



SCIENCE & DIPLOMACY

How countries interact with the Boston innovation ecosystem //

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**Science & Diplomacy:
How countries interact with the Boston innovation ecosystem**

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Table of contents

1. Executive summary	3
2. Introduction and context	3
2.1 Science diplomacy: foreign policy and economic development.....	4
2.2 Boston's innovation ecosystem	5
3.1 Missions in the Boston area: a diverse portfolio	8
3.1 Scope of activities of science attachés	8
A. Private sector engagement.....	9
B. Academic collaborations.....	11
C. Horizon scanning and STI watch.....	12
D. Transfer of STI policy best practices	12
E. Public diplomacy.....	12
F. Engaging the diaspora	13
G. Negotiating and implementing S&T agreements	13
3.2 Measuring the success of science attachés	14
4. Models of representations and cooperation in Boston	15
4.1 Models of representation	18
A. Embassy in Washington, D.C.....	15
B. Consulate with an embedded science attaché	15
C. Consulate with an S&T agenda (STI consulate).....	15
D. Within a university.....	17
E. Establishing a nonprofit.....	17
F. Other means of representation.....	18
4.2 Hierarchy and dependencies	18
4.3 Models of cooperation within the Boston representation.....	19
A. Bilateral.....	19
B. Between multiple representations.....	19
5. Backgrounds, attributes, and training of science attachés	20
Backgrounds and attributes of science attachés in Boston	20
Science diplomacy training opportunities.....	20
6. Conclusion and recommendations	23
Endnotes.....	27
About Diplo	30
About AAAS.....	31



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SCIENCE & DIPLOMACY: HOW COUNTRIES INTERACT WITH THE BOSTON INNOVATION ECOSYSTEM

1. Executive summary //

Science and technology (S&T) extends the diplomatic agenda beyond traditional issues that diplomats have been addressing for centuries. Cybersecurity, artificial intelligence (AI), and biotechnology, to name a few, are becoming essential for furthering the national economy, security, and overall well-being and prosperity. In addressing these challenges, countries are developing new diplomatic approaches and techniques, such as establishing an active presence in innovation hubs worldwide. This report focuses on how diplomatic services engage with research, academic, and business actors in the Greater Boston area (hereinafter Boston), Massachusetts, USA.

Boston is historically the center of academia in the United States, and since World War II has developed into one of the country's main scientific and innovation hubs. In recent years, many governments have chosen to expand their existing outposts in the city

while others have made the decision to establish a Boston presence, in an effort to help ensure their future prosperity and stability, and to anticipate the policy implications of the latest science, technology, and innovation (STI) developments.

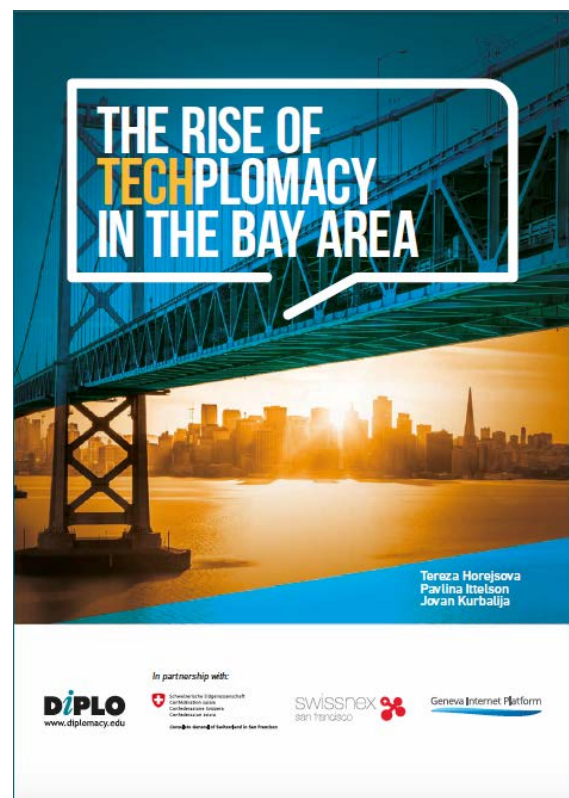
This report provides an overall analysis of how diplomacy interacts with the Boston STI ecosystem and focuses on the practical applications thereof. The identified models of representation include consular representation, networks of science and innovation outposts, and various ways of embedding science attachés within the Boston STI ecosystem, as well as their agenda. The report outlines how results, successes, and failures are measured. It also addresses and identifies possible areas for capacity development and training of these representatives. It should be particularly useful for countries, especially developing ones, which are planning to establish a presence in Boston.

