review and conducted the measurement of the magnets, which requires expensive equipment that SESAME does not have on its own, and also helped to set them up[90].

SESAME staff and stakeholders do not become tired of pointing out the many important contributions the EU has made[91]. The EU support has been described as comprehensive and coherent[92]. The EU has made and/or enabled numerous financial contributions more recently, mainly within the last few years. The EU provided EUR 6.36 million (own estimation upon the given number of USD 7.05 million) for the construction of an on-grid solar power plant through the Jordanian government in 2016[93]. The power plant was officially inaugurated in February 2019 and is located 30 km away from the research facility. It will be able to satisfy SESAME's full energy demand in the years to come. "Thanks to this power plant SESAME is now not only the first synchrotron light facility in the region, but also the world's first large accelerator complex to be fully powered by renewable energy."[94] Again, the Jordanian authorities, in this case especially the support from the Jordan Atomic Energy Commission (JAEC), have been key in realizing this effort.[95] Since the high electricity requirement has been a major concern for SESAME and has even forced a stop of the running of beamline for weeks during the year 2018, the new power plant is a big step forward also in terms of financial security and budget reliability[96]. For the first time, the EU as a donor has invested in an effort that helps to cover the running expenses, by contrast to the majority of contributions that went into technological expansions and enhancements of the facility.

Furthermore, the EU has provided EUR 5.97 million also through a Horizon 2020 grant to design and install the fifth beamline, producing hard X-ray light for tomography (BEATS), beginning in 2019 and in cooperation with ESRF (European Synchrotron Radiation Facility).[97] The major advantage of this project and its funding scheme is that SESAME staff is in charge of conducting all the single steps of setting up the beamline. This is different in comparison to other donations and cooperation with European synchrotrons that have sent

[89] Ibid. p. 179. Just like SESAME, CERN is organized as an international research organization that is principally independent from the EU. Most Member Countries are European, but not all are part of the EU such as Norway and Switzerland. The EU has observer status at CERN.

[90] Interview 3

[91] "The EU has been very supportive. They deserve a lot of credits." (Interview 3)

[92] Interview 5; „They gave us human capacity. They gave us the opportunity for training for our staff and for training the users community. They gave us one beamline and they gave us funds for our operational. It is really an integrated approach. They gave us a lot of opportunities. So I think that this integrated approach is really successful." (Interview 5)

[93] EEAS (2019): Sesame Becomes the World's First Large Accelerator Complex to be Fully Powered by Renewable Energy. Retrieved from: https://eeas.europa.eu/headquarters/headquarters-homepage/58793/sesame-becomes-world%E2%80%99s-first-large-accelerator-complex-be-fully-powered-renewable-energy_en

[94] Ibid.

[95] Ibid.

[96] Interview 5

[97] ESRF: H2020 project for a tomography beamline at SESAME is officially launched. Retrieved from: https://www.esrf.eu/home/news/general/content-news/general/h2020-project-for-a-tomography-beamline-at-sesame-is-officially-launched.html

own engineers for the set-up of the donated equipment[98]. In addition to that, the EU has provided funds for the "OPEN SESAME" consortium consisting of 10 European synchrotron facilities and science organizations with funds to establish an orchestrated training and promotion programme that is tailored to the needs of SESAME within the Horizon 2020 framework programme.[99] The project started on January 1, 2017 and runs three years. It also aims at having a "lasting impact on a reinforced European Research Area, and particularly in strengthening international cooperation for research infrastructures with a key Region located close to Europe."[100] Finally, the EU funds a project called "CALIPSOplus", which is geared towards supporting the users community and research trips to SESAME.[101] It mainly funds research trips to SESAME for researchers coming from the member states Turkey, Israel and Cyprus[102].

4.7. The Global Synchrotron Community

The global synchrotron community is the group of scientists and engineers that design, build and maintain synchrotrons. Even though it spans globally, this community is fairly small and intimate. In general, members know each other[103]. This is different from the synchrotron *user's* community, which is far larger (it amounts to around 25.000 scientists only at the European facilities), rapidly growing and much more diverse in disciplinary background. There is a frequent exchange of expertise and personnel between the facilities in the world. "Synchrotron x-ray sources and free-electron lasers have always collaborated, but not in a coordinated way, says LEAPS founder Helmut Dosch, director of the German Electron Synchrotron (DESY) in Hamburg."[104] The community is competitive when it comes to designing and experimenting with more powerful and innovative technologies. Yet, it also has proven to be highly cooperative and engaging when it comes to sharing expertise and supporting each other in the construction of new synchrotrons.[105] Furthermore, the community is still evolving and constantly (re-)organizing.[106]

The intimate character of the synchrotron community is linked to the fact that synchrotrons are sophisticated machines that require highly specialized expertise and therefore attract and bring together a small group of people. The cohesion of the group is also due to the fact that there are only rare advanced synchrotron light sources around the world where people are trained and develop the technology. Furthermore, synchrotron technology is fairly young (the community has transitioned into the 2nd generation). Three decades

98 Interview 5

99 Open SESAME: Integrating SESAME into the public and socio-economic landscape to fulfil its role as an important driver for the scientific, technical, cultural and economic development of the region. Retrieved from: http://www.opensesame-h2020.eu/en/#section-1231 More details about "Open SESAME" is covered in section 5.1

100 Instruct ERIC: OPEN SESAME. Retrieved from: https://instruct-eric.eu/content/open-sesame

101 Open SESAME project (H2020) - SESAME User Perspective. Presentation slides. Retrieved from: http://www.sjnc.jo/images/docs/lectures/Kirsi-Lorentz.pdf

102 Interview 5

103 Interview 4

104 Physics Today: Europe's user facilities find strength in numbers. Retrieved from: https://physicstoday.scitation.org/do/10.1063/PT.6.2.20190123a/full/

105 Ibid.

106 In 2017, 16 European particle accelerator facilities have formed a common umbrella organization called LEAPS in order to "jointly develop methods, instruments, and data-management approaches; avoid duplication; and communicate with policymakers and funding agencies." (https://physicstoday.scitation.org/do/10.1063/PT.6.2.20190123a/full/)

passed by before synchrotrons could be used as the users research facilities that they are today. Until the 1980s the technology was still in its infancy and the community was accordingly tinier. It was not before the early 1990s that more countries – besides the few initial sites in the US, in the Soviet Union, in Germany and in Switzerland – constructed facilities for a broader range of research applications. Consequently, the few founding figures and early developers of this technology were imperative advisers for the establishment of new synchrotrons. In the late 1980s, e.g. Taiwan and South Korea decided to build synchrotrons as part of their investment strategy in innovation with the financial resources coming out of export excesses from the growing low technology industries (in clothes, toys, electronics etc.). They depended on expertise outside of their country. A major motivation was to train students on an internationally competitive level and to prevent brain drain[107]. They succeeded in training hundreds of students and in building up their own user's communities in the region even with a limited performance range of their facility[108]. Therefore, SESAME is not the first synchrotron that is built on the basis of the support of the global synchrotron community in a country that is completely new to the technology.

The biggest difference is the member constellation and structure of SESAME that again has a major impact on the financial support, esp. income reliability and users structure. These countries such as Taiwan and South Korea were ready to spend USD 100 million on this technology and succeeded in building up highly active users communities that carried the synchrotrons into self-sustaining futures[109]. Similarly, there is almost no experience with accelerator technologies in the Middle East. Usually, scientists from the region have to go to facilities in Europe or the US to be trained and to conduct research if they get a chance. It will be a major challenge for SESAME to also create the scientific awareness and demand not only within one country but a whole region to attract users.

Looking at the overall personnel structure (meaning people who have lend their expertise and time during the management, design, construction and running of the site), SESAME is brought into being by the global synchrotron community. It is based on the profound support of a large number of facilities in Europe and the United States that have contributed components, expertise, trainings and exchanges. Apart from that, current staff at SESAME is also recruited from these synchrotrons. These physicists come from different parts of the world and usually have worked at several synchrotrons around the globe. This includes also scientists from the Middle East region that went to other countries to study and work before they now returned to the region and before getting involved with SESAME. Seen against this background, SESAME is a product of what we call the global synchrotron community and in that it is truly an international science endeavour.

[107] Interview 4

[108] Taiwan started with a 1.3 GeV synchrotron and pushed it to 1.5 GeV. Therefore, it could not do the high energy X-rays. The design was proposed by western physicists (H. Winick was one of them). They later recognized that they were too modest with regards to the proposed performance layout (Interview 3).

[109] Interview 3

5. Practices, Interfaces and Frictions

5.1. Trainings

Offering training is one of SESAME's main activities and objectives. Before SESAME started to serve as a research facility in 2018 and before it even operated its first beamlines, it has been organizing trainings at different synchrotron facilities and has tried to bring academics together in order to create an interest and understanding of the technology since many years. The intention of creating a community in the region that is familiar with synchrotron technology might be just as important and strong as building the research site itself. Given the fact that there have been only two research teams present in 2018, the main "interfaces" that are of interest from a science diplomacy perspective are still trainings, users meetings, and the collaboration during the designing and commissioning of the facility. Furthermore, the trainings are another instance of international and cross-cultural encounter and collaboration. At these events, scientists from the region and from the international synchrotron community meet each other in one place, which they would not necessarily do during the short research stays at the site.

In the case of SESAME, trainings mainly deal with "accelerator physics, beamlines, and scientific applications"[110]. The purpose of the trainings is pursued in different settings and frameworks. It does not only include traditional workshops and individual trainings through visits at other synchrotrons and fellowships, but includes also the annual users meetings[111]. Training opportunities from SESAME get funding and support from a large number of national scientific societies and international organizations: IAEA, UNESCO, ICTP, ESRF and a large number of national synchrotron facilities in Brazil, France, Germany, Italy, Japan, Portugal, Spain, Sweden, Switzerland, Taiwan, UK, USA[112] and in that is another example for the importance of the global synchrotron community for the furthering of SESAME. A recent individual exchange example is the Diamond[113]-SESAME Fellowship Grant, endowed with the amount of GBP 1.5 million for a time frame of 3 years (2017-2019). It funds administration and mentoring efforts of SESAME staff at the DIAMOND site for visits of 1 to 3 months[114]. It is required that the selected fellow is both a staff member of SESAME and has the nationality of one of the member states. The selection process is in the responsibility of SESAME management[115].

However, one of the major and institutionalized training efforts has been realized through the EU Horizon 2020 funded "OPEN SESAME"[116] consortium that started in 2017 and is scheduled for three years and funded with EUR 2 million. The main objective of OPEN SESAME is to "train SESAME staff in the storage ring and beamline instrumentation technology, research techniques and administration for optimal use of a modern light source facility, to build-up human capacity in Middle East researchers and to train SESAME staff and its user community in public outreach and corporate communications".[117] The

[110] Paolucci, G. (2016): SESAME: A Concrete Science for Peace Project in the Middle East. Presentation slides.

[111] Ibid.

[112] Ibid.

[113] DIAMOND is the biggest national synchrotron user facility in the UK.

[114] Al-Zoubi, A. (2018): Diamond-Sesame Fellowship Grant: Supporting Scientific Knowledge Exchange. 16th SESAME users meeting.

[115] Ibid.

[116] OPEN SESAME: Bringing together 150 years of accumulated light source operational know-how for the growth of a new research infrastructure. Retrieved from: http://www.opensesame-h2020.eu/en/#section-1192

[117] Instruct ERIC: OPEN SESAME. Retrieved from: https://instruct-eric.eu/content/open-sesame

consortium's core activity consists of 65 staff exchanges to the 10 other consortium member synchrotrons and science organizations in Europe and five training schools. It furthermore provides online learning materials and fellowships for students at the Master and doctoral level and a "roadshow" to promote SESAME's scientific purpose in the region.

Apart from the training efforts tailored to the researcher community in the Middle East, SESAME trains engineers and electricians at its facility as part of the positions that operate the accelerator and storage ring. It therefore also "produces" well-trained staff in the region that is sought for also by others, such as employers from the industry. Unfortunately, SESAME already had to make the experience to lose well-trained staff to the industry[118]. While this is of course a good sign for the quality and acceptance of the site, it is also a costly risk.

5.2. Users Meetings

The users meetings take place once a year, usually in Jordan or in another member country at a conference venue (also due to the fact that there is not yet a conference venue at the SESAME research facility).[119] These meetings are the main encounters ("interface") of the wider research community in the region that SESAME intends to address and international researchers from the global synchrotron community that work for SESAME (including members of the advisory committees, the Council president and the directors of SESAME). Users meetings are in general a means to provide the community of researchers (that are involved in a wide range of research applications and different topics) with a platform to exchange and learn about each other. The talks also provide current information on the state of affairs of the facility and of the selection processes and time schedules. In the case of SESAME, the users meetings are also employed as a means to give teachings and general insights into the synchrotron technology and its potential applications. In that regard, the talks explicitly entail pedagogic ends and speakers, who are invited from other facilities mostly in Europe and the US, are asked to incorporate this purpose in their presentations[120]. Participation at the users meetings is restricted and requires application through the online SESAME Portal. Users are selected based on the scientific quality of their abstracts[121].

5.3. Researchers at SESAME and User's Access Management

Researcher's access to synchrotron user facilities is commonly restricted through a peer review selection process. Researchers ("users") need to apply for "beam time". This is also the case for SESAME. Researchers submit proposals and announce their research ideas in response to a call for proposal that is issued twice a year according to the schedule.[122] The proposals are selected on the basis of scientific merit and technical feasibility by an international board (the Proposal Review Committee, RPC) that assigns a certain time frame for the researchers. "The PRC members are appointed by the Director of SESAME after seeking suggestions from the members of SESAME's Scientific Advisory Committee. They serve in a personal capacity, and hold office for three years. An additional

[118] Interview 4

[119] SESAME: Events and Trainings. Retrieved from: http://www.sesame.org.jo/sesame_2018/sesames/events

[120] Interview 4

[121] Interview 5

[122] Proposals are submitted through SESAME's online portal: https://sup.sesame.org.jo/pls/vuo/guest.startup

appointment of three years is possible, but not automatic."[123] The evaluation of the proposals includes an initial safety assessment and the assessment of technical feasibility by the relevant beamline scientist. Users are strongly invited to contact the beamline scientists before submitting proposals in order to assess and adjust needs and possibilities beforehand.[124]

The first call for the IR EMIRA-Beamline resulted in 43 proposal submissions. On the one hand, training and promotion efforts have proven to be successful: 12 proposals were submitted by scientists, who got involved through the OPEN SESAME schools[125]. However, the facility was not ready soon enough for the created research demand. In its first year of official operation (2018), research at SESAME could be conducted only during approximately 15 weeks. The first round of calls for the IR beamline was emitted as early as 2013[126], already. The first round of calls for the XFAS BASEMA-Beamline was published in 2017 and resulted in 19 selected proposals.[127] Yet, only one experiment could be conducted at each beamline until the end of 2018. In 2018, two research teams (from Cyprus and from Egypt) have conducted research at SESAME so far. Due to the delays in the running of the beamlines, the original schedules could not all be maintained and confirmations could not be adhered to, which has created dissonances and frustration among the users community already. One scientist reported that the interest and trust in collaborating with SESAME has been damaged due to recurring delays in the start of the operation[128]. SESAME is certainly in a crucial moment in its evolution, specifically at this moment of transitioning into a fully operational facility while building up more beamlines on a permanent basis. This moment in times requires even fortified investments and community building while academic results need time to build up and cannot proof the scientific merit of the project immediately.

5.4. Funding and Financial Situation

As a member-owned research centre, SESAME's financial resources are to be primarily generated on the basis of member contributions. Reliable and timely payment of the member countries contribution has proven a major challenge from the start. The yearly contribution expected from each member country is adjusted to the country's spending capacity. In the year 2018, Iran, Israel, Pakistan and Turkey were expected to pay USD 913.000 as each one's yearly share. Cyprus, Jordan and Egypt were expected to pay approximately USD 520.000 each. Palestine was granted to contribute the smallest share of around USD 60.000. These yearly shares have been alike in former years. Cyprus, Israel, Turkey and Jordan seem to be able to overall satisfy their financial obligations, while other

[123] SESAME: Proposal Review Committee (PRC). Retrieved from: http://old.sesame.org.jo/sesame/users/user-guide/applying-for-beam-time/proposal-review-committee-prc.html

[124] Open SESAME project (H2020) – SESAME User Perspective. Presentation slides. Retrieved from: http://www.sjnc.jo/images/docs/lectures/Kirsi-Lorentz.pdf

[125] Paolucci, G. (2016): SESAME: A Concrete Science for Peace Project in the Middle East. presentation slides, Retrieved from: http://www.namesnetwork.org/Names2016/Attachments/Speakers/20170123104034511 37_GP.pdf

[126] Paolucci, G. (2015): SESAME: X-rays for the Middle East. Presentation slides. Retrieved from: https://www.iycr2014.org/__data/assets/pdf_file/0017/112049/Session7_Paolucci.pdf

[127] The Cyprus Institute (2018): Scientists from The Cyprus Institute Become the First Official User Group to Use SESAME Light Source. Retrieved from: https://www.cyi.ac.cy/index.php/cyi-news/scientists-from-the-cyprus-institute-become-the-first-official-user-group-to-use-sesame-light-source.html

[128] Interview 1

countries are in arrears. The financial situation is strained due to persistent payment defaults of several member countries.

The reasons for payment delays are manifold and different for each country. In some cases, a lack of governmental support may contribute to the low payment morale.[129] E.g. the Egyptian contribution was frozen during the regime change.[130] In other cases, payments could not be transferred due to international sanctions despite the willingness of the member. This has happened in the case of Iran. In general, the member countries commonly take their contribution from the respective science and research budgets. Yet, most member countries allocate a comparably small share of the national budget to the science and research budgets[131]. The Council's leverage to sanction payment defaults is limited to the eventual exclusion of a member. (This has happened only once so far in the case of Bahrain.) Yet, from a rational choice point of view, the exclusion of a member further reduces the potential source of income for SESAME and therefore it is unlikely to be in the primary interest of the Council. This is especially true during the construction and extension phase, when initial investment requirements are high.

The two main expenditure items of running costs are staff and electricity. Electricity consumption amounts to approx. USD 1 million per year, an equivalent of up to 30-40 % of the current annual budget[132]. This is also due to the fact that electricity prices in Jordan are high. Jordan does not possess own oil springs. Most of SESAME's electricity consumption goes into the magnets for the acceleration of particles. The required basic energy input to build up the energy level in the storage ring is fairly the same for one, two or more beamlines. From a point of view of efficiency it would be therefore crucial to complete further beamlines as soon as possible. However, the budget based on the yearly contribution of the member shares does not cover more than the running expenses (approximately USD 3.000.000 in the year 2018). This means that SESAME depends on additional (perhaps external) contributions when it comes to initial investments, extending the facility or adding new beamlines.

5.5. Ownership and Support

External financial support and equipment donations could be secured during all phases of the construction of SESAME for individual purposes and were crucial for its constitution from the very beginning. Additional national resources have been tapped in several instances on an almost regular basis to collect the instruments and expertise in order to set-up the first beamlines: some member countries have contributed extra shares; countries, science organizations and institutions with observer status have contributed financial resources, e.g. Germany, Japan, Sweden, Italy, Russia. But this was not on a regular basis or in disproportionate amounts. Despite the great support from Jordan it seems crucial however that SESAME is not perceived as a national project, neither as a project of Jordan nor any other member country among the members and users. The

[129] Scientific priorities do not directly and not necessarily translate into political priorities. Researchers and potential users of SESAME have been called upon to approach their respective governments and exert political pressure at home. It remains an open question, to which extent this can yield successful results and serve as a promising leverage.

[130] Worldcrunch: SESAME: A New Accelerator Of Science And Middle East Peace. Retrieved from: https://www.worldcrunch.com/tech-science/sesame-a-new-accelerator-of-science-and-middle-east-peace

[131] Smith, C. L. (2012): Synchrotron Light and the Middle East: Bringing the Region's Scientific Communities Together Through SESAME. In: Science & Diplomacy, 1(4).; Interview 4

[132] Interview 4

Jordanian Royal Family representing the country's national support for the facility was described as very supportive. Yet, their possibility to support the facility was described also as limited due to the fact that the facility should not be perceived as a national project[133]. This is true for any other funding and supporting partner from inside or outside SESAME so that it maintains its character as an international research site that is run equally by all its members. Against this background, it seems to be important that contributions can be made through international or supranational bodies and scientific institutions. This is also an important asset of the EU as a partner of SESAME.

On the one hand, it plays an important part for the character and coherence of SESAME as a self-governing research centre (and therefore exceeds the financial aspect) that its member countries are able to gather sufficient support within their own countries to sustain the facility[134]. On the other hand, it can be deemed tragic that they are not allowed to do so. Considering that the overall required budget is comparatively small for a synchrotron of this size and in regard of the overall honourable ambition of the project, there are individual donors within the country and beyond that could easily increase their share and even would be willing to do so[135]. In comparison to the construction of national synchrotrons, SESAME seems to have also suffered from being somewhat "doomed" to be set up as an international research centre with the explicit expectations that countries have to cooperate and contribute equally. It remains a hypothetical question, if it might have been easier and faster to finish the synchrotron in smaller membership constellations.

The dependence on external contributions from other countries, supranational organizations and scientific institution entails risks and frictions[136]. First, it has prolonged the construction considerably. During its reconstruction, BESSY I had to receive a number of technical upgrades. Among others, it was necessary to build a new storage ring to make SESAME a competitive machine, therefore not using the BESSY I storage ring as initially intended. "In December 2004, the design of the SESAME machine for a final energy of 2.5 GeV was approved – this meant building a new storage ring from scratch with a much larger circumference (133.2m) rather than upgrading that of BESSY I."[137] Many components have been added also by contributions from other synchrotrons and supporting facilities (e.g. from the UK and France[138]), which again took time to organize, ship, and attach.

Furthermore, the dependence on donations and contributions apart from member contributions entailed the risk of misinterpretations and of creating the image of a donor-receiver asymmetry[139]. In fact, BESSY I was an outdated facility and had been in use for decades when the decision was made that it should be replaced and decommissioned[140]. Despite, the idea was brilliant to decommission and recycle a synchrotron with the intention to "sell" it as a starting point for the construction of a new synchrotron. It would have been much harder (if not impossible) to create sufficient support to start a synchrotron project from scratch without any initial assets. Therefore the donation of BESSY I can be

[133] Interview 4
[134] Interview 4
[135] Interview 4
[136] At the same time, it has to be taken into account that otherwise it would not have been realized at all.
[137] UNESCO: SESAME, a visionary endeavor in science and diplomacy. Retrieved from: https://en.unesco.org/sesame-history
[138] Daresbury and LURE (Laboratoire pour l'Utilisation du Rayonnement Electromagnétique)
[139] Interview 1
[140] Interview 4

considered first and foremost a successful micro science policy strategy to convince official stakeholders and to create the founding narrative that might be strong enough to carry the idea into being. Yet, it also created the impression among scientists in the region that outdated equipment was donated that was not of use in Germany anymore[141].