2. Introduction and context //

Interactions between science and diplomacy, in particular the role of science in foreign policy to address national and global challenges, have been on the rise since the second half of the twentieth century. The expansion of the Internet and the pace and complexity of new S&T developments are having a significant impact on traditional diplomacy and on the way governments respond to it. The array of issues that today's diplomats have to consider, understand, and navigate is vast and increasingly involves STI issues.

Similarly, scientists at the forefront of their fields are increasingly in contact with governments^{1,2} to ensure that the impacts of new research developments do not have harmful effects on society, and that the decision-making process includes future developments in S&T.³

There is an increasing need for countries to engage at the nexus of STI and diplomacy. Many



governments have therefore established a presence in hubs where academia and businesses are delivering the latest in S&T developments. As such, they can contribute to better-informed policy decisions and leverage these developments for economic growth. Examples of such hubs include the San Francisco Bay Area or, as is the focus of this study, Boston.

In 2018, DiploFoundation looked into new forms of diplomacy emerging in the San Francisco Bay Area,⁴ given that what happens in the Bay Area profoundly impacts digital issues worldwide. S&T developments that take place in specific hubs also have an indisputable impact on international relations, the world's economy, and society as a whole.

Although the Bay Area receives a lot of attention, other centers are becoming increasingly relevant with respect to S&T progress and related policy matters. Global policy hubs and centers exist worldwide – for example, Beijing, Bangalore, Berlin, Tel Aviv, and Zurich – and each of them has its own unique and common elements. It was therefore worth exploring Boston as another model ecosystem to help develop a more complete picture of global policy hubs and centers.

The premise of this report is to map the diplomatic representations in Boston,⁵ and their interactions with the local government, academia, the private sector, and other S&T-related communities. Given the concentration of academic, innovative, and scientific domain in the city, 66 countries⁶ have an established a diplomatic presence in Boston.⁷ For those that do not have an outpost there, their Washington, D.C. embassies or New York representations often handle interactions with Boston. Although setting up a presence in Boston has been on the rise, even more countries are now trying to find a way to scale their interactions with the hub. While some actors, like Switzerland or the United Kingdom, established their science diplomacy presence in Boston decades ago, more and more have entered this space in the past five years, including the Netherlands, Quebec, Brazil, Taiwan, and Denmark.

We explored how the representation of different countries unfolds practically. The ways different countries have structured their presence in the Boston area depend on the differences in their motivation to be present in the area, their personnel and financial resources, and their domestic administrative set-up. We focused on countries presenting a wide range of approaches to their representation and activities in Boston. We also selected actors from different geographical regions to achieve a balanced sample, and included subnational entities. The research covers all the members of the Science and Technology Diplomatic Circle (S&TDC)

Boston,⁸ as well as a sample of innovation centers, business chambers, and local government representations. While the mapping exercise is not exhaustive, it provides a general overview of the different types of representations present in Boston. We conducted interviews from November 2018 to May 2019, either in person or over the phone. The respondents answered a set of open-ended questions. Interviews were complemented by desk research.

This report, conducted as a joint partnership between the Center for Science Diplomacy⁹ at the American Association for the Advancement of Science (AAAS) and DiploFoundation, maps the main types of diplomatic representation and their interactions with the Boston STI ecosystem. It also shows the main characteristics of each identified model, their agendas, their methods of measuring progress and success, their need for capacity development, and gives a sample of strategic considerations for countries contemplating implementing similar models.

The report will be particularly useful for:

- The diplomatic and policy communities worldwide. It should help them understand the advantages of and requirements for developing a presence in regional scientific and innovation hubs;
- Countries planning to develop a presence in the Boston innovation ecosystem;
- Boston's scientists, technologists, and innovators. It should help them understand the role of diplomats in their midst and how and why scientists and diplomats must engage;
- The DC-based diplomatic community. It should alert them of the relevance and importance of the Boston ecosystem to their work in the United States and/or how best to leverage and build their presence in Boston;
- Diplomatic training and academic institutions providing training and courses in science diplomacy, including the preparation of science attachés;
- Individuals interested in training to become S&T attachés, regardless of where they will be placed;
- The wider S&T community (academia, business, and nonprofits) interested in understanding the broader implications of their work and how it may be of interest to the diplomatic community.

2.1 Science diplomacy: foreign policy and economic development

Over the last decade, science diplomacy has increasingly captured the attention of governments and various actors. In practice, it is driven by the growing need to address S&T-related global challenges, to harness scientific knowledge, and

to manage technological disruptions for economic growth, prosperity, and security. In addition to diplomats and scientists, science diplomacy involves technologists and innovators, as well as representatives of international scientific organizations.

Science diplomacy has many aspects. Primarily, it is an actionable tool used by regions, states, and organizations to further their foreign policy and economic agenda via science and a way to attract talent, cooperate, and influence.¹⁰ In addition, science diplomacy involves multilateral initiatives and activities or organizations, such as the European Organization for Nuclear Research (CERN).¹¹ For example, nations aspire to attract and retain the best scientists from around the world to benefit their national research systems, which can result in breakthroughs in STI that may drive economic development. Simply providing scientific expertise and leadership can be a positive way for a nation to further its interests, visibility, and STI presence, as a form of soft power.¹²



Figure 1. The science diplomacy ecosystem and its various actors/levels (non-exhaustive list), from left to right: international scientific organizations where states collaborate on scientific endeavors; ministries of foreign affairs where science diplomacy is defined and led by nation-states; embassies and consulates (and other non-conventional means) where science diplomacy and involvement in STI collaboration for economic growth is deployed; S&T-based businesses (from large companies to startups) that cross national boundaries; nonprofit science organizations and foundations, as well as formal and informal scientific networks whose work has an impact on international relations.

Some of the new developments in S&T innovation occur in certain regions and, at a more micro level, in cities (e.g. San Francisco and Silicon Valley in the USA, the Greater Bay Area in China, or Bangalore in India). In these hubs, embassies, consulates, and other government-employed actors are the eyes and ears of their governments and the necessary connection point between the home country and the local ecosystem.

Given the confluence of science diplomacy and economic development through technology and innovation, this particular type of science diplomacy could be referred to as STI diplomacy but, for simplicity, we will be using the term ‘science diplomacy’ throughout this report. In addition, many different titles are used for governmental actors tasked with an STI portfolio (science attaché, research and innovation attaché, or consul for innovation, for example). While recognizing the diversity of missions and actors, for simplicity, ‘science attaché’ will be the common denomination referred to in this report.

The goal of this report is limited to providing an overview of the activities and models of deployments of science attachés in Boston. It does not intend to analyze specific strategies that governments may devise to meet their economic needs or set their foreign policy in S&T, or how these are matched to the missions of their science attachés in Boston. While a detailed understanding of the incentives leading to the deployment of a science attaché is certainly important, this is beyond the scope of this report.