5.6. Science Diplomacy, International Collaboration and Scientific Excellence

This impression was even aggravated with SESAME being linked to a political vision of "bringing peace to the region" and with being established as a science diplomacy project[142], a narrative that is potentially imbued with a number of non-scientific intentions that are hard to read and guess for all stakeholders in the field. In general it can be stated that the political imprint of the project has not only pushed SESAME forward with regards to raising support and commitment, but it has also raised further suspicion mainly among scientists from the region. Interestingly, the narrative of science diplomacy as being part of SESAME's mission was interpreted as such a political agenda that was rejected for this science collaboration effort. Some scientists were eager to point out that the project will be successful only on scientific grounds and that political motives are potentially damaging for its further success[143]. It seemed as if the support of political stakeholders (both from a national and supranational level) was regarded as charged with intransparent motives that were potentially hampering scientific goals or were even interpreted as a disguise to impose political goals[144]. The explicit aim of bringing people together was described by some people as a political agenda and was sometimes assessed critically or as a somewhat artificial obligation[145]. The fact that SESAME and the support of the EU would not have been realized without Israel being a member of SESAME (a condition that is unlikely to apply to any other member) plays a part in its perception and in caveats and insecurities about the political agenda[146].

When it comes to the very science diplomacy intention of SESAME to bring people from conflicting national and cultural backgrounds together, assessments and results cut both ways: On the one extreme are scientists that clearly oppose to work together in (what they find to be) imposed teams consisting e.g. of Israelis and Palestinians. This does not mean that they oppose SESAME as the scientific effort but rather seems to resent the idealistic charges and expectations of SESAME that from their point of view clashes with reality. One scientist said he could not ignore what Israelis have done to Arab communities and directly linked his disapproval of working closely together with Israelis (apart from taking notice of published results) to the political situation: "If an Israeli comes to SESAME he has the right to work. I do not care. But collaborate with him: No. Frankly speaking. All people in the region will do the same."[147] Furthermore, he pointed out that a group of scientists left the room when an Israeli scientist presented during a recent users meeting for the same reason[148]. He added: "We cannot accept the fact that there were things done wrong against

[141] One interviewee reported: "At that time it was like a shock for me: Why are we getting the garbage?" (Interview 1)
[142] Interview 1; Interview 2
[143] Interview 2
[144] Interview 1; Interview 2
[145] Interview 2
[146] Interview 1
[147] Interview 1
[148] "I think you have noticed that when Ron started his talk, people were pulling out. [...] Because he is from Israel. We do not have to listen to him talking about crystals. We know crystals. We have the same knowledge.

our society, our people.[...] This dream is not coming true. It is not coming true. Unless the Israelis understand that this has to change, the owners of the land should go back to their homes, the refugees should go back to their towns. We are not against Jewish people."[149]

At the same time and on the other hand, SESAME is praised by scientists, who work at SESAME, for exactly its vision and endeavor to bring people together beyond conflicting boundaries on the grounds of the uniting capacity of science. It is described as an "oasis of advanced science and technology, of understanding, neutrality, and fairness. An oasis of peace; a certain kind of peace that calls no diplomatic deals. Just science. The very pure logic of science."[150] While this assessment is much more positive and affirmative with regards to the peace building effects of SESAME, it should be noticed that again the scientific nature of SESAME is emphasized beyond all others and is particularly juxtaposed in opposition to diplomatic ends. "I don't think that the governments of SESAME Members or Observers are wasting their time or money for nothing. There are politicians, policymakers, diplomats, administrators, but the key players are scientists, engineers, and technicians. The end product is scientific results, not agreements, regulations or measures."[151] Regardless of how much one is in favor of the peace making aspect of SESAME, it seems to be consensus that it will only materialize *as a result* of the scientific achievements and progress of SESAME. It will not be the result of a concrete strategy or immediate aspirations that may as well run under the heading of "science diplomacy".

It can be summarized that scientific international collaboration at SESAME will only be successful in the sense of being inclusive and coherent towards the region if the scientific aspect is prioritized above all others[152]. The directors, scientists and managers that are involved in SESAME and that have talked to us did not get tired of highlighting the importance of advancing SESAME in terms of scientific excellence. If SESAME does not proof that it is able to produce competitive scientific results, it will also not be able to serve in diplomatic terms. SESAME will not be a credible science diplomacy case if the scientific ambition is not considered paramount.

5.7. Inclusion and Exclusion of Actors

The topic of participation and inclusion/exclusion is a central and vigorous one in the case of SESAME and plays a role on at least two different levels. On both levels the relevance of this topic is "real" in the sense that it can be empirically substantiated; yet it clearly depends on how one choses to look at the case. On the first and probably more obvious layer, the relevance of the topic of participation is the case in as much inclusion is regarded as a constitutive part of the founding narrative and publicly transmitted identity of SESAME. This addresses the core idea of this project, which rests on the vision of bringing together different people from different member countries on a scientific basis that do not usually cooperate. On this layer, inclusion and exclusion as a topic takes place mainly between the

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We do not have to listen to him. Why? The question is why! Because those scientists do not also stand up against their society and say 'Hey, people, you politicians, you are doing wrong things in the regions. You are not respecting the rights of the people in the region.'" (Interview 1)

[149] Interview 1

[150] Kamel, G. (2018): SESAME Synchrotron Light Source, Why in the Middle East? In: L. Maiani et al. (eds.): International Cooperation for Enhancing Nuclear Safety, Security, Safeguards and Non-proliferation–60 Years of IAEA and EURATOM. Springer Proceedings in Physics 206, p. 188.

[151] Ibid. p. 188.

[152] Interview 2

member countries according to differences or even hostilities between them that feeds into the founding myth of SESAME. However, this perspective relates only to the rather obvious layer of the topic of participation in this case.

On a second and more tacit layer, the topic of inclusion and exclusion may play another quite different role in the formation and current understanding of the project among the participants. Twisting the perspective from the donor/initiator to the recipient discourse, SESAME is also understood as a response to the on-going exclusion and discrimination of Arab researchers in a Western dominated international science community[153]. It has been reported in several talks and interviews that it has proven difficult for Arab researchers to get their proposals accepted in order to be allowed to conduct research in the advanced European facilities. By contrast, Israeli researchers are much more likely to get access to western facilities. In contrast to most Arab research communities, they have direct access for example to ESRF and ELLETRA in Italy[154]. The positive effects of a synchrotron (community) within the region might therefore not be self-evident for Israeli researchers from the start but it would be important to secure their involvement[155]. At the same time, this makes them also an important member of SESAME. Yet again, it can be more difficult for Israelis to reach a facility that is located a couple of kilometres right beside their country than to fly to European synchrotrons. For Israeli researchers it is not easy to cross the border to Jordan on their way to SESAME[156].

To sum it up, while the value of SESAME has often been deemed to lie in its peace-making capacity in the region, this is mainly from the point of view of the international press and of the international community. It might be just as much considered a needed redress of a lack of synchrotron technological development in the region and maybe discrimination and exclusion of Arab researchers in the international arena. In that sense, the topic of ex/inclusion plays a vital role on the level of defining SESAME's purpose and core identity.

5.8. Gender

Women made substantial contributions to SESAME and it is fair to say that SESAME would not exist in its current form without the input of a number of individual female scientists. One of the two beamline scientists in charge is Gihan Kamel, a woman from Egypt. She joined SESAME as early as 2005 and has pushed forward the construction of the IR beamline from the beginning. Unfortunately, she has also been the only woman working permanently in the facility for a long time and she had to tackle pushbacks because of being a woman working full-time[157]. Another woman, who has been part of the evolution of SESAME almost from the beginning, is Zehra Sayers. She was a driving force for SESAME in the function of the long-standing chair of the Scientific Advisory Committee (SAC) (for more details on her outstanding role and contribution see section 4.4).

Apart from the key contributions by individual women, women seem to be generally more active and are better represented (at least currently, 2019) than men in the current users

[153] "We or most of the scientists here in the region, they usually do not have collaboration with scientists from Germany or France or whatever. It is like there is a gap. We cannot cover it." (Interview 1)
[154] Interview 4
[155] Interview 4
[156] Interview 4
[157] Interview 4

group[158]: The first official experiment that was ever conducted at SESAME and at the XAFS/XRF beamline was led by Kirsi Lorentz, a woman from Cyprus. The second official experiment, conducted at SESAME and the first one officially conducted at the IR beamline, was also led by a team of female researchers from Egypt, Kairo University. It would be interesting to know more about the reasons for that finding. Yet it generally matches the fact that women researchers are well represented in scientific institutions in many Arab countries (e.g. Tunisia or Egypt) often contradicting wide spread beliefs among Europeans[159]. On average, women are better represented statistically in research institutions in Arab countries than in North America or Western Europe.

At the directorate level, there are currently no women at all.

[158] „We have really a lot of good scientists that are women. It is not difficult to get a good gender balance." (Interview 5)

[159] Plackett, B. (2018): Behind the Numbers: Arab Women in Research, In: Al-Fanar Media, 6 August 2018. Retrieved from: https://www.al-fanarmedia.org/2018/08/behind-the-numbers-arab-women-in-research/

6. Conclusion and Recommendations

SESAME is a unique science collaboration and science diplomacy effort in the Middle East. Its core ambition is to operate an international state-of-the-art synchrotron radiation users facility in Jordan that is accessible to scientists from the member countries Cyprus, Egypt, Iran, Israel, Pakistan, Palestine, Turkey and Jordan. In that, it wants to advance scientific and technological development in the region and reverse brain drain. Being the first synchrotron in the Middle East region it maintains enormous potential with regards to furthering individual disciplines and research fields as well as strengthening the community of researchers in the region as a whole. SESAME has also been constituted as a science diplomacy effort with the aim of creating new links and intercultural understanding between scientists in this conflict affected region. The EU and European actors have played (and still play) an important role in many regards and on several layers.

SESAME is mainly an effort of scientific actors, namely the international synchrotron community that was institutionalized with the strong support of UNESCO. It was therefore brought into life first of all by the dedication of individual scientists and the institutional support of the broader synchrotron user facilities community, namely national research institutes and science associations. Science associations and synchrotron facilities from Europe played a crucial part in this, both at a national and supranational level, namely CERN, ESFR, the Helmholtz Foundation (with DESY and BESSY), SOLEIL and many others. These facilities have provided expertise, experience, components and trainings. SESAME is in large part a result of their enterprise. Having said this, the European Union has also made major contributions to SESAME. By contrast, European Member States have not been explicitly active or supportive in general.

In the case of SESAME, the EU seems to have gotten many things right. It has not only provided considerable financial resources (in the order of EUR 10 to 20 million) throughout the last 15 years, but this has happened also in an almost integrated approach. It enabled the allocation of resources (also from other national donors) in close cooperation with the executives and with regards to the particular needs of the facility. Resources were spent on the procurement and commissioning of technical components and even full beamlines (most recently the BEATS Project). It has funded the construction of an on-grid solar power plant in Jordan that satisfies the high electricity consumption of the particle accelerator (in that, SESAME is the first synchrotron in the world that has gone green) and in that the EU has made a major investment in the future of the synchrotron facility as well is in environmental friendly energy consumption. Thirdly, the EU has supported the development of human capacity and networks. Most importantly in that regard, the EU provided funds for OPEN SESAME, a Horizon 2020 consortium consisting of 10 European synchrotron facilities and science associations to train and advise SESAME staff and users and to connect them with each other. On top of that, the consortium aims to develop a strategy to reach out to scientists in the region, develop the users community and promote the purpose of SESAME in the regional industry. Investments (not only those of the EU, of course) are very slowly starting to pay off. The year 2019 marks the first year, in which the facility is open to users on an almost regular basis and research is being conducted. Apart from the full operation of the beamlines, SESAME has brought together hundreds of (mostly young) scientists from the region in trainings and user's meeting and scientists from the Middle East and beyond have collaborated closely in the set-up of the facility, already in recent years. In a few instances it has in fact "reversed brain drain" and caused "brain circulation"[160]. Finally, it should not be forgotten that SESAME receives the credits for its support in the region. Staff and users of SESAME are well aware of the EU's contributions and this is interpreted as a neighborhood policy, though a strategic and self-interested motivation is identified.

One of SESAME's main obstacles is the little cooperation that happens at the member level. This refers to the fact that researchers/users communities at the national level are not developed and systematically organized yet. This makes it hard for SESAME to reach out to the potential users communities more effectively[161]. Organizing (or helping to organize) users communities could be also a task for the national governments of the member states, such as approaching universities and science communities in their countries. The biggest (diplomatic) effort still remains with securing the yearly budget. SESAME had to continually struggle with the financial situation. Again, this is most probably a topic that also needs to be negotiated among the member countries and requires the commitment of political elites within the countries. SESAME has enjoyed wide institutional and symbolic support on the international political and scientific level up till today (e.g. by UNESCO, the European Union, national and international research centers such as CERN and the majority of European synchrotrons) that has equipped the project with international backing. Among others, the European Commissioner for Research (2014-2019), Carlos Moedas has been a strong proponent of the project.

Paradoxically, SESAME will be most effective in its science diplomacy effort if it does not try to be a science diplomacy effort at all costs. It should continue to put the focus on its scientific core purpose: providing a research facility and advancing the researchers (users) community in the region. The public narration and articulate expectation of SESAME as purposefully bringing people together and building bridges has been interpreted at times as a political agenda that is not always easy to read for everyone and can be interpreted as standing in opposition to scientific objectives. It has raised suspicion and resistance among the fairly diverse groups of researchers. Furthermore, the specific member country constellation – which is based on its science diplomacy ambition to comprise politically adverse countries – seems to have complicated the negotiation of (financial) support and commitment considerably. It has also made it difficult to attract new member countries. In the worst case, if SESAME showcases an overly explicit ambition of overcoming difference and peacemaking, it might just attract the staging of political conflicts. This scenario is unlikely from a current point of view, but should be considered. Maintaining an explicit science diplomacy ambition or not is independent from the fact, that people from different backgrounds do (and will) meet and overcome cultural biases while working at SESAME anyways. The science diplomacy narrative might have earned SESAME support within the international political community and might have propelled even more dedication by the international synchrotron community. We do not know this. Yet, SESAME was modeled on the example of CERN to foster international collaboration and development on scientific grounds. And if SESAME is to follow the example of CERN, this means that it has to continue to consolidate the scientific effort before anything else. SESAME and staff should be supported in exactly this effort (they will pursue this effort anyway, we have no doubt about that).

[160] Kamel, G. (2018): SESAME Synchrotron Light Source, Why in the Middle East? In: L. Maiani et al. (eds.): International Cooperation for Enhancing Nuclear Safety, Security, Safeguards and Non-proliferation–60 Years of IAEA and EURATOM. Springer Proceedings in Physics 206

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SESAME: Proposal Review Committee (PRC). Retrieved from: http://old.sesame.org.jo/sesame/users/user-guide/applying-for-beam-time/proposal-review-committee-prc.html

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8. International Joint Research Programming

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1. International Joint Research Programming as a Challenge

International research collaborations have seen an enormous rise in recent years[1]. While for many scientific[2] fields (e.g. radio-astronomy, geophysics) an international setting of collaborations is most common, one should not think of this type of social interaction as a given. Numerous issues need to be resolved, such as legal frameworks to safeguard collaboration (this pertains to work permissions and mobility, the importing and exporting of material and immaterial scientific data and other related issues of intellectual properties, liability cases in case of damage etc.), specific modes of funding, questions of the type of institutional configuration[3] and not least quality issues. Therefore, individual and collective actors from different national states and/or international organisations must reach a common understanding before, during and after international research programming.

That the programming of international research collaborations can be challenging is reflected in joint political statements, such as the "Singapore Statement on Research Integrity"[4] or the "Montreal Statement on Cross-Boundary Research Collaborations"[5]. The latter statement urged the "world science community" to acknowledge that international collaborations are challenging, as "they may involve substantial differences in regulatory and legal systems, organizational and funding structures, research cultures, and approaches to training. It is critically important, therefore, that researchers be aware of and able to address such differences […] that might arise in cross-boundary research collaborations"[6]

The complexity of international joint programming is also reflected in the necessity of regular meetings by the so-called Global Research Council that also crafted the two afore-mentioned statements. The GRC, though not in the focus of this report, is worth mentioning as it brings together representatives of different research funding agencies, ministries and other agencies (depending on the individual country's specific set-up) to reach common understandings of research and evaluation standards. In addition, there is a rise of bi-lateral International Science and Technology Agreements as of the mid-1990s[7] that should express goodwill of or sometimes safeguard international research collaborations. And not least does coordination and joint programming of research pose a challenge for EU Member States, which is why the European Commission launched the ERA-Net coordination instrument in the early 2000s as part of its idea to gain deeper European integration under

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[1] UNESCO (2015): World Science Report. Towards 2030. UNESCO Regional Office for Science and Technology for Europe.; Wagner, C. S., K. Jonkers (2017): Open Countries have Strong Science. In: Nature | Comment, 550, pp. 32–33.; Wagner, C. S., L. Leydesdorff (2005): Network structure, self-organization, and the growth of international collaboration in science. In: Research Policy, 34, pp. 1608–1618.

[2] By "science" we mean all actors that seek for new knowledge in a structured way of no matter what disciplinary background they have.

[3] cf. Laudel, G. (2001): Collaboration, creativity and rewards: Why and how scientists collaborate. In: International Journal of Technology Management, 22(7–8), pp. 762–781.

[4] Resnik, D. B., A. E. Shamoo (2011): The singapore statement on research integrity. In: Accountability in Research, 18(2), pp. 71–75.

[5] Anderson, M., S. Kleinert (Eds.) (2013): Montréal statement on research integrity in cross-boundary research collaborations. In: Third world conference on research integrity. Montreal, Canada, pp. 5–8.

[6] Ibid.

[7] Rüffin, N. (2017): Science and Technology Agreements in the Toolbox of Science Diplomacy: Effective Instruments or Insignificant Add-ons? EL-CSID Working Paper 6.

the leitmotif of the European Research Area[8]. As quite a variable instrument[9], ERA-Nets were first and foremost a possibility for national R&D stakeholders (program owners, such as ministries, and program managers, i.e. project/funding agencies) to engage in joint learning and potentially find ways of multilateral programming and funding of R&D activities[10].

We will focus on international research programming that takes place on a bilateral basis, whilst acknowledging – and marginally discussing – multilateral programming. Bi- *and* multilateral joint programming activities take different causes of action, they support all types of research (basic, use-inspired, applied research etc.), they are vested by different funding programs, they might be based on an explicit international legal treaty, their procedural form of assessment varies, especially as regards the type of evaluation and its expected rigor, and they might follow specific (or unspecific) political goals and apply specific standards or operating procedures (while the latter do not have to be standardized). Probably only applicable to multilateral programming, another category programming involves the European Commission, which means that actors in multilateral settings can resort to the ERA-Net[11] scheme and other guidelines as a blueprint for their course of joint actions.[12] Thereby, our focus will be on the social process of how modes of international research programming are agreed upon and how they the latter are actually set up, acknowledging that the various logics and lifeworld interpretations of actors must be bridged. Not least, in order to collaborate actors will have to reduce social complexity on two (and crossbreeding) dimensions:

a) At the minimum level of complexity, two sovereign entities, i.e. two states, a state and an international organisation, or two international organisations that cannot rule upon each other must resort to diplomatic activities in whatever possible way in order to find an agreement *how* they would want to collaborate. Even in those cases where international research collaborations and their political advocacy date back to longstanding relationships – some have lasted for centuries –, these relationships must always be revitalized and reinterpreted anew.
b) Politics and science, as often described in a principal agent relationship[13], must find a way of coordinating each other's interests as regards the question of what kind of research should to be funded (e.g. investigator-driven research of any kind or rather thematically-driven and development-oriented research), how research should be organised (via programs or projects, individually or group-oriented, long-term or short-term etc.), how it should be reviewed (e.g. ex ante, in between

[8] European Commission (2000): Making a reality of The European Research Area: Guidelines for EU research activities (2002-2006), COM (2000) 612, 4 October.; Abels, G. (2003): The European Research Area and the Social Contextualization of Technological Innovations. The Case of Biotechnology. In: J. Edler, M. Behrens, S. Kuhlmann (Eds.): Changing Governance of Research and Technology Policy: The European Research Area. Cheltenham: Edward Elgar, pp. 314–337.; Kaiser, R., H. Prange (2005): The Open Method of Coordination in the European Research Area. A New Concept of Deepening Integration? In: Comparative European Politics, 3(3), pp. 289–306.

[9] Edler, J. (2012): Toward variable funding for international science. In: Science, 338(6105), pp. 331–332.

[10] Pérez, S. E. (2010): Mapping ERA-NETs across Europe: Overview of the ERA-NET scheme and its results. EUR 24668 EN. Joint Research Center.

[11] European Commission: ERA-Net Cofund scheme. Retrieved from: https://ec.europa.eu/programmes/horizon2020/en/h2020-section/era-net

[12] What will not be covered by this report, are international collaborations on a permanent basis, such as the Jurassic funding networks COST and EUREKA or international research performing and funding organisations like CERN, EMBO/EMBL.

[13] Braun, D., D. H. Guston (2003): Principal-agent theory and research policy: An introduction. In: Science and Public Policy, 30(5), pp. 302–308.

and/or ex post; summative or formative, written or orally, open to the public or not) , and what role each actor should fulfil in this social undertaking. In particular, this coordination entails sorting out questions about procedural standards and about quality in general.

Each of the two dimensions in itself provides for ample social complexity. The mainstream of International Relations (as the scholarly field of studies on international affairs) has, for example, dealt with the intricacies of 'double-edged diplomacy' and 'double chess' delegation games: Actors must attune domestic and foreign affairs in the absence of a global leviathan if they want to successfully carry their points in policymaking[14]. Under this premise, it is an empirically open question as to whether foreign policy is decoupled domestic policymaking and their actors, if – in light of a multi-governance perspective[15] – foreign policy is in line with domestic policy or even employed to influence domestic actors. In addition, scholars and practitioners have to cope with the challenge of attributing events and actions to 'actorhood', which can only be done by presupposing that actors conceive of the world as being lawful, that they can understand these laws and that they apprehend a connection between such laws and their own and others' actions[16]. However, as actorhood is an abstract correlate that gets continuously reconfigured in the course of social interactions and interpretations, it remains an empirical question if something or someone gets accredited with actorhood and not least what actions, roles and underlying expectations are thereby inscribed. In this respect and despite revivals of state-centrism and categories of power[17], IR has come to acknowledge that a plethora of multiple-networked subjects (individual and organizational ones) can neither be attributed to individual states nor steered by governments (let alone their individual departments) or quasi-governmental regimes[18], none of which can be presupposed to featuring coherence.

On the other hand, science policy research has devoted much capacity to investigate into the political steering of scientific actors that are expected to contribute to economically and socially attainable products and services. Despite recent paradigm shifts in science policy that have disclosed an uptake of more outspoken and targeted strategies to state-coordinated scientific activities[19], scholars have become aware of a potentially huge information asymmetry between scientists and political actors as well as of the idiosyncratic self-governing norms of scientific groups[20] that render the governance of science as being

[14] Keohane, R. O. (1984): After Hegemony: Cooperation and Discord in the World Political Economy. Princeton: Princeton University Press.; Marks, M. P. (2011): Game Theory Metaphors. In: Metaphors in International Relations Theory. Springer, pp. 137–160.; Moravcsik, A. (1997): Taking preferences seriously: A liberal theory of international politics. In: International Organization, 51(4), pp. 513–553.

[15] Bache, I., M. Flinders (Eds.) (2004): Multi-level Governance. New York: Oxford University Press.

[16] Drori, G., J. W. Meyer, F.O. Ramirez, E. Schofer (2003a): Introduction: Science as a World Institution. In: G. Drori, J. W. Meyer, F. O. Ramirez, E. Schofer (Eds.): Science in the Modern World Polity. Institutionalization and Globalization. Stanford: Stanford University Press, pp. 1–20.

[17] Skocpol, T., P. Evans, D. Rueschemeyer (1999): Bringing the state back in. Cambridge.

[18] Albert, M. (2010): Modern Systems Theory and World Politics. In: M. Albert, L.-E. Cederman, A. Wendt (Eds.): New Systems Theories and World Politics. Basingstoke: Macmillan Palgrave, pp. 43–68.; Albert, M., B. Buzan, M. Zürn (Eds.) (2015): Bringing Sociology to International Relations. World Politics as Differentiation Theory. Cambridge: Cambridge University Press.; Brenner, N. (2004): New state spaces: Urban governance and the rescaling of statehood. Oxford University Press.; Lacher, H. (2003): Putting the state in its place: The critique of state-centrism and its limits. In: Review of International Studies, 29(4), pp. 521–541.

[19] Ruivo, B. (1994): 'Phases' or 'paradigms' of science policy? In: Science and Public Policy, 21(3), pp. 157–164.; Whitley, R. (2011): Changing governance and authority relations in the public sciences. In: Minerva, 49(4), pp. 359–385.

[20] Daston, L. (1995): The moral economy of science. In: Osiris, 10, pp. 2–24.; Fleck, L. (2012): Genesis and development of a scientific fact. University of Chicago Press.; Merton, R. K. (1973): The Normative Structure of Science. In: N. W. Storer (Ed.): The Sociology of Science: Theoretical and Empirical Investigations. IL: University of Chicago Press, pp. 267–278.

in a constitutive dilemma[21]. In this respect, the social expectation that policymakers confine themselves to acting in boundless trust as fiduciaries[22] vis-à-vis scientists is over[23]. Scientific work has got increasingly conditioned via selective third party funds, specific types of research evaluations and the introduction of comparability regimes that empower an elitist system of scientific capitalism[24].[25]

The previous discussions allow for two tentative hypotheses. First, social complexity increases, as entities need to be coordinated beyond national boundaries and from the realms of science and policy. Second, complexity does not necessarily increase as for example compared to national settings – in fact it might even decrease –, because actors cannot assess each other's social position as they do in national settings. We can also expect that they good-natured and encounter their international partner with in an extra amount of courtesy and principles of charity. And not least does complexity vary depending on whether collaborations are a single-shot game or a recurring one, if actors know each other or face a first-encounter situation, and if their properties feature huge differences, such as in terms of socioeconomic development and scientific infrastructural levels. Not least, actors bring in their specific convictions and expectations into the programming of research collaborations. While some actors expect clearly outlined and mandatory procedural rules, others expect more room for maneuver. Again, the entire notion of scientific research may be borne by different convictions. Some expect immediate and palpable results whereas others stick to the notion of non-directional or indirect knowledge production[26], and yet others hold international collaborations sacred no matter what they contain.

2. Research Programming: Processes and Actors

Joint international research programming is a social process. In fact, it can be viewed as a sequence of special communication, because participants do not only take part in its communication but also discuss the principles of their communication concurrently. The process of joint programming can be regarded and analyzed as a sequence of social actions that features a series of phases.

An **initial cause of motivation** for participant(s) to collaborate internationally. Such an initial cause can derive from academic researchers, policymakers, business men, and other advocacy groups. The cause can be palpable, finite and direct. The German Egyptian Year

[21] Guston, D. H. (2000): Between Politics and Science. Assuring the Integrity and Productivity of Research. Massachusetts: Cambridge University Press.

[22] Braun, D. (1993): Who Governs Intermediary Agencies?: Principal-Agent Relations in Research Policy-Making. In: Journal of Public Policy, 13(2), pp. 135–162.

[23] Whitley, R., J. Gläser (2007): The changing governance of the sciences. In: Sociology of the Sciences Yearbook 26.

[24] Musselin, C. (2013): How peer review empowers the academic profession and university managers: Changes in relationships between the state, universities and the professoriate. In: Research Policy, 42(5), pp. 1165–1173.; Slaughter, S., G. Rhoades (1996): The Emergence of a Competitiveness Research and Development Policy Coalition and the Commercialization of Academic Science and Technology. In: Science, Technology, & Human Values, 21(3), pp. 303–339.

[25] Ironically, financially mechanisms to manipulate the behaviour of individual researchers, i.e. via incentivisation and control, yield no desired outcome no matter what disciplinary background. Biester, C., T. Flink (2015): The Elusive Effectiveness of Performance Measurement in Science: Insights from a German University. In: I. M. Welpe, J. Wollersheim, S. Ringelhan, M. Osterloh (Eds.): Incentives and Performance: Governance of Research Organizations. Cham: Springer International Publishing, pp. 397–412.

[26] Callon, M. (1994): Is Science a Public Good? Fifth Mullins Lecture, Virginia Polytechnic Institute, 23 March 1993. In: Science Technology Human Values, 19(4), pp. 395–424.

of Science and Technology[27], for example, can be regarded a politically driven point of reference that triggered concrete bilateral science policy planning and collaborations between researchers of the two countries. On the other hand, a collaboration can also stem from a gradual rise of mutual interests, i.e. researchers might have read about the works of others or met them on conference and build up a trustful relationship over years (including visits or long-term stays). At some point this may lead to the point where policymakers set up a research funding program.

The **preparatory phases of setting up a transnational program** defines the purposes, scope and conditions of a collaboration. International research funding requires from organisations of each state to develop and openly communicate a reason for why the collaboration is deemed necessary. It also defines the financial and programmatic scope of an initiative: Who can apply (public and/or private entities, natural persons or body corporate etc.)? What topics are funded and what are the funded results needed for? What is the global budget of an international initiative, how much funding should be devoted to individual projects and how long can funding periods last? These questions only represent a limited number of issues that organisations must agree upon from the earliest possible state of planning. But even more so: participants of international joint research programming activities must actually acquiesce in discussing these questions. Because touching upon them without having agreed upon it can be interpreted as an act of outside interference into sovereignty. Needless to say, the preparatory phase also includes the setting up of organizational bodies, such as bilateral decision or advisory boards, peer review/expert panels, ethics committees and a (shared) data management infrastructure. Probably the most crucial distinction in this programming phase is the degree of integration. Will joint programming mean that a real common pot system is going to be installed in which all partners pay in their share? The same question is to be answered with respect to the evaluation principles: Will each party have *their* peers evaluate *their* domestic applicants or will one pool of reviewers be defined that will organize a joint review process? Will research managers or policymakers from one side decide for the entire international joint program (e.g. with annually changing responsibilities) or will each side decide separately?

In the actual **implementation phase**, the joint program will be finalized until the point of inviting tenders or disseminating calls for proposals. This includes finally agreeing upon rules for participation, all (first) terms of procedures necessary for partners to engage into the selection and payment of beneficiaries, their rules for participation and the standards and procedures of evaluation. This phase also entails agreeing upon the specific timing of the project's application phase, as most joint calls must be based on rigid time schedules in order to pass muster with national administrative regulations. For example, in some countries and organisations projects must start until a fixed deadline in the winter due to cameralistic accounting principles.

The **application and evaluation phase** starts with the official announcement of the call for proposal and ends with project consortia being selected for contracting and thus starting their research and developing work. Among the biggest issues of joint programming lies the question of what kind of evaluation should be used and going along with this: what criteria should apply whilst running an evaluation. Do the program designers think of scientific quality criteria (originality, novelty, relevance, the applicants' merits etc.) only or do they include other criteria (sustainable development goals, societal impact, and how are criteria weighted? Moreover, all participants must know how to operate according to

[27] Federal Ministry of Education and Research: The German- Egyptian Year of Science and Technology. Retrieved from: https://www.bmbf.de/upload_filestore/pub/German_Egyptian_Year_of_Science.pdf as accessed 13.06.2019.

the established principles. A seemingly trivial but crucial question is how much time experts have for reviewing a proposal, that they know how rate and grade research proposals and that everyone knows what to do in the likely case of different contradictory grades being given to proposals. Finally and also concerning evaluations, it will be necessary to define if the projects are assessed whilst running (e.g. mid-term reviews) or afterwards (ex post assessments), and whether they may include stakeholders other than those who evaluated them in the first place.

Similar to criticism as regards policy cycle models[28] or the linear model of innovation[29], one might quickly come to realize that research programming does not need to follow the sequential logic as sketched above. Features that would be common for e.g. later phases can appear at the beginning, and certainly can programs be set up without any feedbacks from ex post ante evaluations. On the other hand, procedural evaluations can take place in all phases, and certainly is it possible that joint programming participants can change criteria in the course of action. And one should forget the possibility that sometimes there might be no formal procedures in place but haphazardness, informality, spontaneity or even governance by capriciousness.

In a similar vein, actors' positions in international joint programming can vary in the course of the generic programming and depending on the country of collaboration. In some countries there is a relatively clear and functional differentiation between (i) program owners represented by ministerial staff, (ii) program managers e.g. represented by funding/ project agency staff that run the actual programs, (iii) peers that are responsible for judging project proposals or running consortia. In other cases, program owners and administrators are the same, and yet in other cases program administrators are scientific experts of highest professorial rank that also fulfil the duty of working in funding/project agencies. In some countries, research funding agencies enjoy high degrees of independence vis-à-vis policymaking, while in others they are bound to the level of program owners[30].

3. Case Selection And Operationalization

The case study report revolves around the question how international joint programming can be organised, provided that actors from different states as well as from politics and must find a common understanding of the purpose and process of international research funding. So how does joint international research programming get negotiated? Who takes part in it when, and how are understandings about aspects of quality in research dealt with by actors from different countries/political entities? How is contingency/conflict mediated as regards different convictions about what makes good scientific practice, especially when representatives of science (funding) organizations or ministries of differently developed countries are dealing with one another to jointly program or evaluate funded research programs?

[28] Howlett, M. (2009): Process Sequencing Policy Dynamics: Beyond Homeostasis and Path Dependency. In: Journal of Public Policy, 29(03), pp. 241–262.; Howlett, M., M. Ramesh, A. Perl (2009): Studying public policy: Policy cycles and policy subsystems (Vol. 3). Oxford university press Oxford.

[29] Godin, B. (2006): The Linear Model of Innovation: The Historical Construction of an Analytical Framework. In: Science, Technology & Human Values, 31(6), pp. 639–667.; Rosenberg, N. (1991): Critical Issues in Science Policy Research. In: Research Policy, 18(6), pp. 335–346.

[30] Braun, D. (2003): Lasting tensions in research policy-making – a delegation problem. In: Science and Public Policy, 30(5), pp. 309–321.; Gulbradsen, M. (2005): Tensions in the research council – research community relationship. In: Science and Public Policy, 32(3), pp. 199–209.

These questions are dealt with in comparative perspective. The comparison features three settings, two of which will be discussed in more detail: a) a multilateral initiatives will be cursorily discussed in relation to the ERA-Net coordination mechanism. b) three bilateral initiatives between organizations from EU Member States and three different non-EU countries, i.e. Turkey, Egypt and the Palestinian territories that hugely differ in terms of territorial and demographic size, socioeconomic and S&T development status as well as their science policy. It is important to note that no organisation will be disclosed, as the highest possible level of anonymity has been granted to the interviewees who would not have shared their knowledge otherwise. As some collaborations in the world are unique – as is the case here –, even the slightest hint to either countries' organizations would almost certainly lead back to the identity of interviewees and their institutions.

The empirical backbone of this case study is a selection of ten expert interviews, eight of which have been carried out by the author alone, while two had been done in collaboration with the EL-CSID project team of the Berlin Social Science Research Center. The interviewees are representatives from the European Commission's DG RTD, research funding agencies and research ministries of European states. If applicable, expert interviews were compared with a document analysis, while documents were rarely to be found or hardly shared by the experts. Needless to say, making explicit references would compromise the reviewers and can for most of the time not be made explicit in order to guarantee that promised anonymity will not be compromised.

The following empirical section will present three joint programming settings individually before drawing a comparative conclusion. For each of the cases we will, as best as possible, highlight its idiosyncratic structures and identify its positive and negative aspects, as identified by the interviewed experts.

4. Bilateral Collaborations in Turbulent Times

Classical for a policy-driven agenda-setting, the new international joint programming between the European state and Egypt and Turkey emerged as a result of a series of bilateral meetings organised by the two national ministries that are responsible for education, science and technology.[31] For some it is the usual case that such bilateral initiatives are launched in the course of high-level meetings between ministers or state secretaries. As an interviewee states:

> *„Often we get this on our tables as a request from the outside, for example from a foreign politician, or very often as the result of a bilateral meeting of two ministers that will lead to the proposal of one party to do something together…you know these kinds of delegation visits where broad interests of a country are discussed, and then both sides shake hands and conclude that they want to collaborate. At this stage, it remains open where exactly they would want to collaborate, it's just a declaration of goodwill. And finally, staff from the ministry approach the agencies and others to fathom what could be done." (Interviewee T)*

That said, some agencies in Europe follow a multiannual heuristic with two variables: countries and topics of strategic interest:

[31] The actual science and technology policy interactions between the two states' ministries (or their precursors) dates back to the 1970s and was geared toward research and development especially in nuclear energy technologies.

> *"We are a national research agency, and so our money must not cross borders, it's a co-funding thing. And our principle is to finance excellent science. That means, whenever we find in this pillar collaborating partners from developing countries to co-finance projects, they have to compete with our own domestic science or intra-European collaborations. But we also have more strategic projects, where the country and the topic are of governmental concern. Often the funding is not so important then but to build up capacities in the funding agencies abroad of these countries." (Interviewee A)*

In the bilateral collaboration with Egypt, the first meetings that sought to find topics of mutual S&T-interests were organised in the mid-2000 years, i.e. about six few years before the Arab Spring led to the political turmoil and the Egyptian crisis as of 2011. Amidst the regime change in Egypt, the bilateral science policy collaborations have been explicitly sustained to symbolise support for civil societal actors, to point to science as a modernization force for socioeconomic progress and to keep up communication channels.

In the case of Turkey, hitherto well-going research collaborations were terminated after the presidential elections in August 2014, which widely empowered the president constitutionally vis-à-vis the parliament and was followed by a veritable purge against intellectuals, journalists and academic scholars, many of whom left the country. In general, the Arabic Spring, the Turkish convergence into a presidential regime, the civil/proxy wars and a persistently tensed situation within and between states and the state-like regions of Middle East do not allow for stable scientific research planning. One of the interviewee who is heading the entire department responsible for the Middle East describes this situation:

> *"Over somewhat the last ten years, you never knew what would happen next. One week before a contract should have been signed, your partners would just cancel it out of the blue. You'll find out that a regime change has now also reached the research ministry and its funding agency. In another we could have started a collaboration, but then a President would purge the academics of his country."*

Back to Egypt: In the initial meeting, a bilateral task force was formed to start its work. It consisted of representatives from the ministries, two research funding agencies from the European state and the Egyptian Science and Technology Development Fund, a spin-off and soon project agency of the Ministry of Higher Education and Scientific Research (MHESR). The meetings were accompanied by the respective science attachés of the EU member state that, based at the embassy in Cairo, mainly provided logistical support. In the strategic meetings, a series of public science (policy) events were planned that flanked the official launch of a bi-national fund. Over a period of three years, the binational group met twice a year, while preparatory work was also assisted by numerous individual face-to-face and virtual meetings.

For agenda-setting purposes, these public events are not to be underestimated, because they constitute focal points that structure actors as regards their timing and commitment of resources and might leave the ceremonial mark on individuals[32] of having done something meaningful and of importance.

A similar cause and structure can be observed for the collaboration with Turkey. There has been a well-established exchange between individuals from scientific communities as well as between ministries and intermediary organizations in the field of science and technology. Moreover, a new bilateral initiative was founded after the 2010er years to underpin and boost the scientific and policy relationships with this country.

[32] Meyer, J. W., B. Rowan (1977): Institutionalized Organizations: Formal Structure as Myth and Ceremony. In: American Journal of Sociology, 83(2), pp. 340–363.

For both bilateral collaborations, i.e. the one with Egypt and the one with Turkey, each side is paying about 50 per cent of the budget for each project into the fund, and in both cases should the bilateral S&T-collaborations help achieve applied-oriented research goals of mutual interest. It was decided to finance research and technological development activities e.g. in the areas of agriculture, biotechnology, health, ICT, material sciences and mechanical engineering, renewable energies, and urbanisation, while each side also consulted with their domestic peer groups to get input. The funds are also supposed to aid each consortium side on a 50 per cent basis for a funding period of three years.

As interviewees report, it was clear from the beginning that these funds had to abide to national administrative law and accustomed procedures, however, this is not as simple as it might sound:

> *"Often we think, oh well, it's just administrative rules. But these are not trivial because you don't know to what extent you can bend or even defy them. In some countries including our own, projects, for example, must start on a fixed date or be terminated at a given point of time. Sometimes at the end of the year, sometimes in…let's say the 1st of March. Otherwise they cannot start at all, no matter how much you want that or how much have already invested resources into them. So, joint programming…well it's a tricky process of mediating. And you know, while sometimes you don't even know how flexible your own political program owners are, how can you anticipate this for your foreign partners?"*

In line with the statement, all interviewees reported that the attuning of different administrative procedures (including of codes of practices, timing, the distribution of earmarked funds etc.) poses a challenge, whenever a bilateral collaboration are to be installed. The reason is that international research policies are bound to social institutions. As we know from generations of social scientists, "[i]nstitutions by definition are the more enduring features of social life...giving 'solidity' across time and space"[33]. Yet, viewed as collectively stabilized expectations, institutions are not necessarily taken-for-granted assumptions or mere tradition[34], as they experience being constantly "created, maintained, changed and decline"[35]. For analytical purposes, scholars[36] differentiate institutions into three pillars: institutions can be *regulative* (rules enacted via coercion of actors), *normative* (they persuade actors due to beliefs in what is morally right/wrong and what is mannered/appropriate) and *cognitive* (actors share the same beliefs in causal mechanisms). With respect to the setting up of research funding in general, administrative rules *can* structure in the form of *regulative* institutions, at least if they coerce actors into abiding to their demands. Funds are not freely distributed but are always conditioned, they depend on review procedures and timespans of spending financial resources etc. However, even in domestic science policy regulative institutions only apply seldom, for example when ethical lines are in danger to be stepped over or whenever third party funds should be spent in accordance with administrative and budgetary law. Moreover, due to the different logics of science, politics and other social spheres, regulative institutions can hardly stand

[33] Giddens, A. (1984): The constitution of society: Outline of the theory of structuration. Cambridge: Polity Press.
[34] esp. DiMaggio, P. J., W. W. Powell (1983): 'The Iron Cage Revisited' Institutional Isomorphism and Collective Rationality in Organizational Fields. In: American Sociological Review, 48(2), pp. 147–160.
[35] Hatch, M. J., T. Zilber (2012): Conversation at the border between organizational culture theory and institutional theory. In: Journal of Management Inquiry, 21(1), pp. 94–97.
[36] Scott, R. W. (1995): Institutions and Organizations. Thousand Oaks, CA: SAGE.

on their own feet, as rules must be embedded in normative and cognitive assumptions about the purpose of distinct positions in the social contract for science[37].

With respect to the social dimensions of international research funding initiatives, regulative institutions can hardly ever work. These collaborations are voluntarily set up, which crosses out most possibilities to command actors to abide to rules. This does not mean that one cannot agree upon mutually valid norms and codes of practices. However, these are borne by shared assumptions about the functioning of processes as well as about the appropriateness of behaviour.

At the outset of a concrete phase of joint programming, i.e. the setting up of the actual funding mechanism, actors must resort to interpreting the other's positions, procedures, demands, their understandings of the purpose of science policy and of science collaborations in general as well as notions about the functioning of evaluative scientific expertise in funding procedures. For the observer just as well as for the participant of such bilateral programming, the challenge is to differentiate between tacit organizational practices on the one hand and overarching social institutions[38] on the other hand.

5. The concrete programming procedure

In both cases, the collaboration with Turkey and Egypt, all involved actors had to ensure legal accordance with domestic funding procedures and budgetary law. In the case of the EU member state, legal clearance included the allowance of state subsidies with respect to the EU's internal market paradigm.[39] With this clarified, the funding agencies and ministries informed each other about how competitive research can be funded according to their rules and best practices. For example, in the case of Egypt and Turkey, the principal investigator must be a member of an Egyptian or Turkish legal entity, which is not necessarily the case of the European member state's principal investigator. Also, both sides must regulate their terms of collaboration in a cooperation agreement. And the call for proposal must be officially advertised in English. There are many other technical details that regulate the joint and the individual conditions of funding. Also that an IT-system from one of the partners is used to operate the entire evaluation process. Speaking of which, the most important part is that actors needed to decide upon the concrete evaluation procedure.

It was agreed that consortia can send one joint proposal that will be evaluated by each side. This means, each elect scientific/expert reviewers that would write review reports and rate the proposals following an A-B-C-logic with A being of the highest grade, B meaning "good" but not outstanding, and C meaning a reject. The reviewers rate the research proposal *and* the participating persons and their host institutions, whereby each side assesses only their country's applicants and institutions. Then, the reviewers that each side would have had selected meet during one day in order to discuss their proposed shortlist and their hitherto existing rejections, also in light of available funding. On the

[37] Flink, T., D. Kaldewey (2018): The New Production of Legitimacy: STI Policy Discourses Beyond the Contract Metaphor. In: Research Policy, 47(1), pp. 14–22.; Guston, D. H. (2000): Between Politics and Science. Assuring the Integrity and Productivity of Research. Massachusetts: Cambridge University Press.

[38] Drori, G., J. W. Meyer, F.O. Ramirez, E. Schofer (2003b): World Polity and the Authority and Empowerment of Science. In: G. Drori, J. W. Meyer, F. O. Ramirez, E. Schofer (Eds.): Science in the Modern World Polity. Institutionalization and Globalization. Stanford: Stanford University Press, pp. 23–42.; Holzer, B., F. Kastner, T. Werron (Eds.) (2015): From Globalization to World Society. London:Routledge.