2.2 Boston’s innovation ecosystem

Since World War II, several areas across the United States have developed into scientific hubs. Whether for the purpose of education, defense, life sciences, or technology, the locations have developed into leading centers with the capacity to address issues of global importance. The United States is a leading country in the S&T sphere, with total US spending on research and development above \$500 billion – just over 26% of the world’s annual research and development spending.¹³ In the physical sciences, seven of the ten best universities worldwide are located in the United States.¹⁴

Communities with a strong scientific presence in the United States vary from mid-size cities to metropolises and are located throughout the country, for example in San Francisco, CA; New York, NY; Chicago, IL; Houston, TX; and Boston, MA. The unifying traits of these cities include established institutions of higher education, research facilities, business

centers, and a record of attracting both domestic and foreign businesses looking for access to and insight into the latest, cutting-edge scientific developments. These attributes also create an incentive for foreign governments to establish a presence that goes beyond traditional consular diplomacy.

One of the major US centers as a scientific hub is the Boston (MA) metropolitan area. Greater Boston, with a population approaching 5 million inhabitants, is the tenth largest metropolitan area in the United States.¹⁵ Home to numerous world-class institutions of higher education and research, it is also the sixth largest tech hub in the world based on the number of deals concluded from January 2012 to May 2018.¹⁶

The world's leading universities like Harvard University, Massachusetts Institute of Technology (MIT), Tufts University, Boston University, Boston College, Northeastern University, and Brandeis

University¹⁷ are based in the Greater Boston Area, in addition to 30+ other colleges and universities. Many of these schools harbor world-leading S&T departments, have strong technology transfer offices, and serve as incubators for startups. One example is the MIT Engineering Department that has its own Tech Licensing Office¹⁸ and Global Startup Lab.¹⁹ Some universities have started focusing on science diplomacy education, for example the MIT Science Impact Collaborative²⁰ and the Science Diplomacy Center at Tufts University's Fletcher School.²¹

In addition to being a center of academia, Boston is a bustling innovation hub. The greater metropolitan area ranks first in the United States in receipt of National Institute of Health (NIH) funding,²² having received nearly 5000 awards totaling close to \$2.5 billion in 2018.²³ In addition, venture capital funding exceeded \$6 billion²⁴ with lab space approaching 2.5 million sqm the same year.

INDUSTRY	2015	%
Health Care and Social Assistance	139,911	18,5%
Professional, Scientific, and Technical Services	91,858	12,1%
Finance and insurance	86,971	11,5%
Government	76,708	10,1%
Accommodation and Food Services	59,910	7,9%
Educational Services	57,534	7,6%

Table 1. Boston's jobs by industry⁷⁶

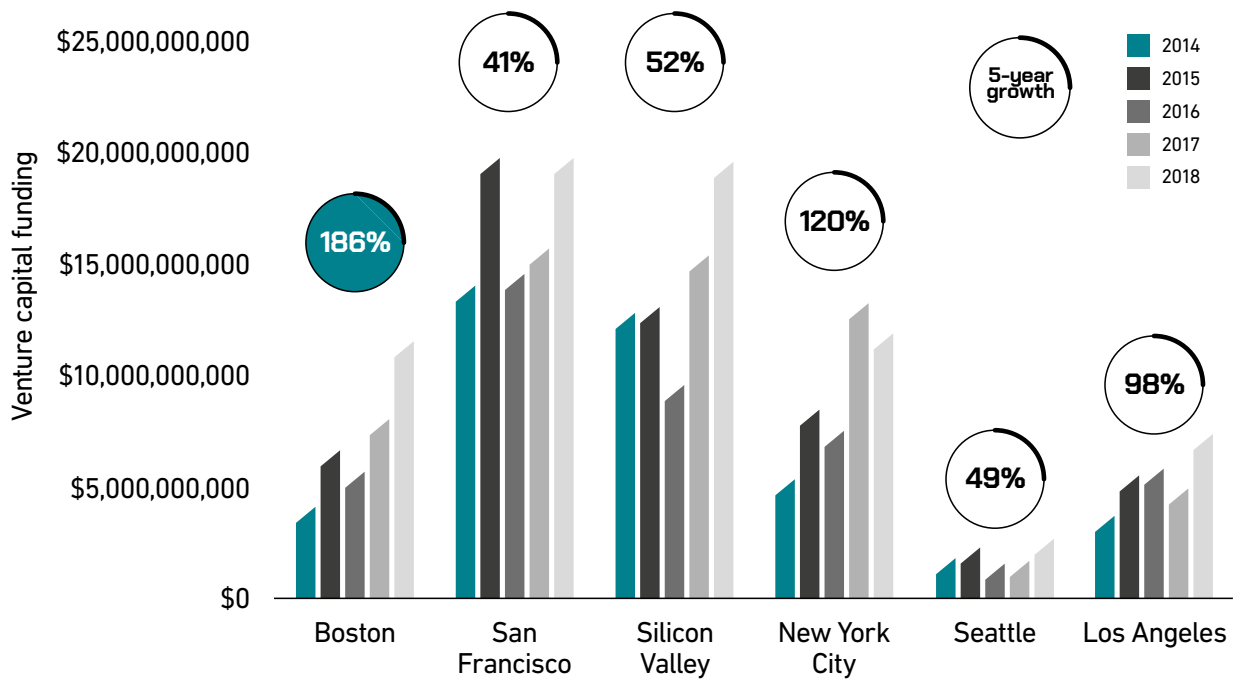


Figure 2. Increase in venture capital funding from 2014 to 2018 in the main US tech hubs²⁵

The main industries related to S&T research are pharmaceutical, life sciences, and biotech;²⁶ computer and software;²⁷ finance (including venture capital); education; defense; and government. Examples of Boston's rich innovation ecosystem include Greentown Labs,²⁸ the largest cleantech startup incubator in the United States; and

MassChallenge,²⁹ which in the wake of the 2008 economic recession helped accelerate over 1000 startups from around the world, raising \$2.5 billion in funding. Among other actors dedicated to further supporting the ecosystem are topical nonprofits such as the Massachusetts Biotechnology Council (MassBio)³⁰ which focuses on life sciences.