[39] See European Commission: Commission Regulation (EU) No 651/2014 of 17 June 2014 declaring certain categories of aid compatible with the internal market in application of Articles 107 and 108 of the Treaty Text with EEA relevance. Retrieved from: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32014R0651 as accessed 20.06.2019.

second day, it is the board of each binational research funds (the Euro-Turkish and Euro-Egyptian) that meets up to present their own assessment, based on or at least compared with the reviewers' preference list of day one. At the end of the process, successful applications will be selected and offered to set up a contract.

The reality of this phase of programming reveals – again – a complex mediation process, which also calls upon actors to revisit their cognitive and normative institutions that research funding mechanisms bear upon. An interviewee reports:

> *"You know, our and their researchers and ministries collaborate for decades. Their scientific basis builds on a longstanding tradition and, indeed, is quite strong in international comparison. No wonder, it's quite English- or US-oriented. But imagine: it took us four years until 2011 to agree upon a joint evaluation procedure, a structure, how we would evaluate, which means what evaluation levels we would go for, when the evaluators are brought in, if they should be exclusively consist of scientists or also include other experts, and what we do in the case of this or that, what kind of reporting we would want, and so on and so forth."*

Asking further how mutual agreements could be reached, the interviewee as well as other interviewed staff said that the best "rhetorical" strategy was to simply report about past experience of joint evaluations and funding with other countries – good examples as well as bad ones. This mode was then adopted by everyone in the group, because it acknowledges everyone's experience, and neither does it obligate nor blame others, which was described very important as a start condition. In this respect, the interviewee goes on, such meetings also contain important aspects of understanding the other's and one's own culture[40] as well as its social positioning of individuals:

> *"You know, in all modesty I can say that I am an expert of the Middle East. I studied Arabic and regional studies, I have immersed myself into the region to live and work there for many years, my better half is also from the region. But even if you know most customs and conventions and you speak the Standard Arabic and some dialects, these meetings you refer to are still quite challenging, even to an old stager like me. The most important aspect is your social status in this setting. This is decisive to be seen as a competent speaker or not."*

The interviewee specified that this with few exceptions, being treated in a gender-differentiating way was not an issue. Both sides have had women and men of all ranks sitting at the table. Rather, it is the question of academic title and position (which implicitly goes in line with social positions). On the Egyptian side – the same holds true for Turkey – professors who carry out research and teaching also work for the funding agency as staff members. On the European side, staff members of funding agencies have a university degree (M.A. or equivalent) or a doctoral degree, while neither the degree nor the subject background defined their domain of work within the funding agencies.[41] Hence, in comparison, the staff from Egypt and Turkey were reported to act with greater assertiveness both with respect to setting the terms and assessing research proposals.

> *"I am no scientist anymore. Many years ago, I did my PhD in the field of [xxx], and dropped out. For example in the field, where I come from I somehow understand the content of the proposals, but just on a superficial level, but I know the community of people and can ask competent scientists if they are*

[40] Sammut, G., G. Gaskell (2010): 'Points of View, Social Positioning and Intercultural Relations'. In: Journal for the Theory of Social Behaviour, 40(1), pp. 47–64.

[41] Only some interviewees hold a doctoral degree but worked generically for all funding initiatives in their agencies,

> *interested in reviewing for us. And I can see from a managerial point if a proposal is sound or not, if its institutions have a standing or not, if applicants promise too much or if a topic is relevant on the policy level…you know?"*

This said, the interviewees state that collaborating with active researchers from the other side is an asset but also quite challenging, as it is more cumbersome to disagree or getting one's own position fully accepted. This is not a sustained problem, but one that often recurs in situations of concrete decision-making:

> *"The reviewers have met one day before and put the proposals in the three baskets – no problem. But in our meeting, we decide at the very moment. And then [x] has an issue with a proposal, and you don't get to know why. But she's acting as an eminent professor, while you're only the science officer from the agency. Do you want to argue scientifically then? This is what I call tough diplomacy."*

Another aspect of hierarchy pertains to the institutional cultures of the involved organizations. According to the European interviewees, one should not expect large degrees of self-responsibility and independence in their counterparts despite their high academic ranks. Neither do their institutions allow for self-responsible actions nor have they laid out clear marching orders or business plans that the Egyptian and Turkish representatives can clearly follow. This led to a tedious stop-and-go decision-making whilst deciding upon the procedure and the evaluation criteria, because even (seemingly) insignificant decisions needed clearance from a non-transparent ministry in the back. In a similar vein, continuity of procedures, once decided upon, had been an issue, particularly in the course of the political upheavals when new staff members changed.

> *"It's like this situation: You run a program the way you do it for good reasons, and you build that on incremental steps, you go back and forth, every side clarifying all sorts of legal issues and administrative procedures with their ministries, you know. And then, the others present a new member to the funds, who questions everything. I don't know why, maybe just to play top dog for a moment. And then, his colleagues must explain to him that there are good reasons that things are running the way the run. And they must explain to the new staff member who everyone is and that we are all quite long in this game. That's just tedious, and it also has to do with new doctrines of lean management in their agency. It's ironic, you know. They are supposed to be more self-responsible, but the opposite happens. They start wondering about the most trivial and taken-for-granted practices of our joint funds."*

Yet, the interviewees also reflect on how their own institutional position is observed by the other side. All interviewees research project/funding work for agencies in EU Member States that have seized science policy importance for various reasons. First and especially due to reforms of the public sector, agencies were either founded or strengthened in order to disencumber ministries – at least that followed the "doctrines" of New Public Management[42]. Bound to lean management, a human resource planning that adapts more flexibly to the concurrent "projectification" in research funding[43] and, allegedly a closer link to interests of scientific disciplines, many research project/funding agencies have managed to expand to their portfolio of actions in recent years. Funding agencies do far more than

[42] Moynihan, D. P. (2006): Ambiguity in policy lessons: The agencification experience. In: Public Administration, 84(4), pp. 1029–1050.
[43] see the seminal works by Marc Torka, *Die Projektförmigkeit Der Forschung* (Torka, M. (2009): Die Projektförmigkeit der Forschung. Baden-Baden: Nomos.); Torka, M. (2018): Projectification of Doctoral Training? How Research Fields Respond to a New Funding Regime. In: Minerva, 56(1), pp. 59–83.

just administering research funds for governmental program owners (the ministries). They engage in elaborate foresight activities, observe S&T and respective policy development, often on the entire globe and backed by liaison offices abroad, and they develop funding schemes for their program owners. A large amount of staff of these agencies hold academic degrees. One should not forget, however, that agencies are not primarily responsible for policymaking.

In the case of binational joint programming, interviewees from funding agencies report that despite their close interactions with their program owners they have experienced surprising interferences from the ministries' staff that spawned unintended consequences on the collaboration. To provide examples, in concrete calls for proposals, the responsible agency from Europe followed its peers' assessment and decided against a certain number of research proposals. But the non-European agency/ministry wanted some of these proposals to be funded or at least considered for possible funding, in case if enough budget was available. Suddenly, the ministry from Europe agreed to finance these projects. An interviewee stated:

> *"You know, of course I was happy that more projects can receive funding, and it's not a big deal if the ministry interferes for whatever politically acute reasons. Just, the problem is that we signal inconsequent behaviour to our partners. So guess what happens in the next round? It was tacitly expected that we have money stored in the back. It's like you just need to tickle us a bit, because in the end, for political reasons the ministry would take it easy with decisions. So to some extent you lose your credibility at once. It's these situations of 'give them an inch, and they'll take a mile. Needless to say, your own scientific peer evaluators – I am sorry for this to say – feel really pranked. So it's less likely that they review for you next time."*

The interviewees make it clear that they do not blame the others by any means. Their own position vis-à-vis their ministries led to these problematic situations. Some also stated that in these instances do not depend on the shares of budgets that each partner is investing into a collaboration. Also agencies from smaller and developing regions would anticipate that interest in collaborations might rather be borne by political than scientific reasons. In this situations, staff members describe their activities as essentially "diplomatic." The afore-described interferences undermine the development of normative and cognitive institutions as to what is appropriate behaviour in bilateral research funding collaborations and what consequences follow specific causes.

6. Multilateral Joint Programming and Soft Coordination

While binational joint programming revealed challenges due to their relative absence of guiding principles, in contrast the European Union has for more than 15 years tested and implemented policy instruments that developed such principles.[44] Originally, these instruments were implemented as part of the Open Method of Coordination[45], and their purpose was to foster better cooperation especially between Member States actors but also with other transnational and supranational research performing and funding institutions in

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[44] See European Commission: H2020 Online Manual. Retrieved from: http://ec.europa.eu/research/participants/docs/h2020-funding-guide/cross-cutting-issues/era-net_en.htm as accessed 26.06.2019.

[45] Kaiser, R., H. Prange (2005): The Open Method of Coordination in the European Research Area. A New Concept of Deepening Integration? In: Comparative European Politics, 3(3), pp. 289–306.; Tholoniat, L. (2010): The Career of the Open Method of Coordination: Lessons from a ›Soft‹ EU Instrument. In: West European Politics, 33(1), pp. 93–117.

order to foster integration into what has been called the European Research Area (ERA). More specifically, under the Sixth Framework Programme (FP6), the instrument of the ERA-Nets were founded as the first explicit attempt engage national member state programme owners and programme managers into a joint cooperation and coordination of research activities, carried out at national or regional level (member + associated states); by networking of research activities or mutual opening of national/regional research programmes. The scheme applied a four step logic of integration intensity reaching from 1. information exchange on best practices of existing programs, 2. identifying common strategic issues, 3. developing joint activities of national/regional programs and 4. implementing joint activities. It is important to note that these activities were solely bottom-up defined, with the Commission's DG RTD only supporting actors via a lean administration and information brokerage within and across individual ERA-Nets.

The Seventh Framework Programme and especially paying attention to calls for combining this bottom-up initiative with some strategic top-down elements[46], in FP7 the Commission launched both the ERA-Net and the ERA-Net Plus schemes that provided for top-up funding and strengthened administrative (as well as legal) support not least to intensify joint funding collaborations.[47] The ERA-Net Plus actions thus supported a limited number of cases with high European added value by additional financial support from the Commission in order to facilitate joint calls for proposals between national and/or regional programmes. Under FP8 (H2020) the ERA-Net Cofund merged the ERA-Net and ERA-Net Plus scheme mostly for reasons of simplification.[48]

The development of the ERA-Nets can be considered a veritable success story, in the sense that it had an impact on national funding institutions within Europe to learn from each other and to collaborate with each other. As Harrap and Boden (2012) report, not only have some ERA-Net joint programming initiatives lasted far beyond the official administrative support by the Commission. In this respect, European coordination was backed by further instruments, such as Art. 185 initiatives or Joint Programming Initiatives (JPI).

[46] Edler, J. (2010): International Policy Coordination for Collaboration in S&T. Manchester Business School Working Paper 590. Retrieved from: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1542583; Harrap, N., M. Boden (2012): ERA-NETs and the realisation of ERA: increasing coordination and reducing fragmentation. European Commission, Joint Research Center. Retrieved from: https://ideas.repec.org/p/ipt/iptwpa/jrc73451.html; Horvat, M., K. Guy, V. Demonte Barreto, J. Engelbrecht, R. Wilken (2006): ERA-Net Review 2006. The Report of the Expert Group. European Commission, DG Research. Retrieved from: https://ec.europa.eu/research/evaluations/pdf/archive/fp6-evidence-base/evaluation_studies_and_reports/evaluation_studies_and_reports_2006/eranet_review_expert_group_report_2006.pdf

[47] One should not forget that soft governance instruments were not an act of infinite wisdom but rather a reaction to the EU corruption scandal that led to the resignation of the Commission under Jacques Santer in 1999, while it was initially caused by research commissioner Edith Cresson in a clear-cut case of favouritism (Ringe, N. (2005): Government-opposition dynamics in the European Union: The Santer Commission resignation crisis. In: European Journal of Political Research, 44(5), pp. 671–696.). As a reaction, the Prodi Commission from 1999 – 2004 embraced a different take on governance that also called for greater integration between European entities on different regional and functional levels via soft governance (Pfister, T. (2009): Governing the knowledge society: Studying Lisbon as epistemic setting. In: European Integration Online Papers, 1(13), pp. 1–14.). The new research commissioner Philippe Busquin and his DG architects placed emphasis on networking instruments, including the funding of Networks of Excellence, the roadmap initiative of jointly setting up European large scientific infrastructures (ESFRI) and, in general, engaging research funders into a process of mutual exchange – and this was an entirely new approach in EU research policymaking Borrás, S. (2003): The Innovation Policy of the EU. From Government to Governance. Cheltenham: Edward Elgar.; Edler, J. (2002): The 'European Research Area' Initiative. Reflections upon a potential take-off in European RTD policy. In: Technologiefolgenabschätzung, 1(11), pp. 136–141.; Kuhlmann, S. (2001): Future Governance of Innovation Policy in Europe – Three Scenarios. In: Research Policy, 30(6), pp. 953–976.

[48] For an overview of all joint programming instruments, see JointProgramming.nl: Instruments for joint programming. Retrieved from: http://www.jointprogramming.nl/instruments1/ as accessed 28.06.2019.

Again, it is essential to note at this point that it was the Commission that had encouraged national actors to test these new instruments which led to a new and positive awareness about the possibilities of transnational collaborations within Europe. And in a positive sense, numerous stakeholders in Europe, including the Commission, underestimated the indirect impact of information exchange and joint programming initiatives. As a soft governance instrument *par excellence*, the ERA-Net schemes revealed in particular where greater and deeper coordination between Member States was possible. Moreover, it also encouraged actors to reflect on the best possible procedures to set up international research funding programs. In this respect, the ERA-Net scheme and its succeeding and cognate instruments have helped develop a European standard model of joint programming, especially due to the fact that the model is flexibly adaptable to theme-specific and organisation-specific requirements.

In light of collaborations with non-EU actors in S&T, representatives from funding agencies have recently realized the advantages of having developed a quasi-European standard model of joint programming, not least because individual ERA-Nets integrated non-European partners in their collaborative efforts. As a member from the Commission's DG RTD makes it clear from the beginning in an interview:

> *"You know, nowadays there is hardly an issue with third country participation, and this is also thanks to the experience that national funding agencies and performers reported to the Commission. So either we have clear rules for participation how to participate in the ordinary Framework Programme funding. The Americans and others sometimes have an issue with them, but anyway, they are articulate and indisputable. And then, all sorts of European agencies have developed the ERA-Net guiding principles that also apply whenever a country outside the EU wants to take part. Because one can only participate by abiding to the principles. [interviewer further inquires] You know, there's no wheeling and dealing: Third parties either accept the rules, or they cannot take part. That's the beauty of it."*

Indeed, interviewees from national research funding agencies agree that integrating partners from non-European states in multilateral collaborations was tested in the course of the ERA-Nets, and that co-developing principles can be considered a challenging but rewarding experience:

> *"The ERA-Nets I have been involved developed a neat and now widely accepted panel solution. Two steps, an A-B-C-assessment, clear division of labour, model contracts that are in accordance with most national regulations and open for ameliorations. I mean you still have to find agreements in every step, but you have a driving direction, landmarks and traffic lights. I really wish we would have had that in our collaboration with region in the Middle East."*

Apparently, the ERA-Nets have changed the experience of national funding agencies, not least because setting them up and trying to deepening dimensions of collaborations is reported as a resource intensive process no one wants to start all over again. In this respect, the ERA-Net guidelines to set up multilateral programming initiatives seem to have created path dependencies and their outline on how one can proceed in joint programming is convincing:

> *"You know, from my experience there were hardly big issues with third countries, I mean big ones. My collaborations focused on the Southeast Asian region, and if we leave few examples aside, one must say that the science evaluation systems in most of the countries function more or less the same way than ours. And we should not forget that we have different approaches within Europe too. The thing is, everyone was thankful for a blueprint or call it a model*

> *for joint programming. And, you know, of course sometimes there were issues but that does not question the procedure as such."*

Another interesting aspect that representatives from agencies broached, was the role of the Commission. In the case of joint programming with third countries abroad, particularly developing countries, agency representatives would want to see the European Commission as a more strategic leader and mediator of interests.

> *"Initially it was chaotic with the Commission. It was very chaotic until three or four years ago. Now they are beginning to be a little more strategic, that's better. I would say is that they are not really taking the responsibility. Often they say they want to do this or that but then they come to us and say 'please, set it up!'. Now, we have set up an ERA-Net with Africa, and here is where I want to see science diplomacy from the Commission, to put a light on it. Why should it be us? We need the Commission, but they keep saying they rely on us to come up with funding agreements. A little bit frustrating."*

The interviewee tries to explain her/his point further:

> *"All the initiatives, all these JPIs, ERA-Nets, co-funds and Article 185 things, all of this is nice within Europe. You need these things to get regions in Europe to work together. But these things only work because there is European law and sanctions. If you want to do this with the world, the EU must have a clear mandate. Science diplomacy is not enough, you know like 'oh I have just negotiated with Russia a bit on this and that.' We are at this edge where if we want to go further and to coordinate with the full thing. What we need is the logic of the Framework Programme applied to the outside world. Then you have a strong form of science diplomacy."*

The statement clearly illustrates the dilemma of the EU's missing legitimacy[49] to take action in specific policy areas. Since neither a clear-cut mandate nor a division of labour allows for a supranational foreign science policy, national agencies have restricted authority to negotiate with stakeholders abroad. The Commission with its different DGs and services, however, can only sometimes act as a strong and well-coordinated leader vis-à-vis non-European partners, while agencies would exactly prefer that, especially in multilateral research funding settings that are already plagued by a plethora of actors and soft recommendations rather than hard rules.

7. Conclusion on bi- and multilateral Joint Programming

The coordination of binational collaborations clearly poses a challenge to its actors. Next to missing common grounds what is concretely meant by coordination and international administrative collaborations[50], staff members face the specific challenge of dealing with each other and with their own domestic program owners at the same time, while concrete guidelines how to set up and shape collaborations are absent, which increases the uncertainty for actors. This does not mean that agencies do not have developed models for international research funding collaborations. On the contrary, it is quite conventional e.g. to separate review processes in the sense that each side "sovereignly" (explicitly described by interviewees) assesses proposals and that scientific peers and administrative

[49] Majone, G. (2005): Dilemmas of European Integration. The Ambiguities & Pitfalls of Integration by Stealth. Oxford/New York: Oxford University Press.
[50] Metcalfe, L. (1994): International policy co-ordination and public management reform. In: International Review of Administrative Sciences, 60(2), pp. 271–290.

decision come together in order to select proposals for funding according to jointly agreed procedures. Yet, what agency staff members miss are blueprints or guidelines that everyone would instantly agree upon, both European actors and foreign collaborating partners from outside the EU. The difference between integrating third country partners into ERA-Net programming and bilateral collaborations to establish a joint funds, is thus the existence of meaningful guiding principles. The latter must be worked out from scratch, just as well as the meta-principles have to be settled before and often in the course of joint programming.

Moreover, actors from funding agencies made it clear that they consider their activities as essentially diplomatic. Interests must be mediated in a tactful manner all the time, cultural habits and conventions, including the social position of individuals must be considered, but even more so, the geostrategic and sociopolitical situation of a partnering actor must be paid heed to. The latter can rapidly change, as political upheavals, such as the Arabic Spring or regime changes, as briefly touched upon, have illustrated in our case study. And not least, the specific principal-agent logic of *all* involved actors, including one's own, has to be taken into account in the context of international coordination.

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9. Scientific advice for fisheries management in the European Union: transnational science diplomacy in practice

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1. Introduction

The European Commission has indicated that European and global research infrastructures can and should be mobilized as important tools and sites of science diplomacy[1]. At the international level, a key element of these infrastructures is the healthy functioning of a science advice system able to inform the development of policy. Against this backdrop, this report focuses on scientific advice structures within the EU, and their contribution to wider EU science diplomacy.

While scientific advice can include informal networks and unsolicited inputs, the focus of this case study is on the formal infrastructures of solicited expert advice that provide input to EU decision-making processes. The EU science advisory system involves the convening of international experts in dialogue with governments and other stakeholders, and therefore constitutes a site in which transnational issues are deliberated and negotiated. These processes can benefit from being analysed and understood through the lens of science diplomacy.

To provide a specific context of transnational policy significance, this case looks in detail at the science advisory bodies involved in the provision of advice for fisheries. The annual negotiation of fishing quotas between the EU and its nearest neighbours relies on routine inputs of expert advice about the status and trends of fish stocks. The implementation of the Common Fisheries Policy also requires scientific, technical, economic and social inputs of various kinds. As a long-standing issue, the scientific advisory and evidentiary of fisheries management in the EU involves organisations that are over 100 years old. However, it is also at the forefront of new attempts to construct authoritative science advisory structures in the EU that have risen in recent years.

Scholarship on the structures and functions of scientific advisory bodies has demonstrated their role in the evidence ecosystem for decision-making.[2] This case study report provides some historical background to the development of science advice for fisheries management in the EU; sets out information on the governance arrangements and actors involved; and identifies potential insights and implications from this case study of broader relevance and application to our understanding of EU science diplomacy.

The role of scientific advice in fisheries management is a good example of science diplomacy in practice. In line with definitions developed elsewhere in the S4D4C project, we understand science diplomacy as a "fluid concept…[and] a "meta-governance framework"[3], which involves "collaborations between stakeholders from science, policy and diplomacy…various governmental or diplomatic organisations as well as non-governmental scientific organisations."[4]

The case study was developed through a mix of desk-based research, semi-structured interviews and participant observation, between June 2018 and March 2019. Desk-based research was directed towards the collection of official documents from EU websites and an analysis of existing academic scholarship on science advice systems. This research was guided by insights gathered through interviews and observations, as well as from discussions with case study collaborators in the S4D4C project. A set of seven semi-

[1] EU Commission (2015): The EU approach to science diplomacy. Retrieved from: https://ec.europa.eu/commission/commissioners/2014-2019/moedas/announcements/eu-approach-science-diplomacy_en

[2] Wilsdon, J., R. Doubleday (eds.) (2015): Future Directions for Scientific Advice in Europe. Cambridge: Centre for Science and Policy. Retrieved from: http://www.csap.cam.ac.uk/media/uploads/files/1/future-directions-for-scientific-advice-in-europe-v10.pdf

[3] Flink, T, C. Rungius (2018): Science Diplomacy in the EU: Practices and Prospects. S4D4C Project Brief No.1, October 2018.

[4] Aukes, E. et al (2020): Towards effective science diplomacy practice. S4D4C Policy Brief No.2, January 2020.

structured interviews were carried out face-to-face or on the telephone, and one structured interview via email. These included interviews with:

- Two contributors to the Scientific, Technical and Economic Committee for Fisheries (STECF)
- One representatives from and one contributor to the International Council for the Exploration of the Sea (ICES)
- One representative from Science Advice for Policy by European Academies (SAPEA)
- One representative from European Commission Scientific Advisory mechanism (EC-SAM)
- One member of the EU Commission Group of Chief Scientific Advisors (GCSA)
- One representative of the EU Commission

Participant observation was carried out during an STECF expert working group meeting in late 2018. This meeting was selectively sampled for convenience due to the availability of the researcher. The research was granted ethical approval by the University of Sheffield Research Ethics Committee in July 2018.

2. Governance arrangements and background of the case

The importance of effective science advice to democratic political systems is gaining increased attention internationally. Today, science advice typically refers to formal structures through which governments obtain scientific and technical information for decision-making. In an EU context, science advice has been defined as:

> *"all the processes and structures aimed at providing scientific knowledge and information to the attention of policy- and decision-makers."*[5]

While science advice might appear to be self-evident and liable for replicated arrangements at different sites and scales, research has shown how science advice is deeply cultural. The formal structures through which scientific knowledge is produced and validated have a tendency to adhere to the political cultures in which science advice systems emerge, which at the national level have been termed 'civic epistemologies'[6]. As guidance to the EU Parliament in 2016 noted:

> *"various structures and institutions [of science advice] exist or have been established at national and international levels. This diversity reflects the different cultures, traditions and political contexts of policy-making."*[7]

To make sense of this diversity, the structures of science advice have been divided into three categories depending on their relationship to the policy processes that they advise[8]. These include:

- External bodies: Such as academies, learned societies and research organisations
- Mandated bodies: Such as permanent or ad hoc advisory structures
- Internal bodies: Such as in-house technical and scientific support and individual scientific advisers

[5] EU Parliament (2016): Scientific advice for policy-makers in the European Union. Retrieved from: http://www.europarl.europa.eu/thinktank/en/document.html?reference=EPRS_BRI(2016)589777

[6] Jasanoff, S. (2005): Designs on Nature: Science and Democracy in Europe and the United States, Princeton: Oxford: Princeton University Press.

[7] EU Parliament (2016): Scientific advice for policy-makers in the European Union. Retrieved from: http://www.europarl.europa.eu/thinktank/en/document.html?reference=EPRS_BRI(2016)589777

[8] EU Parliament (2016): Scientific advice for policy-makers in the European Union. Retrieved from: http://www.europarl.europa.eu/thinktank/en/document.html?reference=EPRS_BRI(2016)589777 ; OECD (2015): Scientific Advice for Policy Making. Retrieved from: https://www.oecd-ilibrary.org/science-and-technology/scientific-advice-for-policy-making_5js33l1jcpwb-en

Despite the different structures and political cultures in different national settings, there are increased efforts to share lessons across countries about successes and failures in the implementation of different science advice arrangements. For example, the International Network for Government Science Advice (INGSA) was established in 2014 as a network of practitioners and researchers with the aim:

> *"to share experience, build capacities, and develop theoretical and practical approaches to the use of scientific evidence in informing policy at all levels of government."*[9]

The growing attention to science advice is also illustrated by an amplification of academic scholarship, sometimes referred to as 'the science of science advice'[10]. This scholarship is applying lenses and methods from policy studies, science and technology studies and other social science approaches to understand the workings of science advice as a social activity, which can and should be examined empirically to derive lessons for its future development.

The EU is a central player in these developments, having featured as an analytical case in numerous academic studies[11] and been the subject of practitioner workshops seeking to better implement evidence use in decision-making[12].

2.1 Science advice in the EU

The EU Commission has recognised evidence as a core part of EU decision-making. Guidelines produced in 2002, for example, set out its ambition to create "a sound knowledge base for better policies". Through these guidelines it was hoped that the Commission could thereby:

> *"encapsulate and promote good practices related to the collection and use of expertise at all stages of Commission policy-making"*[13].

Indeed, the centrality of scientific and technical knowledge to the decision-making of the EU was captured in a reflection by the former Chief Scientific Adviser to the EU President, Anne Glover[14], who commented:

> *"EU policies are much more technical than national policies; this is because the bulk of them are about standardisation and harmonisation, which at the end of the day boils down to scientific-technical matters. Science is therefore crucial at the EU level."*

While the centrality of science to its policy making would suggest the EU has tried and tested mechanisms for science advice, as with many national settings, the formal structures for science advice in the EU are still emergent, experimental and often contested[15]. Indeed, as a multi-level governance structure sui generis, the EU does not

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[9] INGSA (2019): International Network for Government Science Advice. Retrieved from: https://www.ingsa.org

[10] Jasanoff, S. (2013): The science of science advice. In: Doubleday R and Wilsdon J (eds): Future Directions for Scientific Advice in Whitehall. pp. 62-69.

[11] Wilsdon, J., R. Doubleday (2015): Future Directions for Scientific Advice in Europe. Cambridge: Centre for Science and Policy, University of Cambridge.

[12] JRC (2017): Workshop: EU4FACTS: Evidence for policy in a post-fact world. Brussels. 26 September 2017. Retrieved from: https://ec.europa.eu/jrc/en/eu4facts

[13] EU Commission (2002): On the collection and use of expertise by the Commission. Retrieved from: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2002:0713:FIN:EN:PDF%20

[14] Glover, A. (2015): A moment of magic realism in the European Commission. In: Wilsdon, J, R. Doubleday (eds): Future Directions for Scientific Advice in Europe. Cambridge: Centre for Science and Policy, University of Cambridge, pp. 60-81.

[15] See overview in: Wilsdon, J., R. Doubleday (2015): Future Directions for Scientific Advice in Europe. Cambridge: Centre for Science and Policy, University of Cambridge

have a single national culture – or civic epistemology[16] – for how knowledge is produced and validated (indeed there is greater diversity across its Member States[17]). As this case study illustrates, this creates challenges for the design and implementation of an authoritative science advice system at the EU level.

2.2 Fisheries governance

To examine the science advice system of the EU, this case study draws its attention to the particular governance challenge of fisheries. The EU caught a total of 5.3 million tonnes of fish by live weight in 2017[18] at a value of around €7.38 billion[19]. Fishing industries can be a significant symbolic, if not economic, part of national cultures in the EU, and the management of fisheries requires careful negotiations between the EU Member States. It is particularly challenging because fish stocks can be considered to be a common pool resource: they frequently travel across the borders of territorial waters and exploitation of the resource by one party can limit the extent to which others can benefit from it. Furthermore, while fish are considered by some to be a renewable resource, they are also a vulnerable resource. Overfishing can and has led to the collapse of fish stocks – hardly is there a better example for the commons dilemma[20] –, and without careful management of fisheries activity long term and irreversible damage to the resource can take place. It is for this reason that scientific input is considered so necessary to understand the state of fish stocks and the potential impacts that fisheries will have on them. This allows the governments to consider the quotas and fishing effort that will be invested in different stocks.

The management of fisheries in the EU is largely through the Common Fisheries Policy (CFP). First established in 1970, the CFP provides a set of rules and mechanisms for the management of European fishing fleets in order to protect the sustainability of fish stocks.[21] Its aim is:

> *"to ensure that fishing and aquaculture are environmentally, economically and socially sustainable and that they provide a source of healthy food for EU citizens. Its goal is to foster a dynamic fishing industry and ensure a fair standard of living for fishing communities."*[22]

The CFP has undergone periodic updates and was most recently revised in 2014.[23] The major features of the CFP address four policy areas[24]:

1. Fisheries management focused on access to waters, fishing efforts, and technical measures[25]

[16] Jasanoff, S. (2005): Designs on Nature: Science and Democracy in Europe and the United States, Princeton: Oxford: Princeton University Press.

[17] Šucha, V., D. Wilkinson, D. Mair, et al. (2015): The in-house science service: The evolving role of the Joint Research Centre. In: Wilsdon, J., R. Doubleday (eds): Future Directions for Scientific Advice in Europe. Cambridge: Centre for Science and Policy, University of Cambridge, pp. 42-51.

[18] EU Commission (2018): Eurostate: Fishery statistics. Retrieved from: https://ec.europa.eu/eurostat/statistics-explained/index.php/Fishery_statistics#Total_fisheries_production_and_employment

[19] EU Commission (2018): The EU fish market. Retrieved from: https://ec.europa.eu/fisheries/press/eu-fish-market-2018-edition-out_en

[20] For a seminal article, see: Berkes, F. (1985): Fishermen and 'The Tragedy of the Commons. In: Environmental Conservation, 12(3), pp. 199-206.

[21] EU Commission (2019): Common Fisheries Policy. Retrieved from: https://ec.europa.eu/fisheries/cfp_en

[22] Ibid.

[23] Ibid.

[24] Ibid.

[25] EU Commission (2019): Fishing Rules. Retrieved from: https://ec.europa.eu/fisheries/cfp/fishing_rules

2. International policy focused on fishing activities that take place outside of the EU and international cooperation on fisheries[26]
3. Market and trade policy focused on managing the market in fishery and aquaculture products[27]
4. Funding of the policy and other investments in fisheries

In order to implement the CFP, scientific advice is considered necessary in a number of ways.

2.3 Fisheries science advice

The CFP has a stipulation that requires the Commission to take "into account available scientific, technical and economic advice"[28] in drafting proposals of legislation for the European Parliament and Council. Information from the EU Commission on the CFP states:

> *"Scientific advice is the basis for good policy making, setting fishing opportunities according to the state and productivity of fish stocks."*[29]

The Commission identifies the following key issues that require frequent sources of scientific advice:

- The determination of maximum sustainable yield, "the best possible objective for renewable and profitable fisheries, harvesting the maximum amount of fish on a long term basis."[30]
- The development of multi-annual plans that "contain the goals and tools for fish stock management and the roadmap to achieving the objectives in a sustainable and inclusive way."[31]

Science advice for fisheries has a long history in Europe, and involves the breadth of internal, external and mandated structures for bringing scientific knowledge into the decision-making process. The stakeholder landscape is set out in the following section.

3. Stakeholder landscape

The various institutions and instruments that define the interconnected fields of science advice in the EU; fisheries governance; and fisheries science advice are set out below.

3.1 Science Advice in the EU

Due to its complexity, and the range and interdependency of actors involved, the science advice system in the EU can be likened to an ecosystem. As with national settings with well-developed science advice systems, such as the UK[32], there is no single structure that

[26] EU Commission (2019): International Fisheries. Retrieved from: https://ec.europa.eu/fisheries/cfp/international

[27] EU Commission (2019): Fisheries Market. Retrieved from: https://ec.europa.eu/fisheries/cfp/market

[28] EU (2013): Regulation (EU) No 1380/2013 of the European Parliament and of the Council of 11 December 2013 on the Common Fisheries Policy, amending Council Regulations (EC) No 1954/2003 and (EC) No 1224/2009 and repealing Council Regulations (EC) No 2371/2002 and (EC) No 639/2004 and Council Decision 2004/585/EC. Off J Eur Union L 354:22–61. p. 32

[29] EU Commission (2019): Common Fisheries Policy: Management. Retrieved from: https://ec.europa.eu/fisheries/sites/fisheries/files/docs/body/2015-cfp-management_en.pdf

[30] Ibid.

[31] Ibid.

[32] Wilsdon, J., R. Doubleday (2013): Future Directions for Scientific Advice in Whitehall. Cambridge: Centre for Science and Policy, University of Cambridge.

provides scientific knowledge into the decision-making process, rather there are a range of structures that include a mix of external bodies; mandated bodies; and internal bodies that each contribute input to the decision-making process. Taken in its totality, science advice in the EU is most prominent in the work of three structural features.

First, the Joint Research Centre (JRC) that was established in 1957 and is now a core part of the science advisory system of the EU[33]. Often described as the EU Commission's in-house science service[34], the JRC employs over 3000 people and has an annual budget of around €330 million, which it directs towards scientific and technical advice for EU policy making[35]. The JRC has headquarters in Brussels, and research sites in five Member States: Geel (Belgium), Ispra (Italy), Karlsruhe (Germany), Petten (the Netherlands) and Seville (Spain)[36], and states that its "researchers provide EU and national authorities with solid facts and independent support to help tackle the big challenges facing our societies today."[37]

Second, the position of Chief Scientific Adviser (2012-2014) and now the Group of Chief Scientific Advisers (2015-) are a central feature of the EU science advice system as a whole. This evolving set of positions has provided figure heads for science advice in the EU system, and details of this history are set out further in the case study below.

Third, the agencies and committees that provide requested advice direct to the EU Commission[38]. Many of these have been in operation since the 1980s, and are generally specifically constituted to provide advice on particular areas of the Commissions operations. The Commission expert groups[39] "advise the Commission in relation to:

- the preparation of legislative proposals and policy initiatives
- the preparation of delegated acts
- the implementation of EU legislation, programmes and policies, including coordination and cooperation with Member States and stakeholders in that regard
- where necessary, the preparation of implementing acts at an early stage, before they are submitted to the committee in accordance with Regulation (EU) No 182/2011."[40]

To gain a better understanding of how the different parts of the system work in practice, it is possible to draw attention to the more specific arrangements for a given topical area: in this case, fisheries. Paying attention to a particular topical area brings complexity into the case in a way that cannot be achieved by looking at the general processes of science advice within the EU.

[33] EU Commission (2019): Highlights of the JRC: 50 Years in Science. Retrieved from: https://ec.europa.eu/jrc/sites/jrcsh/files/jrc_50_years_brochure_en.pdf
[34] Šucha, V., D. Wilkinson, D. Mair, et al. (2015): The in-house science service: The evolving role of the Joint Research Centre. In: Wilsdon, J., R. Doubleday (eds): Future Directions for Scientific Advice in Europe. Cambridge: Centre for Science and Policy, University of Cambridge, pp. 42-51.
[35] EU Commission (2019): JRC: Organisation. Retrieved from: https://ec.europa.eu/jrc/en/about/organisation
[36] EU Commission (2019): JRC: Science and knowledge management at the service of Europe's citizens. Retrieved from: https://ec.europa.eu/jrc/sites/jrcsh/files/jrc_paper-eu-policy-making-based-on-facts.pdf
[37] Ibid.
[38] EU Commission (2019): Expert Groups Explained. Retrieved from: http://ec.europa.eu/transparency/regexpert/index.cfm?do=faq.faq&aide=2
[39] Ibid.
[40] EU (2011): Regulation (EU) No 182/2011. Retrieved from: https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32011R0182&from=EN

3.2 Fisheries Governance

Fisheries management is a long-standing issue in the European Union with well-established governance arrangements. As previously set out, fisheries are mostly coordinated through the Common Fisheries Policy (CFP). The CFP is implemented by the European Commission whose work in this area is carried out by the Directorate-General for Maritime Affairs and Fisheries (DG MARE). The remit of DG MARE[41] is to:

- "ensure that the ocean resources are used sustainably and that coastal communities and the fishing sector have a prosperous future
- promote maritime policies and stimulate a sustainable blue economy
- promote ocean governance at international level"

One of the most prominent components of the CFP is the allocation of fishing quotas to Member States. This requires an agreement on total allowable catches (TACs), which are the total allowable commercial fishing catch per year across the whole EU that are agreed by Member States based on proposals set out by the Commission.[42] The TACs for each fish stock are then shared out among the EU Member States through national quotas.[43] In the allocation of quotas for fisheries, Member States are represented in the Agriculture and Fisheries Council where national quotas are allocated by political agreement.[44] Member States are allocated quota based on maintaining relative stability in the system, with recognition of historical catch data and the needs of coastal communities that are dependent on fisheries.[45] More recently, efforts have been made to provide for longer-range planning. In 2014, the EU Commission proposed the development of multiannual plans, which include goals for fish stock management that work towards a maximum sustainable yield (the largest catch that can be taken from a species' stock to maintain the size of the population).[46]

3.3 Fisheries science advice

There is a wide range of science advice structures that provide science advice for fisheries management.

- The Scientific, Technical and Economic Committee for Fisheries (STECF): a Commission expert group established in 1993 reporting directly to the Commission with advice on fisheries management[47].
- The International Council for the Exploration of the Sea (ICES): an intergovernmental membership organisation founded in 1902, which provides advice to the EU, other governments, and organisations[48].
- The Scientific Advisory Committee (SAC) of the General Fisheries Commission for the Mediterranean (GFCM) that was established in 1952 as a regional fisheries

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41 EU Commission (2019): Maritime Affairs and Fisheries. Retrieved from: https://ec.europa.eu/info/departments/maritime-affairs-and-fisheries_en
42 EU Council (2019): Management of the EU's fish stocks. Retrieved from: https://www.consilium.europa.eu/en/policies/eu-fish-stocks/
43 Ibid.
44 Ibid.
45 Institute for Government (2018): Common Fisheries Policy. Retrieved from: https://www.instituteforgovernment.org.uk/explainers/common-fisheries-policy
46 EU Council (2019): Management of the EU's fish stocks. Retrieved from: https://www.consilium.europa.eu/en/policies/eu-fish-stocks/
47 EU Commission (2019): Scientific advice on managing fish stocks. Retrieved from: https://ec.europa.eu/fisheries/cfp/fishing_rules/scientific_advice
48 Ibid.

management organisation[49]. The SAC offers advice for decision-making of the GFCM.

- Ad-hoc advice from the scientific committees of regional fisheries organisations and regional fisheries management organisations relating to fishing activities outside of EU waters[50].
- Ad-hoc advice from scientific cooperation between EU and non-EU scientific communities relating to fisheries partnership agreements with non-EU coastal countries[51].
- Ad-hoc advice from the Commission's Joint Research Centre[52].

The science advice system for fisheries is therefore a complex arrangement of structures, which reflect more of a science advisory ecosystem (Figure 1). To better understand the workings of some of these structures, this report turns in the next section to examine three comparative case studies of science advice bodies for fisheries in the EU: the STECF; ICES; and the more recently created Scientific Advice Mechanism (SAM).

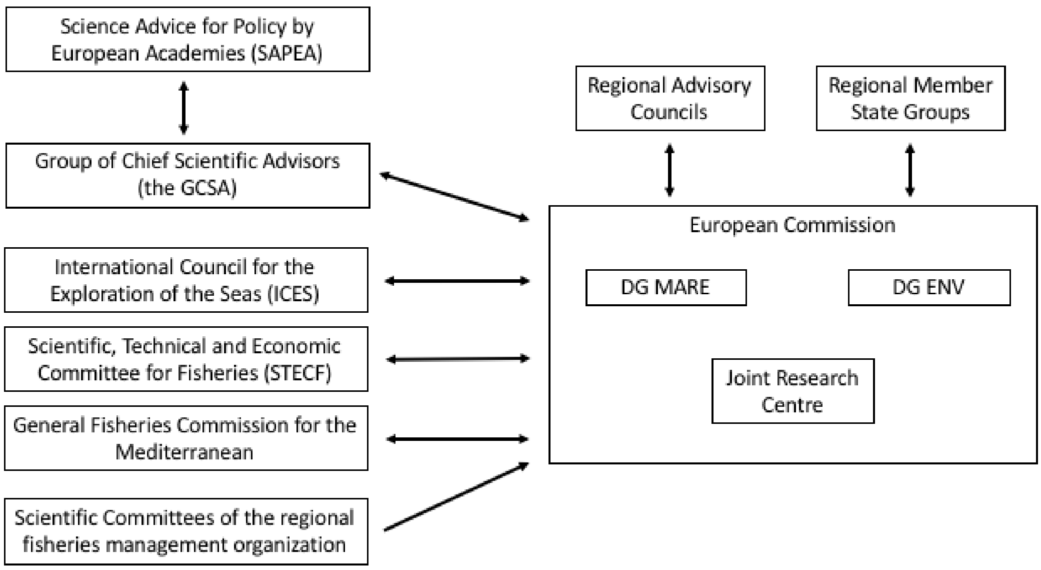

Figure 1: An overview of the advisory system for fisheries in the EU, including the Common Fisheries Policy and related strategy (adapted from Ballesteros et al. 2017[53]). Directional arrows denote request and provision of advice.

[49] Ibid.
[50] Ibid.
[51] Ibid.
[52] Ibid.
[53] Ballesteros, M., R. Chapela, P. Ramírez-Monsalve, et al. (2017): Do not shoot the messenger: ICES advice for an ecosystem approach to fisheries management in the European Union. In: ICES Journal of Marine Science 75(2): pp. 519-530.

4. A comparison of three types of science advice

This section compares the work of three different expert groups who provide science advice for fisheries within the EU. Each example focuses on a formal science advice body that provides scientific input to the decision-making processes for EU fisheries, but operating under different rules of procedure and fulfilling different functions. By comparing these examples a number of important insights about de facto governance practices emerge and these insights are presented below. The implications for science diplomacy are discussed in the next section (Section 5).

4.1 Example One: The Scientific, Technical and Economic Committee of Fisheries (STECF)

The Scientific, Technical and Economic Committee for Fisheries (STECF) was established in 1993 as a Commission expert group providing advice on fisheries management[54]. The STECF is not a permanent body, but is instead better understood as an organised pool of experts that act on a temporary basis either as members of the STECF or as experts that contribute to its working groups[55].

4.1.1 What is the mandate?

The Commission is expected under the CFP to consult STECF on:

> *"matters pertaining to the conservation and management of living marine resources, including biological, economic, environmental, social and technical considerations."*[56]

The STECF in turn is expected to provide expertise in the form of scientific advice drawing on:

> *"marine and fisheries biology, fishing gear technology, fisheries economics, fisheries governance, ecosystem effects of fisheries, aquaculture or similar disciplines"*[57].

The STECF operates under the rules of procedure for commission expert groups[58]. The work of the STECF takes place under the principles of excellence, independence and transparency[59].

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[54] EU Commission (2019): Scientific advice on managing fish stocks. Retrieved from: https://ec.europa.eu/fisheries/cfp/fishing_rules/scientific_advice

[55] Ibid.

[56] Article 26 of European Parliament and Council Regulation (EU) No 1380/2013

[57] Articles 3 of Commission Decision of 25 February 2016 setting up a Scientific, Technical and Economic Committee for Fisheries (2016/C 74/05)

[58] Art 7(7) of Commission Decision (2016/C 74/05)

[59] EU Commission (2019): About STECF. Retrieved from: https://stecf.jrc.ec.europa.eu/about-stecf

4.1.2 Who are the experts?

The Experts of STECF are appointed directly by the Commission[60]. The STECF has a membership of between 30 and 35 experts. Each member of the STECF is generally appointed by the Director General of DG Maritime Affairs and Fisheries for a period of three years[61]. The members of STECF are selected by the Commission as independent experts and not as representatives of EU Member States. As an STECF contributor explained:

> *"you apply to be part of the committee but the Commission selects, so Member States have no control over who is actually on the committee, only as far as if they want to, a member state laboratory for example could say to a scientist, "We'd like you to apply because we'd really like to have somebody on STECF", but it's also completely open, STECF is completely open to scientists from anywhere just as experts, as independents."*[62]

Experts contribute to STECF either as committee members, or as experts that attend expert working group meetings. As is set out below, the committee is ultimately responsible for providing advice, whereas the expert working groups carry out the underlying technical synthesis. The independence of experts contributing to both the committee and the expert working groups is reinforced in STECF meetings, where experts are reminded that they are there in their own capacity.[63]

4.1.3 How is advice produced?

Formally, 'STECF' refers to the advice-giving STECF committee that provides scientific opinions to the commission, which are generally adopted at STECF plenary meetings[64]. In some cases, those scientific opinions are derived from technical and analytical work carried out by the committee itself, but in many cases the STECF will convene an expert working group that is given time to carry out technical analysis and compile an evidence report from which the STECF plenary can offer advice[65]. These expert working groups are mandated to "undertake tasks which are clearly defined and directly linked to the requests submitted by the Commission."[66] As one of the STECF contributors explained:

> *"the committee is the STECF and is the advice giving body but some of the information required is so hungry in terms of data requirements, in terms of the amounts of material that have to be collated from all the different Member States in order to provide that advice, that the time available in the sort of three [STECF] plenaries that are held each year, is insufficient. So the way they handle that is have a series of expert groups which pulls in additional people, they're not mutually exclusive, some STECF members are encouraged to participate in the working groups but there's a bigger body of people who essentially do the number crunching or consider the detail, and try and produce a report which is then helpful to STECF to complete the task efficiently."*[67]

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[60] EU Commission (2019): Scientific advice on managing fish stocks. Retrieved from: https://ec.europa.eu/fisheries/cfp/fishing_rules/scientific_advice

[61] EU Commission (2019): About STECF. Retrieved from: https://stecf.jrc.ec.europa.eu/about-stecf

[62] STECF Interview 2, February 2019

[63] STECF Field Notes, October 2018

[64] EU Commission (2019): STECF Rules of Procedure. Retrieved from: https://stecf.jrc.ec.europa.eu/c/document_library/get_file?uuid=8822fd78-07ea-407a-80b3-00146359b6c7&groupId=43805

[65] EU Commission (2019): STECF Rules of Procedure. Retrieved from: https://stecf.jrc.ec.europa.eu/c/document_library/get_file?uuid=8822fd78-07ea-407a-80b3-00146359b6c7&groupId=43805

[66] Ibid.

[67] STECF Interview 2, February 2019

The STECF plenary generally meets three times per year and there are up to around 20 expert working group meetings in support of these[68]. Meetings typically last for 3-7 days[69]. Both the STECF Plenary and the expert working groups are encouraged to reach consensus positions, but have the provision to include minority opinions in their reports[70]. In some cases, the STECF will collaborate or consult other bodies in shaping its advice. As its rules note:

> *"Where necessary, the STECF shall co-operate with other relevant scientific and advisory bodies in undertaking its work and in preparing its opinions and advice. Such activities shall be coordinated by the Secretariat."*[71]

4.1.4 How are requests for advice developed?

The Commission is the only body able to request advice from the STECF[72]. Requests for advice are issued through 'Terms of Reference'. The STECF rules note:

> *"Terms of reference to the STECF shall include a list of requests for advice together with background information and relevant supporting documentation to enable the STECF to provide an informed response. The terms of reference shall be submitted to the STECF via the Secretariat."*[73]

The Terms of Reference are issued to the STECF, and the STECF can ask for clarification from the Commission and for any additional supporting information[74]. The interpretation of the Terms of Reference also develops through informal dialogue between STECF experts and members of the Commission, who are able to attend any STECF meetings of their interest[75]. Members of the Commission are able to attend expert working group meetings and offer further guidance on the Terms of Reference. As one of the STECF contributors explained:

> *"The way that we try to arrange it is that people [from the Commission] who are responsible for a particular item on the agenda are at least there at the beginning of the meeting to clear up any misunderstanding of what's actually been requested. I would say, again this is off the top of my head, but I would say that 60-70% of the time, those people are there, maybe 20-30% of the time, they're unable to turn up. The desire for those people to be at the proceedings is simply to just clear up any misunderstandings and to make sure that at the drafting stage, we actually didn't lose the plot on the way and that we're not trying to provide something that they didn't really want."*[76]

The Terms of Reference set the scope for the advice provided by the STECF, and also ensure that the expert working groups carry out the appropriate technical work that allows the STECF Plenary to issue appropriate advice. As one of the STECF contributors explained:

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[68] EU Commission (2019): STECF Meetings. Retrieved from: https://stecf.jrc.ec.europa.eu/meetings

[69] Ibid.

[70] EU Commission (2019): STECF Rules of Procedure. Retrieved from: https://stecf.jrc.ec.europa.eu/c/document_library/get_file?uuid=8822fd78-07ea-407a-80b3-00146359b6c7&groupId=43805

[71] Ibid.

[72] EU Commission (2019): STECF Rules of Procedure. Retrieved from: https://stecf.jrc.ec.europa.eu/c/document_library/get_file?uuid=8822fd78-07ea-407a-80b3-00146359b6c7&groupId=43805

[73] Ibid.

[74] Ibid.

[75] EU Commission (2019): About STECF. Retrieved from: https://stecf.jrc.ec.europa.eu/about-stecf

[76] STECF Interview 1, October 2018

> *"Generally, the working groups don't have time to go too far off track and do things of their own but if they do, the plenary is really quite ruthless, it will say, "that section is all very interesting but it's nothing to do with what we've been asked to do" and it will be completely ignored in its answering of the questions. It [the STECF plenary] will still have the same terms of reference that the working group had, sometimes they're modified slightly by the Commission because a new issue has come up and they're asked politely, "Could you have a look at this as well?" but generally the terms of reference follow through into the plenary and the plenary then prepares a much shorter, pithy advice, based around what the working group has said and so if there's any extraneous material or stuff that's not relevant, it's completely ignored…So the plenary tries to be even-handed and make use of what is definitely relevant to answer in the question and does have the, it doesn't have to be so tied to the terms of reference that it can't raise a pertinent issue that the Commission really ought to pay attention to, and so sometimes it does."*[77]

In describing what the advice from the STECF looks like, one of its participants explained: "STECF doesn't say to the Commission, "you should do this", it just says, "Given this question, given this information and indeed any other information that we have on the topic, this would be our best advice.""[78]

In some cases, the science advice mechanisms of the EU are directly responding to international relations issues with regards to requests from EU Member States about their implementation of the CFP. As one of the STECF participants explained:

> *"the Member States themselves responding to the various policies and measures that are introduced, proposed by the Commission but usually or often agreed by the Council of Ministers and then more recently, by joint decision between the Council of Ministers and the parliament, the Member States fire in questions to the Commission about, "We would like to do this, could we modify the policy or the rule in order to do this?" […] The Commission then has to respond to that and often in those cases, the lead-in time, the response time is of a very short nature and sometimes, it's not quite so bad nowadays but in the past, in response to some of the TAC and quota outcomes, which there are proposals for those usually in the late summer of the year, by the November, STECF plenary, there were often questions which said, "We would like to do something different here, we think we need you to look at this advice that came from ICES again, we don't think it's quite right, could we have a slightly higher mortality rate?" and in that case, STECF has to respond to that in very short order, usually then in the space of a week, to give the Commission new advice or updated advice or to uphold the original advice, in order that they can then provide the basis for the discussions in the Council of Ministers…."*[79]

4.1.5 What administrative support is provided?

The STECF is supported by a secretariat provided by the Commission administered by the Joint Research Centre (JRC)[80]. The JRC has provided the secretariat for the STECF since 2005, and its role is to provide facilitation services for the activities of STECF, which includes data dissemination and storage, and organising expert group processes.

[77] STECF Interview 2, February 2019
[78] STECF Interview 2, February 2019
[79] STECF Interview 2, February 2019
[80] EU Commission (2019): About STECF. Retrieved from: https://stecf.jrc.ec.europa.eu/about-stecf

4.2 Example Two: International Council for the Exploration of the Sea

The International Council for the Exploration of the Sea (ICES) is an intergovernmental membership organisation founded in 1902. Indeed, it claims to be the oldest intergovernmental science organization in the world. The goal of ICES[81] is:

> *"to advance and share scientific understanding of marine ecosystems and the services they provide and to use this knowledge to generate state-of-the-art advice for meeting conservation, management, and sustainability goals."*

ICES provides advice to the EU, other national governments, and private sector and civil society organisations. The work of ICES involves around 1,500 scientists per year, and derives the majority of these from its 20 member countries[82]. ICES has a dual part structure for its work, including committees dedicated to the science of fisheries and those more explicitly dedicated to science advice related to fisheries. The focus of this report is on the science advice component of ICES.

4.2.1 What is the mandate?

The mandate for the provision of science advice to the EU with regards to fisheries is governed by a Memorandum of Understanding (MoU) agreed each year with the EU Commission. In 2019, the MoU[83] related to the recurrent advice on single fish stocks, mixed fisheries, fisheries and ecosystems, and other related advice, as well as additional non-recurrent advice as agreed between the parties. Given that ICES is a membership organization that provides advice on commission, the MoU agreed a payment from the EU Commission of €1.9 million for the year 2019.

4.2.2 Who are the experts?

The advice from ICES is prepared in an advice drafting group and approved by the Advisory Committee (ACOM). In explaining the composition of these expert groups, a representative from ICES explained:

> *"it's designed the way that all member countries have delegates that can assign experts, national experts to the groups, and all our groups are open to all our ICES member countries, so a delegate can assign any expert to any group in the ICES community, so we really try to open that way."*[84]

Another contributor to ICES added:

> *"once you're in ICES as a member country, you nominate scientists to the processes, so the member state has control of who is there for the different groups that are set up. They have an advisory committee, ACOM, again with nominations from the member state as to who they want to sit on that overarching body."*[85]

[81] ICES (2019): About ICES. Retrieved from: https://www.ices.dk/explore-us/who-we-are/Pages/Who-we-are.aspx
[82] Ibid.
[83] EU Commission (2019): Specific Agreement number S12.801046. Retrieved from: https://www.ices.dk/explore-us/Documents/Cooperation%20agreements/EU/20190308_EC_DGMARE_ref%20G.16.f._Specific%20Grant%20Agreement_Signed_PUBLIC.pdf
[84] ICES Interview 2, January 2019
[85] STECF Interview 2, February 2019

However, ICES doesn't only seek participation from the countries in the regions in which the fish stocks that are being assessed are from. As a representative from ICES explained:

> *"The Advice Drafting Groups are composed of Advisory Committee (ACOM) members, and there we are trying to facilitate that you have a good mixture of ACOM members familiar with the region, but also ACOM members completely removed from that region, so our US and Canada ACOM members are quite busy when they're looking at the single stock advice for instance because they are our external ACOM members for these processes"*[86]

4.2.3 How is advice produced?

ICES produces advice in response to requests for advice from members that are defined in MoUs and other special requests[87]. This means that it operates on a client-contractor basis, where members request and pay for advice either on a recurrent or ad-hoc basis[88]. As a contributor to ICES commented:

> *"member countries of ICES can ask ICES to do additional questions and work, for which ICES will essentially say, "Here's an estimate of how much that's going to cost you" and they can bill them for it."*[89]

The MoU between ICES and the EU Commission sets out some expectations for the production of advice in stating that:

> *"ICES will provide advisory deliverables which are independent of political influence and subject to best international quality procedures for research and research-based advisory deliverables. The technical basis for the advisory deliverables and the process through which it is produced will be transparent. The quality of the technical basis will be ensured through internal and external peer review."*

The structure of the advice production process is defined by ICES[90] to follow the following steps:

- "A request for advice is received from a client
- Data are collected by expert groups, which then make assessments and draft a first scientific/technical response to the request
- Expert group reports are peer-reviewed by independent experts
- In cases of stock assessments where the benchmark (established assessment method to be used) has been agreed upon, the reviewing is carried out within the expert group and then followed by an advice drafting group
- The expert group report together with the review is used in the advice drafting group
- Draft advice prepared by the advice drafting group is discussed and finally approved by the Advisory Committee (ACOM)
- The advice is delivered to the client."

[86] ICES Interview 2, January 2019

[87] ICES (2019): ICES Cooperation Agreements. Retrieved from: http://www.ices.dk/explore-us/how-we-work/Pages/Cooperation-agreements.aspx

[88] ICES (2019): Introduction to advice. Retrieved from: http://www.ices.dk/sites/pub/Publication%20Reports/Advice/2018/2018/Introduction_to_advice_2018.pdf

[89] STECF Interview 2, February 2019

[90] ICES (2019): ICES Advisory Process. Retrieved from: http://www.ices.dk/community/advisory-process/Pages/default.aspx

4.2.4 How are requests for advice developed?

Much of the advice provided by ICES is recurrent advice about fish stocks, fisheries and ecosystems that has an agreed scope based on requests for advice from members that are defined in MoUs and other special requests[91]. A representative from ICES explained:

> *"The overall agreement between us and the clients and the framework is more or less stable, but the particular bits like, on an annual basis it can vary for instance which stocks the clients want to have advice for, or whether they would like to have a bi-annual advice for some of the stocks and not for others, so every year, in particular for the EU, we have to revise that list of stocks and what type of advice they would like to have. There are of course linkages, so all the shared stocks, all the clients need to agree upon how they want the advice to be delivered, so if you for instance have a stock where there's an agreed management plan, has been evaluated as being precautionary, then that's what we're using for basis of the advice. But if you have a stock where one of the clients hasn't agreed to that management plan, then we provide advice on the basis of the [Maximum Sustainable Yield (MSY)] approach, and then of course we can provide a catch scenario using that management plan [for that particular client], but the main advice will be the ICES MSY approach if it's a category one stock."*[92]

This means that ICES experts contribute to the framing of the questions that are being put to them for advice. As a representative for ICES explained:

> *"usually we're quite involved in management plan evaluations of course, and we do interact quite a bit with the clients on this […] to provide the scientific basis for what harvest control could look like, what questions would be useful to know scientifically, so that they're not asking us to evaluate plans that are completely bonkers, and we're helping them formulating the requests for advice so that it's actually something we can evaluate scientifically. […] There are lots of shared stocks, and mostly the clients have settled in good time what they would like us to do, and every year I send out a list of the known management plans that we're aware of and ask whether or not these are still valid, if they have agreed them, because of course I don't know everything, and then they have to respond back, and if there are management plans then that have been terminated or that they do not agree upon anymore, then they're taken off the list and we're not using them as basis for the advice."*[93]

Even once the advice is requested, there is an ongoing dialogue to ensure that the experts know what is being asked of them and carries out the advice in accordance with the needs of the client. As a representative for ICES explained:

> *"for the single stock advice there's not much back and forth, everybody knows what to do, that's cranking the tape machine, but very often when we get special requests, what we do is that once ACOM has decided that it's fine to start working on the requests we get in touch with the relevant experts and Expert Working Groups and ask them to read through the requests, and if there are any unclear issues to get back to us, and they usually do, and then we go back to the clients and say, "We need to have a specification of what criteria you would like us to use", or, "The criteria's you have proposed aren't valid, we can't use them, but we suggest this and this instead", and then the clients have*

[91] ICES (2019): ICES Cooperation Agreements. Retrieved from: http://www.ices.dk/explore-us/how-we-work/Pages/Cooperation-agreements.aspx

[92] ICES Interview 2, January 2019

[93] ICES Interview 2, January 2019

a think and then they come back to us and then we settle, so we have a common understanding of what's being asked for."[94]

4.2.5 What administrative support is provided?

As a permanent structure, ICES has a relatively large established secretariat based in Copenhagen, Denmark.[95] The secretariat is responsible for secretarial, administrative, scientific, and data handling support for the ICES community.

4.3 Example Three: The Scientific Advice Mechanism

The Scientific Advice Mechanism (SAM) was formalised in 2015 through a decision that stated:

> *"High quality scientific advice, provided at the right time, greatly improves the quality of EU legislation and therefore contributes directly to the better regulation agenda"*[96].

The SAM was established with two components. The first included a panel of senior science advisors that could be directly consulted by the EU Commission called the Group of Chief Scientific Advisors (the GCSA), formerly known as the High Level Group of Scientific Advisors[97]. The GCSA was complemented by the funding of a parallel organisation that brought in the scientific communities through a collection of European Academies called Science Advice for Policy by European Academies (SAPEA), which was funded as a Horizon 2020 project to carry out evidence synthesis activities as part of the Science Advisory Mechanism.

4.3.1 What is the mandate?

The mandate of the SAM is:

> *"to provide high quality and independent scientific advice to the European Commission on matters of importance to Commission policy making, in as transparent and unbiased a manner as possible."*[98]

The work of the SAM is defined in a set of documents, including a Rules of Procedure and a set of Guidelines on how the SAM produces scientific advice[99].

SAPEA was established in November 2016 and funded by a grant from the European Union's Horizon 2020 programme[100].

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[94] ICES Interview 2, January 2019

[95] ICES (2019): ICES Secretariat. Retrieved from: https://www.ices.dk/explore-us/who-we-are/Pages/Secretariat.aspx

[96] European Commission (2015): Commission Decision on the setting up of the High Level Group of Scientific Advisors. Retrieved from: http://ec.europa.eu/research/sam/pdf/c_2015_6946_f1_commission_decision_en_827417.pdf

[97] European Council (2015): EC Decision C(2015) 6946. Retrieved from: https://ec.europa.eu/research/sam/pdf/c_2015_6946_f1_commission_decision_en_827417.pdf ; amended in EC Decision C(2018) 1919. Retrieved from: https://ec.europa.eu/research/sam/pdf/c_2018_1919_f1_commission_decision_en_v4_p1_970017.pdf

[98] European Commission (2019): Scientific Advice Mechanism: From questions to answers. Retrieved from: https://ec.europa.eu/research/sam/pdf/guidelines_how_sam_produces_scientific_advice.pdf

[99] European Commission (2019): Group of Chief Scientific Advisors. Retrieved from: https://ec.europa.eu/research/sam/index.cfm?pg=hlg

[100] SAPEA (2019): About SAPEA. Retrieved from: https://www.sapea.info/about-us/

4.3.2 Who are the experts?

The GCSA has up to seven members that derive from different disciplines and countries of the EU[101].

Encompassing expertise from engineering, humanities, medicine, natural sciences and social sciences, SAPEA provides an organisation that can bring together contributors from national academies and learned societies throughout Europe in the production of advice.

> *"In selecting experts for workshops, SAPEA pays due attention to diversity (of scientific views, geographical balance, gender balance, as well as including young scientists)."*[102]

In contrast to the GCSA, which have standing contracts to provide ongoing advice throughout their terms, the experts of SAPEA are brought together on a task-specific basis to write reports.

4.3.3 How is advice produced?

The *Food from the Oceans* report provides an illustrative example of the kind of work carried out by the GCSA and SAPEA. This was one of the first evidence review reports of SAPEA, which was published on the 29th of November 2017[103], and followed up by a subsequent Scientific Opinion from the GCSA[104]. The *Food from the Oceans* evidence review was produced in response to a request from Karmenu Vella[105], the Commissioner for Environment, Maritime Affairs and Fisheries, for a scientific opinion on the question:

> *"How can more food and biomass be obtained from the oceans in a way that does not deprive future generations of their benefits?"*[106]

The scope of the report was defined by a scoping paper that was jointly agreed between the commission and the group of chief scientists at a meeting on 24-25 November 2016[107].

The GCSA provides scientific advice to the College of European Commissioners[108]. A description of the group on its website notes that:

> *"The Group is unique in its dialogue with, and provision of advice directly to, the College; the Group also works with other science advice structures supporting decision-making within the EC such as the Joint Research Centre (JRC); the various decentralised agencies of the Commission; and the Scientific Committees, etc. This cooperation and coordination enables expertise to be shared and overlap to be avoided."*

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101 European Commission (2019): Group of Chief Scientific Advisors. Retrieved from: https://ec.europa.eu/research/sam/index.cfm?pg=hlg

102 European Commission (2019): Scientific Advice Mechanism: From questions to answers. Retrieved from: https://ec.europa.eu/research/sam/pdf/guidelines_how_sam_produces_scientific_advice.pdf

103 SAPEA (2017): Food from the Oceans Evidence Review. Retrieved from: https://www.sapea.info/wp-content/uploads/FFOFINALREPORT.pdf

104 European Commission (2017): Food from the Oceans Report. Retrieved from: http://ec.europa.eu/research/sam/pdf/sam_food-from-oceans_report.pdf

105 European Commission (2017): Food from the Oceans: Scientific advice in the area of food and biomass from the oceans. Retrieved from: https://ec.europa.eu/research/sam/index.cfm?pg=oceanfood

106 European Commission (2016): Scoping paper: Food from the Oceans Report. Retrieved from: https://ec.europa.eu/research/sam/pdf/meetings/hlg_sam_052016_scoping_paper_oceanfood.pdf

107 European Commission (2017): Food from the Oceans: Scientific advice in the area of food and biomass from the oceans. Retrieved from: https://ec.europa.eu/research/sam/index.cfm?pg=oceanfood

108 European Commission (2019): Group of Chief Scientific Advisors. Retrieved from: https://ec.europa.eu/research/sam/index.cfm?pg=hlg

The production of scientific advice by the GCSA is underpinned by "the principles of excellence, transparency and independence"[109]. A member of the GCSA emphasised that their advice was 'authoritative' because:

> *"it constitutes a recommendation from the Commission's group of Chief Scientific Advisors"[110].*

In other words, the appointment of the GCSA by the Commission gives it a level of authority that unsolicited advice may not have. The advice is developed in a scientific opinion for which the Group seeks to produce a consensus position, although there is provision for dissenting opinions to be noted in the reports[111].

The evidentiary basis for the GCSA scientific opinion is often derived largely from the work of SAPEA. As someone from SAPEA explained:

> *"I think they realised that one person can't cover all of this work that's needed, and that's when they put the group of chief scientific advisers, which is now seven, pretty high-level scientists with policy experience, but they even don't know every science."[112]*

SAPEA describes itself as providing "timely, independent and evidence-based scientific expertise for the highest policy level in Europe and for the wider public."[113] The function of SAPEA differs from that of the GCSA. As a statement on the SAM website notes:

> *"SAPEA produces Evidence Review Reports (ERR) following methods developed with SAM to ensure the highest quality standard in order to minimise bias, improve efficiency and ensure transparency. SAPEA ERRs may, in addition to the review of the evidence, identify policy options."*

The distinction between the two organisations is therefore very important. SAPEA only provides evidence synthesis and a set of options – it explicitly does not make recommendations. As one of its representatives commented:

> *"In science advice for policy, SAPEA doesn't write recommendations, we give options based on the science, we make sense of the science and if there's options for policy, that's what we deliver. The recommendations come from the Group"[114].*

The procedure for evidence synthesis are set out in the Guidelines[115]. As a representative explained:

> *"there's procedures to ensure that there isn't bias, that we have an even spread of scientists from across Europe, that we train them, we brief them on and how to be balanced in reporting the science, that they're not driving their own 'save the environment' or 'kill the environment' agenda, that they report on what the science says and this, as much as possible, honest broker method."[116]*

[109] European Commission (2018): Group of Chief Scientific Advisors in the European Commission's Scientific Advice Mechanism. Retrieved from: https://ec.europa.eu/research/sam/pdf/sam_general_citizen_summary_072018.pdf
[110] GCSA Interview, February 2019
[111] European Commission (2019): Scientific Advice Mechanism: From questions to answers. Retrieved from: https://ec.europa.eu/research/sam/pdf/guidelines_how_sam_produces_scientific_advice.pdf
[112] SAPEA Interview, October 2018
[113] SAPEA (2019): About SAPEA. Retrieved from: https://www.sapea.info/about-us/
[114] SAPEA Interview, October 2018
[115] European Commission (2019): Scientific Advice Mechanism: From questions to answers. Retrieved from: https://ec.europa.eu/research/sam/pdf/guidelines_how_sam_produces_scientific_advice.pdf
[116] SAPEA Interview, October 2018

SAPEA reports typically take around one year to produce, and might involve around 20 experts from across the EU. Although the SAPEA evidence review reports can take around a year, there is some provision for slightly faster turn-around scientific advice. As a representative from SAPEA said:

> *"there is a rapid response mechanism built into the grant which it hasn't been really developed, which means we host a workshop or we just use a network report, […] or [a report from] the other academies. On our website you can find all the different reports and if they needed advice urgently on something, we can look in this database and just send that, or sometimes they'll have a brainstorm learning meeting and they'll want an expert, so we'll look in the academies for a fellow who's an expert on epidemiology or an expert on how plastic influences health or something, and then we can send that, and that's kind of a quick sort of response, but that's still being developed. We're not like the Red Cross where we can work two weeks, 24 hours a day to put together a report quickly on desert winds or Ebola or something, we don't work like that just yet."*[117]

Both the GCSA and SAPEA involve broader groups of stakeholders in the final review of the evidence reviews and scientific opinions. As an example, in the production of one of the early outputs of SAPEA and the GCSA on *Food from the Oceans*, effort was made to involve a broader set of stakeholders in the drafting of the Scientific Opinion. In advance of the finalisation of this report, a stakeholder meeting was run on the 13th of November 2017 involving interest groups and other policy actors[118], and a broader expert meeting was held with the Group of Scientific Advisors, members of the SAPEA, other experts from industry, civil society, specialised agencies and observers from the EU Commission[119]. While typically the science advice bodies of the EU remain independent of one another, there was some cross-over between the different science advice bodies in the production of the *Food from the Oceans* report. On the 17th of November 2017, the Policy Officer of the SAM, James Gavigan, presented the latest draft of the Scientific Opinion on *Food from the Oceans* to the Scientific, Technical and Economic Committee for Fisheries (STECF).

4.3.4 How are requests for advice developed?

Requests for advice from the GCSA are either made by the College of Commissioners for work in a particular area, or the GCSA can propose an area of work to the College[120]. The Guidelines for the scientific advice state:

> *"requests should address specific issues where such advice is critical to the development of EU policies or legislation and does not duplicate advice being provided by existing bodies."*[121]

The developing of the scoping paper, including the question to be answered, was described by one of the GCSA as 'co-produced'. They explained that this is:

[117] SAPEA Interview, October 2018

[118] European Commission (2017): Food from the Ocean Stakeholder Meeting Report. Retrieved from: https://ec.europa.eu/research/sam/pdf/meetings/ffo_stakeholder_meeting.pdf

[119] European Commission (2017): Food from the Ocean Expert Workshop Report. Retrieved from: https://ec.europa.eu/research/sam/pdf/food_from_oceans_expert_workshop_report.pdf

[120] European Commission (2019): Scientific Advice Mechanism: From questions to answers. Retrieved from: https://ec.europa.eu/research/sam/pdf/guidelines_how_sam_produces_scientific_advice.pdf

[121] Ibid

> *"to both assure that the scoping paper - in particular the main research question for it - targets a researchable scientific problem and that advice developed on this basis will be usable and relevant as advice to multiple bodies is the rule."*[122]

The topical focus of the work of SAPEA is determined by requests from the EU Commission. The precise work requested is set out in a mutually agreed scoping paper that:

> *"develops the reasoning for the request, describes the main issues at stake, the EU policy context, the requirements for evidence, frames the questions to be answered by the Advisors and indicates the date by when the product is to be delivered."*[123]

Even before the scope of evidence review is defined there are conversations about what is needed. As a representative from SAPEA said:

> *"there's lots of meetings that happen to scope topics that never go anywhere, there's a couple of topics that didn't happen, just lots of informal chats about, "Should we do science advise, is there a need, is there an appetite, is it needed?" And then we'd meet with DG CLIMA or we'd meet with whoever the audience and say, "What do you need?" And they might say, "Actually, in two or three years we might need it, but maybe not right now," because of something that's in the pipeline, so that happens all the time."*[124]

About the demand for the report, a representative from SAPEA commented:

> *"You don't want to write a report and have it sit in a draw covered in dust, what's the point in that? So there's generally an appetite for the work we do, that's why we're doing it, that's why there's certain timely adhoc topics that come up. The JRC served the Commission with a lot of advice for policy and the housekeeping, lots and lots of, they're really good and they're a huge institution. But sometimes there's a special topic that there's an added value from this different approach, this European wide academy type project and it's usually some sort of unusual topic that we can pick up and run with."*[125]

In carrying out this work, the SAPEA and the GCSA are provided with administrative support.

4.3.5 What administrative support is provided?

The Group has administrative support in the form of a secretariat in the EU Commission Directorate General (DG) for Research and Innovation[126]. SAPEA has a coordination team administered by acatech, the National Academy of Science and Engineering, Germany[127].

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[122] GCSA Interview, February 2019

[123] European Commission (2019): Scientific Advice Mechanism: From questions to answers. Retrieved from: https://ec.europa.eu/research/sam/pdf/guidelines_how_sam_produces_scientific_advice.pdf

[124] SAPEA Interview, October 2018

[125] SAPEA Interview, October 2018

[126] European Commission (2018): Group of Chief Scientific Advisors in the European Commission's Scientific Advice Mechanism. Retrieved from: https://ec.europa.eu/research/sam/pdf/sam_general_citizen_summary_072018.pdf

[127] SAPEA (2019): SAPEA Team. Retrieved from: https://www.sapea.info/about-us/team/

4.4 Comparing between cases

In seeking to understand how the different science advice bodies differ and interact, interviewees from the different bodies were asked about and commented on the distinct roles played by ICES, STECF and the SAM.

Speaking on the distinction between ICES and the STECF, an expert contributor to STECG explained:

> *"The simple distinction for me is that ICES is an organisation and STCEF is an advisory committee of independent people and it's simply brought together to do a particular job, whereas ICES has a set of standing committees, if you like, and an annual programme to provide certain things, certain types of advice, TAC advice for example, whereas STCEF can be asked to do anything and on almost any timescale. But the main distinction for me is STCEF isn't an organisation, but a lot of people treat it as though it is, it's an ephemeral group of people who get together three times a year and talk to each other a bit in between, that's how I see it anyway. […] ICES is an organisation that serves a lot more purposes than giving advice to DG MARE, essentially STCEF is just the advisory committee for DG MARE. The thinking a while ago, and I'm not sure it's the same, maybe it is, was that ICES is giving advice to a recipe, whereas STCEF, the recipe might not be quite so obvious.*
>
> *The other thing was that ICES is advising, the main thing ICES does for the Commission is to do the assessments and give the catch options, so it's providing options for catches in accordance with management objectives, which at the moment is [Maximum Sustainable Yield] (MSY). What STCEF in principle should be doing, it should be giving management advice, taking into account other things other than the catch options. So it's an advisory body but it should be advising on management rather than just on catch options, it just so happens that the main management tool that people have got in, certainly in the North Atlantic, in the ICES area are [Total Allowable Catch](TACs), but STCEF is asked to do a lot of other things that ICES isn't asked to look at, like management plans, doing simulations and management strategy evaluations. ICES does it as well but normally the things that are, not normally, quite a lot of the requests that are ancillary to catch options come to STCEF and some of them go to ICES."*[128]

Another contributor to the STECF understood the distinction with ICES in different terms. They suggested that the kind of science advice that STECF offers can be thought about in relation to its proximity to the policy process. It provides scientific opinions on issues that are often pressing and management actions that need to be informed. As they explained:

> *"I would say generally, it is science which is closer to policy in that it has to deal with the immediacy and things and being light footed and responsive to questions that emerge, trying to be helpful and constructive in a short space of time, so yes, I would argue that it is quite close and has to be in a sense, slightly more mindful of that role."*[129]

Another interviewee talked about the kind of knowledge and the disciplinary range of the different science advice bodies:

> *"it is quite fascinating because what's the difference between ICES' working groups and STECF is that STECF is actually including economic information, more social information in the advice, and the funny thing is that for many cases, perhaps specifically like with Danish and Dutch cases or German cases,*

[128] STECF Interview 1, October 2018
[129] STECF Interview 2, February 2019

> *you have people who are in the ICES working group running the assessment and then are in the same STECF working group, the same people talking about the same thing but with different hats on…but it's because the Commission wants to have their own group doing their own thing and ICES is ICES, but STECF, then we have more autonomy and we can do different types of analysis, we can include different types of data. From a public perspective, it looks extremely redundant but it has its political features."*[130]

This was reinforced by another interviewee, who commented:

> *"There's a big difference in that we do not deal with economics that much in ICES, that's more STECF that is dealing with that. I think we have a broader community given that we also have the States and Canada involved in our Expert Groups, and we have both the advisory part but certainly also the science part, and the interface between all the Science Groups that are really just doing scientific work, they're not doing advice, they're making the science that is the basis for what we do in advice. That interaction between the Science Groups and the Advice Groups I think is unique, because you're carrying over more longer-term research into what we are providing as day to day advice, so in that sense I think if you compare us to STECF that we have a lot more science input to our advisory work in that way, plus we have a broader community because it's not just EU countries."*[131]

When the work of the SAM, and in particular the reports on *Food from the Oceans* were considered, a representative from ICES commented:

> *"I would definitely see this report not with an ICES lens at all but more perhaps of a type of UN/academic lens. That is my reading of it."*[132]

In thinking about the distinction between ICES and the work of the SAM, another commented:

> *"the way that ICES is organised and the way that we're operating, having the data development stuff and science development and our advice development running throughout many years I think is quite different than from having a, and I don't mean to sound snobbish or anything, but like a one off project doing this [as seen in the SAM work on Food from the Oceans], and not having that wide based peer reviewing that we do of our work here. […] I don't think it's alarmingly wrong or horrible what they've done, what I think is lacking is first of all when you're dealing with project you're not having that kind of set mechanism for peer review and transparency and all those things that I think is the virtues of ICES, you're not really sure what exactly are the objectives behind what's being done, and I think if I was a manager I would probably look into, "Okay, what are the incentives to providing this piece of advice, what's behind it, has it been peer reviewed, can I see through that whole process?""*[133]

Representative from the STECF also expressed concern about the production of the *Food from the Oceans* report. The report was presented to the STECF plenary meeting, which offered the response:

> *"STECF has not had the opportunity to consult the SAPEA evidence review report, on which the recommendations of the HLG are based. In addition, the*

[130] ICES Interview 1, January 2019
[131] ICES Interview 2, January 2019
[132] ICES Interview 1, January 2019
[133] ICES Interview 2, January 2019

> *Committee was not permitted to retain a copy of the presentation, which limited the opportunity for any in-depth discussion on which to base constructive, informed feedback. STECF welcomes the initiative to have had this report presented during plenary. However, it is regrettable that the STECF was not consulted to provide input to the FFO initiative at an earlier stage in the process, for example to provide feedback on the SAPEA evidence review report before the HLG recommendations were formulated based on the evidence in that report."*

In contrast, a representative from the SAM explained their view:

> *"To my mind, in particular very broad and wide-ranging areas are highly suitable to the GCSA given that it builds on evidence gathered and assessed amongst the networks of European academies, and that the SAM and GCSA are themselves not focused on any one discipline or sub-area, or restricted to any one Commission activity. This makes it possible for the SAM mechanism to transcend existing Commission areas, such as in Food from the Oceans recommending mainstreaming food systems considerations. This is a focus of advice that might not have been placed in focus if the advice had been restricted to providing advice only within any one specific Commission or administration area, but that is resultant of the broad scope of the opinion in relation to the broad question set in the scoping paper."*[134]

These divergent reflections raise the issue of specialism over breadth, which are expanded upon in the discussion below on de-facto governance practices.

[134] GCSA Interview, February 2019

5. De-facto governance practices

5.1 Issues and discussions

In the analysis of science advice structures in the EU, there is a number of important issues and discussions that can be highlighted. The two that are discussed in this report are about the communities of practice that participate in the science advice system in the EU, and the second is the recognized role of science as part of the negotiation for fisheries, but not the source of the answers.

5.1.1 Communities of practice

First, the question of who participates in these science advice is reflected in the question 'who are the experts?' in the three example study science advice bodies above. Each of the three structures is dedicated to including diverse representation of experts both from different national settings, but also from a wide range of disciplinary perspectives. Asked about this diversity, interviewees commented about the importance of country and disciplinary representation as contributing to the credibility of the institution by ensuring that knowledge from different parts of the EU could be included, but also that the science advice bodies are seen as authoritative from the different Member States. As a representative from SAPEA commented:

> *"it's supposed to represent Europe, it's policy advice for Europe and so we want it to be relevant"[135].*

Many of the science advice bodies see their role as not only providing evidentiary input into the policy process, but also contributing to the scientific capacity of EU researchers. As a representative from SAPEA commented:

> *"It's one of our objectives specifically, interestingly in the grant, it's not just to give the policy advice to the Commission, but also to improve connections between academies and the academies and their networks and between the networks and the Commission, so to try and develop a more kind of European collaboration for policy."[136]*

Communities of practice are therefore built through the production of networks between existing organisations that have skills in a particular area. They also support the development of participants in science advice processes to become more skilled and attuned at their role. As a representative from SAPEA commented:

> *"They also have this geographical spread which is nice, which can, in Europe, reach different countries in both cases. And the case of diplomacy, it's really good for scientists from Eastern Europe for example to come and join one of our working groups and learn from the process, and take what they learn there back and build that locally, as well as the policy advise, which they deliver to their ministries, and in a very centralised hub advise. It's one of the nice features of SAPEA in that we disseminate widely and we try to cover, it's not easy to cover all the countries, southern and eastern as well as this kind of northern, western European countries, which are very strong in research, but we try to do that as much as possible."[137]*

[135] SAPEA Interview, October 2018

[136] SAPEA Interview, October 2018

[137] SAPEA Interview, October 2018

This is both considered productive for a strong science advice system, but is also a part of the effectiveness of the operation of these science advice bodies. As a representative from ICES explained:

> *"I think that one of the most valuable things about ICES and its working groups are that scientific camaraderie and that trust, where you're sharing data but also interpreting it together and coming up with new hypothesis about the data or about the system, that you can go back to your institute and try out. So it's a type of peer review, a lot of these assessment working groups in some ways work as scientific symposia, where people are coming with their data, they're showing it on the screen and saying, "This is how we interpret it" and then other people saying, "That looks good but when we look at that in light of our data, we would take this interpretation" and that type of dialogue would be extremely important to the scientific process…*
>
> *I was embedded in a herring assessment working group for a couple of years and people come into the meeting and the first hour is just people hugging, getting coffee and catching up and everybody knows everybody, how are the kids doing, it's extremely tight socially. You're sitting together and some of these assessment groups are 10 days at a time, including weekends, where you don't have to work on Saturdays but still they come in and do the work and all that. So I think that there's a really important role of that, the socio-scientific role of getting people together and then having that critique in a very trustful group."*[138]

Another explained:

> *"it's important to know that, it's a bit of a big family thing, because the clients of course have their scientists that are providing advice to them on what to ask, and ever so often it's the same experts that are going to do the job, so there's an information loop there, if the Norwegians are asking for an evaluation of the Norwegian spring spawning herring management plan, the clients of course have been informed by experts on this stock on what would be sensible to ask ICES to evaluate."*[139]

There was a recognition that while the community-building offered by science advice bodies was important, there was a need to open up these processes so that more people participated. As a representative from ICES explained:

> *"I think one of my main concerns is that the recruitment of scientists into this field, our feeding information and advice to manager is not impressive. I think it's difficult for young scientists and researchers to really see where the rewarding parts of this is because much of what we do when you do work in the ICES system and the advisory system is not particularly producing papers, which is what you mesh it upon, but it's producing advice and engaging with this. And that's what I observe in the wider community of ours, in particular the ones, the experts that are participating in the stock assessment, is that they are mainly driven by a wish and an intent to actually provide salient advice that is operational and can contribute to the preservation of our resources, not so much by the scientific credit they potentially could get from it."*[140]

A contributor to STECF echoed this concern, and emphasized the way that science advice bodies offered great opportunities to work across different cultures from science, to policy, to industry. As one of the contributors to STECF commented:

[138] ICES Interview 1, January 2019
[139] ICES Interview 2, January 2019
[140] ICES Interview 2, January 2019

> *"There's a general absorption of additional knowledge almost by osmosis, just simply by being here and listening and participating in discussions. I'm not sure, in terms of scientific advancement, actually participating in an advisory committee like this actually does anything for most people, because it's not seen in the academic world as being so scientific, that'll be my feeling. Generally, the people that certainly volunteer to be here, and that's most of them, are doing it because they like this kind of interface between science, policy, and in some cases, industry. It's a fairly rare breed, I think, certainly in the fisheries world, it's hard to get people interested in stock assessment and management advice generally, because it isn't seen as a good way of advancing your scientific career, that's my feeling anyway."*[141]

In this respect, the science advice bodies can be understood as spaces in which communities of practice are established that can navigate different cultures and understand the needs of EU policymaking while also recognizing the scientific constraints. They are also communities that reflect on their own practices and worry about the ongoing recruitment of new members.

5.1.2 Timing of politics

The second issue of relevance across the interviews was the role of science advice as an important input to the political process, coupled with a recognition that the politics had an important part to play. For the most part, science advice was seen as the basis for subsequent political decision making. However, interviewees also noted that politics could precede or intersect with the science advice process. In one example, political agreement on a fisheries policy had happened before the science advice was requested. As one of the contributors to STECF explained:

> *"the landing obligation which is on the go at the moment, there was huge pressure for that to happen and regardless of lots of warnings from science saying, "You do realise that if you do this, it will mean XYZ, you will have to change this, you'll have to change that", none of which of course Member States were very happy about, would ever be happy about, nevertheless that policy was driven through and supported by the likes of Hugh Fearnley-Whittingstall to great public acclaim, "We've got to stop this", the policy has come in now but chickens are coming home to roost and starting to recognise that it isn't as easy and it might have been better to have been a bit more circumspect and done it in a slightly different way, but that's history now, we're in it, the policy is there and you have to try and manage it. […S]ometimes the policy driver is so great that regardless of what any of these preliminary consultations, be they with experts in the managerial body or private conversation with other experts, regardless of that, the thing still gets driven through."*[142]

In another example, the politics was seen to enter into the science advice process. As a contributor to STECF commented:

> *"in principle, everyone's working independently and with the best will in the world, people try to work independently but sometimes they have, well, they're lent on, shall we say, by national administrations over particular issues. I don't see that as a problem personally, when I was chairing, I saw it as my job to make sure that everybody else, the committee came to a consensus decision and not be unduly influenced by any particular member, because it's a committee report and not an individual's report. I personally don't see, you're*

[141] STECF Interview 1, October 2018
[142] STECF Interviewee 2, February 2019

> *never going to get away from the fact that people, most of the people are coming from Government departments or something close to a Government department, they're going to be aware of the issues that's worrying that department and they might be persuaded to try and push a particular line, fine, but it's up to the rest of us to spot that and make sure the committee as a whole comes out with an independent consensus opinion."*[143]

The interviewee continued, stating that:

> *"one thing I've learned in all my years, is that you should never underestimate the role of extremely strong personalities, in any committee, as being able to influence the route forward. So if you get somebody who's intent on mischief or steering things in a particular way – and they have a particular strong personality – you can potentially have a recipe for trouble ahead and it relies really then on things like strong chairs, but also a collective attitude within any one of the committees, that "we won't tolerate this mucking about, you will get found out and we won't listen so much to that advice", or you'll politely be asked to leave. So generally, the mechanisms I think largely avoid that happening but there is a risk if your finger is in too many pies along the chain."*[144]

The next example considers a situation where the politics comes after the science advice process, and the importance for science advisors to recognize the place of this politics. One of the contributors to ICES explained:

> *"Once that quota is put on the table, then it's up for negotiations and how to set the actual quota between the countries, between the coastal states of that stock, so EU and Norway, as far as mackerel are known, they get together for two weeks, they're going to go through all their shared stocks and figure out, "Are you going to take 33.3% this year or if we give you some 2% more herring, then we're going to take 4.7% more mackerel" and it's a big negotiation. […] From a scientific perspective, you tend to see in these high state games, your science taking the back seat to the political negotiations, […] it's a classic case of them using the ICES advice as the starting rounds for the negotiation, it's not the final word and then they negotiate down, it's not the top level, it's the bottom boundary. That shows that ICES is extremely relevant, you can't do these things, I mean you could do these things without science but nobody can imagine what that would look like, because of the expertise of catching fish and you can really catch every last fish, the seas wouldn't be as productive, so there's a common agreement that we need the science to know, but we can negotiate on top of that science!"*[145]

Reflecting on this, the contributor to ICES commented:

> *"ICES knows what their role is but they also realise that what happens in the real world when you have to support [the fishing] industry, you have to support jobs and zero catch can mean zero catch scientifically but it doesn't mean that politically."*[146]

This example is supplemented by a description of the way in which a scientific opinion provides a broad recognition that due process has been done. As a contributor to STECF explained:

[143] STECF Interview 1, October 2018

[144] STECF Interview 2, February 2019

[145] ICES Interview 1, January 2019

[146] ICES Interview 1, January 2019

> *"I think that most Member States recognise that having gone through that process, there is not much more they can do on the sort of process-based science approach through the committee of STECF. That doesn't stop them from still lobbying the Commission during the Council of Ministers and saying, "we recognise that STECF said this but we still believe this" and that's where the whole process of arriving at some sort of an agreement, a deal at the end of the year which the Commission are usually interested in doing, where that enters the murky world of politics and winners and losers and all of that, which STECF have to sit back and say, "We didn't say that but they've still gone ahead and done it". But that's in their gift, managers are managers, it's a good job they do."*[147]

In a reflection on the art of science advice, Peter Gluckman argues that the recognition of non-linearity of decision-making with competing values, ethics and policies does not deny that science "should hold a privileged place" but that science advice needs to acknowledge the limits of its offering and the uncertainties that exist[148]. This chimed with a contributor to ICES, who stated:

> *"So counting fish is definitely not like counting trees, it is extremely uncertain, highly uncertain even today, even when we have the best sonars and in some schooling stocks, we can actually pick out individuals and we can kind of count them like trees now, that's very specific for schooling species and for demersal species and other mixes species, we can't even dream to do that. So, it's highly uncertain and these fish stocks are moving all over Europe and actually, because of climate change, the distribution is getting bigger and bigger."*[149]

5.2 Rules and procedures

There are a number of issues related to rules and procedures of the science advice process that are worthy of attention. In particular, the issues of consensus and transparency.

5.2.1 Consensus

All of the science advice bodies are encourages, and normally do, produce consensus positions on their advice. Although there is provision in each of their rules to include minority positions, this function is not commonly used. Many of the interviewees explained the purpose of consensus as being about providing an authoritative statement that could help the political decision-making process. As a contributor to STECF noted:

> *"I suppose it always helps for the Commission to be able to say to Member States, that we talked about this, that go on bleating on about an issue after the science, they can then say, "Look, you can see this on Page so and so of this report, this was agreed by the STECF in a consensus" and that's the way forward. So they do draw comfort from having a report in which it appears to have been signed off by 25 or 30 people who've gone to the plenary meeting."*[150]

Another from ICES explained:

> *"It [consensus] gives them a much more solid and broad background to say, "Okay, we know that 20 member countries of ICES have reviewed this advice,*

[147] STECF Interview 2, February 2019
[148] Gluckman, P. (2014): The art of science advice to government. In: Nature 507, pp. 163-165.
[149] ICES Interview 1, January 2019
[150] STECF Interview 2, February 2019

> *are agreeing with this advice", so it's not just Denmark advising on an enormous sand eel catch for instance, because it gives it more credibility that you have the wide Advisory Committee behind any piece of advice that comes out."*[151]

However, despite recognizing the importance of consensus, interviewees also emphasized the importance of showing the deliberation of different options in the evidence reviews and advice reports so that the various options discussed were put on record, even if they were then not selected as part of the advice. As a contributor to ICES commented:

> *"I think consensus, it's important but it should not be at the expense of deliberation and I think that if I was the working group chair, in an instance where we had a discussion about whether we should do A or B in the model, they have huge consequences, A gives you this and B gives you this, so there's big consequences. I would all of this in the report because I think it's important public information that doesn't discredit science, it shows that scientists are actually doing their job and I think that too much of ICES' work […] is that a lot of these very interesting discussions about what we can say in these situations scientifically but also what we cannot say, they're a lot of times swept under the rug and this becomes a scientific issue when you cannot replicate these models."*[152]

They continued to provide an example of how consensus could be reached, while also acknowledging divergent opinions. The contributor to ICES explained:

> *"There's no objective reason to use [one model over another], we have to decide one or the other, A or B and [one experienced ICES chair that I asked about this] she said she would take an informal vote, like "So how many people think we should do A and how many think we should do B?" and then she would weigh the arguments, so she would ask, "Can you tell me your best arguments and try to weigh that?" and then at the end she had to say, "We're going for A" and that's the prerogative of the chair and hopefully, this is noted in the expert group report, that there was a choice between A and B and then … in that sense it's not a consensus but it is the consensus that the chair can make the final decision and the chair is responsible then, on behalf of all the working group members."*[153]

In this respect, the encouragement of consensus is explicitly stated in the rules of these science advice bodies, however it is something that remains negotiated as it is put into practice.

5.2.2 Transparency

Another core stipulation in the rules of the various science advice bodies is the need to be transparent. This is largely enacted through the publication of all of the documentation about the science advice body and the work that they produce. Everything from the formal decisions that brought them into being to the minutes from their meetings are shared online. Advice documents are also made available for public access at the same time that they are presented to the EU Commission. Asked about the reasoning behind the

[151] ICES Interview 2, January 2019

[152] ICES Interview 1, January 2019

[153] ICES Interview 1, January 2019

publication of science advice, the interviewees broadly echoed a statement made by the former Chief Scientific Adviser, Anne Glover[154], who stated:

> *"Without any doubt, transparency is an essential requirement for a science adviser as this allows public scrutiny of the advice given and checks on whether the advice indeed reflects the majority view of the scientific community."*

By making their advice available, there was an assumption that interested publics will then be able to independently access and assess that information. One of the GCSA members explained:

> *"the work should be available to all actors potentially interested in the area, who are then also able to assess the sources upon which advice to the Commission is based."*[155]

A representative from SAPEA saw the transparency of science advice not only as important for the credibility of the science advice bodies, but also of the policy decisions that are being taken. Transparency was seen as important for performing good policy making in the EU. As a representative from SAPEA commented:

> *"part of the reason that SAPEA exists, is not just to give advice to the Commission but also to boast public confidence and understanding of science advice for policy, so that people end up … the theory is so that we can build public trust in the policy that we make by showing how it's well informed by good science and so on. So one of our roles is to do that and one way we do that is by publishing the advice that we give and say, "Look everyone, we can see how well researched it is, how authoritative it is". And then hopefully down the line, you can then see how it influenced the policy and we ended up with a good bit of policy, a good bit of law."*[156]

However, another interviewee from ICES more critically saw the transparency as providing the basis for both the credibility of the science advisory process, but also as a resource for the public to hold decision-makers to account. The representative from ICES explained:

> *"My biggest quest is this transparency issue, so I think that our process is quite transparent, you have access to all the data that we're basing our advice upon, of course at an appropriate aggregate level so we're not violating the GDPR, but that is publicly available online, Working Group reports are available publicly and the advice is available and you can see who's been asking for it, and also all our MoUs are available to the public, and I think that's important because there are lots of decisions being taken based upon our advice. And as I said in the beginning, I think one of our biggest tasks is to make this advice as easily readable for everybody so that you can tell, "Ok this is the basis, this is what the politicians have had, the managers have had, and they've interpreted it this way", and we hope to give advice so you can only interpret it in the way it was intended, we're not always successful with that, but that's one of the biggest quests. And if you don't know, if we hide for instance our advice and the management decisions are based on something that is not publicly available, I think both the compliance will be absolutely deteriorated but also our…credibility would be diminished."*[157]

[154] Glover, A. (2015): A moment of magic realism in the European Commission. In: J. Wilsdon, R. Doubleday (eds): Future Directions for Scientific Advice in Europe. Cambridge: Centre for Science and Policy, University of Cambridge, pp. 60-81.

[155] GCSA Interview, February 2019

[156] SAPEA Interview, October 2018

[157] ICES Interview 2, January 2019

Finally, a contributor to the STECF took this one step further and suggested that by making the advice publicly available it became a resource with which other actors could lobby decision makers to ensure that responsible actions were being taken. They explained:

> *"I think because the fishing agenda, the world agenda that all the players that are involved, the various big organisations like PEW [Charitable Trusts] and others, all have an interest, not just the Member States whose fishermen are being affected, there's a much bigger agenda out there and so the name of the game across all spheres or best practice across all spheres of management of this type, is get it out there in the public domain and of course, if the kind of material that is produced points to some warning, I've mentioned for example, deep sea fish species and so on, the Commission are more than happy that NGOs and others also bang the drum, if there's an issue that needs to be attended to, I think they are glad if there is sensible lobbying by other organisations in addition to themselves, to try and get economic interests in line and to face up to the fact that, "No, you can't have all these resources, this is critical, you have to play the game""*[158]

It is worth noting, however, despite a commitment to transparency, the science advice bodies surveyed here also have certain elements of control that constrain the extent to which the public can see into their processes. The STECF allows observers, but this requires approval from the Chair and necessitates being there in person during the expert group work. The SAPEA doesn't publish who is in the working groups while they are in operation, as a way to prevent lobbying from outside. As a SAPEA representative noted:

> *"So the working group, they're not locked away in a room together, but we don't say who's in the working group, so no one can write to them and say, "You have to say this"."*[159]

Transparency therefore functions as an important part of the science advice process, but there is still control over what is made transparent and what is left opaque.

5.3 Interfaces

In terms of interfaces that have developed in the science advice process, perhaps most notable are the terms of reference or requests for advice that are negotiated between the science advice bodies and the EU Commission. These encompass the goals and interests that are made apparent in science advice processes. As the examples in this report illustrate, the terms of reference (STECF), MoUs (ICES) or scoping reports (GCSA) are important documents that provide instructions for the science advice bodies, but also define the limits of their authority.

This negotiation of the terms of reference was observed explicitly in a meeting of the STECF in Brussels in December 2018. There, a member of the EU Commission was in attendance and was available to answer questions about the intended scope of the request and the kinds of work that would be most relevant. Indeed, the terms of reference also provided a framework for the Chair to direct the expert working group. At one point when the Chair considered that the expert working group had got bogged down with technical debates and hypothetical questions, the Chair was able to steer them back to their instructions stating we "need to concentrate on giving advice that will help managers make decisions." (Field notes, STECF)

[158] STECF Interview 2, February 2019
[159] SAPEA Interview, October 2018

The recognition that the terms of reference are negotiated is important when considering the kinds of uncertainty and interpretation that can be levelled at the science of fisheries. As a contributor to ICES commented:

> *"science doesn't speak for itself, the numbers don't speak for themselves, they have to be interpreted and when you're in these different scientific fora and different political fora, the numbers take on different meanings because of the way you look at it, the way you treat uncertainty, you can be extremely precautionary in an ICES working group meeting about the quota, but then you go into a political forum and that quota is not precautionary at all."*[160]

In this respect, the process of science advice is also about using the document of the terms of reference as a negotiating object to understand what the policymaking process needs and what the limits of science are. However, it also sets out the instructions for the science advice bodies with regards to the scope of their authority. A similar more technical description of this process was set out in a recent OECD report on science advice, which noted that "clear guidelines and operating procedures can greatly facilitate and improve the provision of scientific advice"[161]. However, despite clear guidelines, there appears to also be different sets of goals and interests that shape the science advice process.

One particular example is a growing push from the scientific community for EU fisheries to adopt a longer timeframe and more ecosystem-based approach to setting fish stock quotas. As a representative from ICES commented:

> *"ICES has this goal for this ecosystem advice that would actually harvest numbers and quotas from an integrated ecosystem assessment (IEA), and the people who are running these IEAs, there's nine of them done within ICES, they also want their information to be used for advice because it's not and I'm like why are we doing all this work, it is an amazing amount of work that is on top of their normal work, if it's not getting used? The scientists are starting to talk with the stakeholders about how this perhaps could be used in the future but then it has to go much more away from single stock advice to more multi-species advice and more type of ecosystem advice and people are really scared, stakeholders are really scared about the consequences of that. So what does that mean if we go away from single stock advice? That means that you can't do those single stock negotiations, you can't do this last minute horse trading, you all of a sudden have a political system that has to actually think in bulks of time of five or six years instead of 15 months or something like this, or less than that, nine month intervals because you have to negotiate every year."*[162]

In this respect, the requests from advice can evolve from both political pressures and from scientific understanding of the complexity of the fisheries biology.

6. Relevance and use of knowledge

Notably, across the science advice bodies there was a range of disciplinary inputs into the science advice process. Based on the interviews, the distinction between ICES and STECF was emphasized around disciplinary differences. STECF includes economics, whereas ICES doesn't. Indeed, the introduction of economics to the STECF was a relatively recent phenomenon. As one of the contributors to STECF commented:

[160] ICES Interview 1, January 2019

[161] OECD (2015): Scientific Advice for Policy Making. p.17. Retrieved from: https://www.oecd-ilibrary.org/docserver/5js33l1jcpwb-en.pdf?expires=1552393587&id=id&accname=guest&checksum=09864E1A7EFD59FC8EFFA1EF56151D94

[162] ICES Interview 1, January 2019

> *"the thinking, as I understand it from DG MARE is that, "Let's have a spread of expertise and let's have a spread of people from different countries". The previous incarnation of STCEF was STCF, no there was no economics in there until 1991, something like that"*[163].

One of the major contributions then of SAPEA and the GCSA was that it includes a breadth of disciplines that are not specific to any one issue. As a representative from SAPEA commented:

> *"something that tripped me up initially [when I started in this job] was the fact that when we talk about science and science advice, we're not using any English sense, meaning excluding arts, humanities and so on, it's in the kind of German sense of wissenschaft, like all the sciences, meaning all bodies of knowledge, so it's everything you'd find in a university essentially, including arts sometimes, but certainly humanities, social sciences, law …"*[164]

This point illustrates the need to think about science not in the singular – but in the plural as 'sciences'.

7. Issues of multi-level policy-making

One way to understand some of the issues of multi-level policymaking in the EU with regards to science advice is to explore the recent history of the science adviser position within the EU. This illustrates the ways in which tensions between different member state cultures and the pressures of the EU to offer legitimate institutions play out in relation to the use of evidence and expertise in policy-making. One useful place to start is in 2009 when EU President José Manuel Barroso[165] announced:

> *"We also need a fundamental review of the way European institutions access and use scientific advice. In the next Commission, I want to set up a Chief Scientific Adviser who has the power to deliver proactive, scientific advice throughout all stages of policy development and delivery. This will reflect the central importance I attach to research and innovation."*

The establishment of this new post was an innovation for the EU, and the precise mandate and relations that the CSA would have with the Commission were yet to be defined[166]. The post was created in March 2010 with the title: "Chief Scientific Adviser to the President of the European Commission" [167] and therefore should direct science advice explicitly towards the President. The post caused some tension with regards to overlap with the existing JRC and the DG Research and Innovation[168]. One particular notable episode during this period related to public views offered by the CSA on genetically modified technologies. Following a request for clarification from an MEP on the Commission's position on these views, the Commission issued a statement noting that: "the CSA has a role in stimulating societal debate on new technologies and to communicate the existing scientific evidence about such

[163] STECF Interview 1, October 2018

[164] SAPEA Interview, October 2018

[165] Barroso, J.P. (2009): Passion and responsibility: Strengthening Europe in a Time of Change. Speech to the European Parliament. Strasbourg. 15 September 2009. Retrieved from: http://europa.eu/rapid/press-release_SPEECH-09-391_en.htm

[166] Glover, A. (2015): A moment of magic realism in the European Commission. In: J. Wilsdon, R. Doubleday (eds): Future Directions for Scientific Advice in Europe. Cambridge: Centre for Science and Policy, University of Cambridge, pp. 60-81.

[167] Glover, A. (2015): A moment of magic realism in the European Commission. In: J. Wilsdon, R. Doubleday (eds): Future Directions for Scientific Advice in Europe. Cambridge: Centre for Science and Policy, University of Cambridge, pp. 60-81.

[168] Ibid.

technologies. The CSA has a purely advisory function and no role in defining Commission policies. Therefore, her views do not necessarily represent the views of the Commission."[169] During the period of the CSA, Anne Glover established a series of science advisory support structures within the EU Commission itself, although such efforts were not without their challenges[170]. The post of CSA encountered controversy on a number of occasions, but most notably when a nine NGOs wrote to the incoming President Juncker in July 2014 arguing that "the post of CSA is fundamentally problematic as it concentrates too much influence in one person, and undermines in-depth scientific research and assessments carried out by or for the Commission Directorates in the course of policy elaboration". The CSA post, they suggested, was "unaccountable, intransparent and controversial" and should therefore be abolished[171]. However, there was support for the CSA role from a large number of scientific organisations and individuals that argued that "we cannot stress strongly enough our objection to any attempt to undermine the integrity and independence of scientific advice received at the highest level of the European Commission."[172] In October 2014, the post of CSA was abolished[173].

Reflecting on the challenges of the CSA position, Director General of the Joint Research Centre, Vladimir Šucha, described the EU's single CSA as "a very difficult experiment" with the particular concern that: "There's no one person who can understand the milieu of 28 Member States"[174]. Following the abolishing of the position, the new President Junker reaffirmed a commitment to "independent scientific advice", but wanted to consider new approaches to "institutionalize" the function[175]. In particular, there was a recognition that science advice for Europe would look different to what existed previously at any national level. The Commissioner for Research, Innovation and Science, Carlos Moedas, explained in March 2015 that the task was to "look for the most appropriate system for the commission — as opposed to the system that works best in the UK, or in any other particular country."[176] It was from here that the Scientific Advice Mechanism (SAM) emerged as a science advice structure in 2015 that could bring country contributions together through the GCSA and SAPEA. As with the CSA position that was abolished in 2014, the SAM remains an experiment whose outcome is as yet unknown.

[169] Barroso, J.P. (2012): Answer given by Mr Barroso on behalf of the Commission. Legal Notice. European Parliament. 3 October 2012. Retrieved from: http://www.europarl.europa.eu/sides/getAllAnswers.do?reference=E-2012-007606&language=EN

[170] Glover, A. (2015): A moment of magic realism in the European Commission. In: J. Wilsdon, R. Doubleday (eds): Future Directions for Scientific Advice in Europe. Cambridge: Centre for Science and Policy, University of Cambridge, pp. 60-81.

[171] Muilerman, H. et al. (2014): Letter to President-elect of the European Commission, Mr. Jean-Claude Juncker. Brussels, 22 July 2014. Retrieved from: http://corporateeurope.org/sites/default/files/attachments/ngo_letter_on_chief_scientific_adviser_-_final.pdf

[172] Sense About Science (2014): Scientific scrutiny in Europe is essential. Retrieved from: https://archive.senseaboutscience.org/pages/maintain-eu-chief-scientific-advisor.html

[173] Glover, A. (2015): A moment of magic realism in the European Commission. In: J. Wilsdon, R. Doubleday (eds): Future Directions for Scientific Advice in Europe. Cambridge: Centre for Science and Policy, University of Cambridge, pp. 60-81.

[174] Science Business (2015): Director General of the Joint Research Centre calls EU chief scientific adviser role into question. Retrieved from: http://www.sciencebusiness.net/news/76995/Director-General-of-the-Joint-Research-Centre-calls-EU-chief-scientific-adviser-role-into-question

[175] Rabesandratana, T. (2014): Science adviser role in the new European Commission in limbo. Science. 11 November 2014. Retrieved from: https://www.sciencemag.org/news/2014/11/science-adviser-role-new-european-commission-limbo

[176] Abbott, A., P. Campbell (2015): Europe's research commissioner lays out his ambitions. Nature. 23 March 2015. Retrieved from: https://www.nature.com/news/europe-s-research-commissioner-lays-out-his-ambitions-1.17165

8. How is the case changing our understanding of Science Diplomacy?

When these science advisory bodies are examined through the lens of science diplomacy – as a "meta-governance framework"[177], which involves "collaborations between stakeholders from science, policy and diplomacy…various governmental or diplomatic organisations as well as non-governmental scientific organisations."[178] – we can identify a number of valuable insights for the future development of science diplomacy. This section briefly discusses these.

8.1 Cross-cultural working

Perhaps most pertinent to science diplomacy is the way in which science advice bodies are forced to work across cultures, both within the EU and beyond. Not only are contributors to science advice operating across scientific communities and policy communities, but they are also negotiating interactions between disciplines and different national cultures. The case of science advice shows that the ability to learn about and work within other cultures as expected in diplomatic settings also applies to the case of science advice.

8.2 Communities of practice

As set out above, the building of communities in science advice is not only important for growing capacity in the skills of science advice, but also allowing the trust between the different contributors to these processes. As previous research by Dankel et al. (2016: 214)[179] has noted with respect to ICES:

> *"Several of the industry representatives who hold seats on the Advisory Councils have been involved in projects and collaborations with fishery scientists and have become familiar with the intricacies of the science that underpins ICES advice. As a result of increased interactions between industry representatives, fishery scientists, and the ICES advisory process, the presentation of official ICES advice no longer comes out of a "black box". The reasons why the advice looks like it does are often already known to the stakeholder representatives whose constituencies will be most affected by the advice in question."*

The case of science advice also shows that the socialisation of practices is not something that only takes place amongst those contributing to science advice processes, it is also something that takes place across those requesting and using the advice.

8.3 Institutionalisation

One challenge that is common to both science advice and science diplomacy is the way they can be institutionalized across different national settings, as well as in the EU's multi-level structure. The case of science advice suggests that this can only be achieved through experimentation and a willingness to learn from experience. Learning from experience in other countries and transnational settings will also be important. The International Network

[177] Flink, T., C. Rungius (2018): Science Diplomacy in the EU: Practices and Prospects. S4D4C Project Brief No.1, October 2018.

[178] Aukes, E. et al (2020): Towards effective science diplomacy practice. S4D4C Policy Brief No.2, January 2020.

[179] Dankel DJ., K. Stange, KN. Nielsen (2016): What hat are you wearing? On the multiple roles of fishery scientists in the ICES community. In: ICES Journal of Marine Science 73(2): pp. 209-216.

for Government Science Advice (INGSA) has already recognised this in its establishment of a special interest group on science diplomacy[180]. In addition to questions of institutionalisation in national settings, there is also the question of whether science advice or diplomacy should focus on specialism or breadth in its disciplinary scope. In what areas, for example, is it good to have diplomats specialised in science diplomacy or alternatively generalist diplomats with some knowledge of the science elements?

8.4 The diploma

The word diplomacy has at its heart the historical traces of the profession in the word diploma, originally meaning a 'state paper' or more precisely from Greek via Latin 'folded paper'[181]. Just as present-day diplomats are frequently instructed by governments, today's scientific advisory groups are furnished with sets of instructions about how they are to operate and what they are to do in the form of terms of reference or agreed scoping documents. The way in which the diploma of science advice is negotiated between the Commission and the science advice bodies perhaps offers some insights into the ways in which interstate negotiations can be understood.

8.5 Timing of Politics

As set out in the discussion above, the timing of politics is also important to science advice. Previous scholarship by Kuus (2014)[182] has emphasised the value of science advice as being a space in which the politics can be partially resolved through the creation of shared understanding between different governments that might thereby reduce the need for traditional forms of diplomacy through shared problem definition.

8.6 Performance

The issue of transparency explored above also shows how the public display of science advice can function to ensure the credibility of science advice bodies but also as a way in which policies can be challenged. This section also noted, however, how transparency is also carefully orchestrated. Previous scholarship by Hilgartner (2000)[183] has described science advice processes as having front stage and back stage processes. It may be therefore useful to consider how science diplomacy might also have front stage and back stage processes, and the ways in which transparency is used in diplomacy as a lobbying device as illustrated in the case of science advice.

8.7 Internal capacities

Finally, the examples of science advice bodies examined in this report are all formal structures, but it is also important to note that there are large numbers of scientific and technical experts that sit within the EU Commission and provide input to the policymaking process that are not detected by only looking at formal science advice structures. These internal capacities of science advice fulfil an important function in improving the

[180] INGSA (2019): Science Policy in Diplomacy and External Relations (SPIDER). Retrieved from: https://www.ingsa.org/divisions/spider/

[181] Oxford English Dictionaries Online (2019).

[182] Kuus, M. (2014): Geopolitics and Expertise: Knowledge and authority in European diplomacy. Chichester, UK: John Wiley & Sons.

[183] Hilgartner, S. (2000): Science on Stage: Expert advice as public drama. Stanford, CA.: Stanford University Press.

development of policy on the inside. In a brief recognition to this, a contributor to STECF explained that there is:

> *"a mix within the Commission of lawyers and social scientists and so on, who typically work on regulations and development of policy but also quite a large body of science experts often detached experts from Member States and there's still some on the Commission now, who have that kind of expertise and can advise from within on the policy."*[184]

In thinking about science diplomacy, it is therefore important to not only acknowledge the formal structures for science diplomacy, but also to consider the ways in which internal capacities for science diplomacy might already be built into diplomatic systems.

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[184] STECF Interview 2, February 2019

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