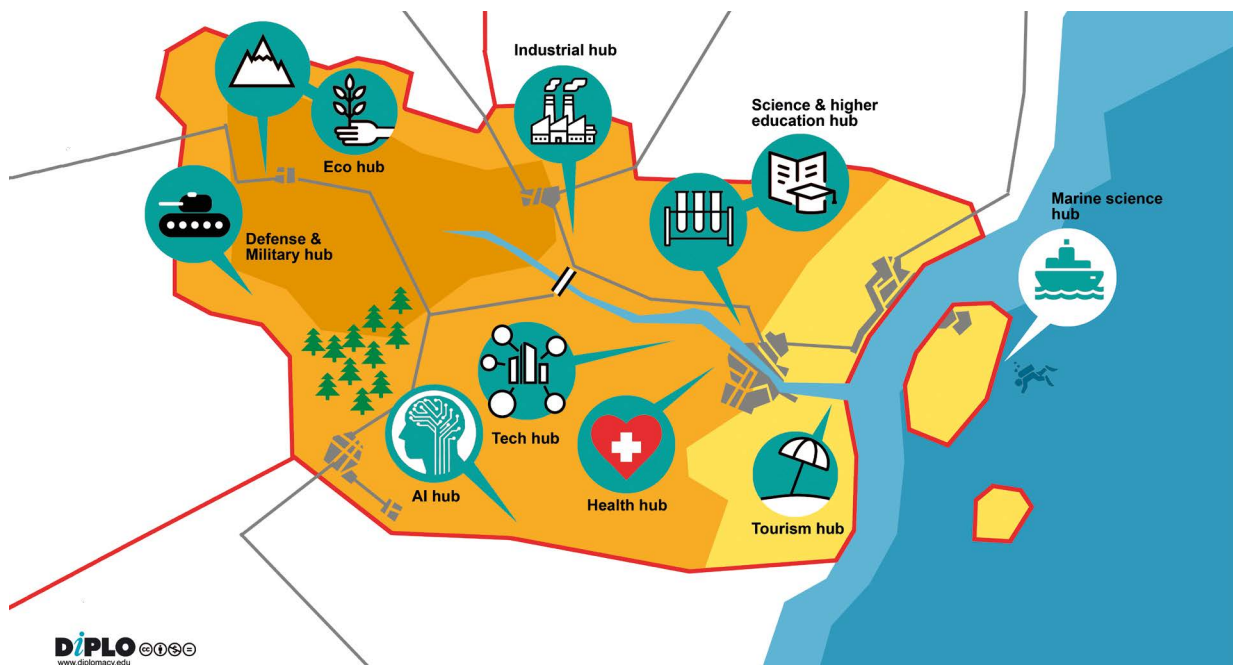


Figure 3. Depiction of an STI hub

Over time, Boston has developed into a significant location for diplomats posted to represent their countries' interests in STI. In addition to Boston, the Commonwealth of Massachusetts has actively assisted countries establishing representations in this area via the Massachusetts Office of International

Trade and Investment (MOITI). MOITI has concluded numerous international agreements with countries or regions on issues related to 'trade and investment, economic opportunity, science, technology, innovation and education.'³¹

Major S&T-focused incubators in the Boston area

Boston-area accelerators and incubators offer startups physical seats, access to hardware and lab space, access to capital through structured pitch opportunities, demo days, and highly targeted networking opportunities with relevant peers, venture capitalists, and major companies. Among the current incubators and accelerators coloring the Boston scene are several which are more industry-specific (such as Greentown Labs³², with its focus on cleantech) and one or two which operate more broadly with highly diverse innovation portfolios (such as MassChallenge³³). These can also include incubators and accelerators that have grown out of local universities. An example of this is The Engine,³⁴ which was recently launched by MIT, but now operates independently as an energy-dedicated accelerator. The Cambridge Innovation Center (CIC), with multiple locations across the Greater Boston area, provides office space, coworking – and therefore also networking – opportunities for startups and other STI-interested actors. The CIC in Kendall Square is a space that many countries use as their base in Boston, including the United Kingdom's Science and Innovation Network, which purposely relocated there from a more traditional office in downtown Boston.

Major companies have launched their own in-house incubators and accelerators that either serve to develop technologies that will remain in house or help launch independent startups. Shell Techworks³⁵ is an example of this model: it brings together technology startups and entrepreneurs from outside the energy industry to find the solutions needed to produce energy with less environmental impact.

Major companies also develop strategic partnerships in the form of sponsorships with local incubators and accelerators, injecting both capital and access to resources and mentorship into the hubs. Oftentimes this comes in specific packages around a certain priority issue area or challenge for the sponsoring company. It is understood (either explicitly or implicitly) that the sponsoring company will be critically assessing the startups participating in a given challenge to see if they represent any interesting opportunities for acquisition.

For non-US startups, accessing the full suite of resources offered via a traditional seat in a Boston-based incubator or accelerator can be challenging for many reasons, so a common model might be a short-term in-residence program framed as an international exchange between a Boston incubator/accelerator and a home-country incubator/accelerator. MassChallenge, as one of the largest ones in Boston, has also physically expanded to open multiple locations outside the United States, including in Switzerland, thereby growing opportunities for non-US startups.

3. Missions in the Boston area: a diverse portfolio //

Countries have set up their representations in Boston for different reasons. In some cases government representations followed to assist businesses from the home country that established their branches in Boston to tap into its research and innovation ecosystem in order to stay competitive. When the portfolios of the economic or higher-education attachés grew, representations created the position of science attaché. This is now commonplace.

As far as the nature of the portfolios of the science attachés in Boston, these are set by the home countries, advisory boards, or international agreements and reflect the specific needs of each country, as well as specific components of the local Boston STI ecosystem. The areas of pharmaceuticals, biotech,

lifesciences, AI and robotics, nanotechnologies, environmental disciplines like renewable energy and technologies, marine debris, and water source management are important STI topics in Boston that were highlighted. It is important to note that the scope of activities of science attachés therefore varies widely.

3.1 Scope of activities of science attachés

Science diplomacy in the Boston area follows a typical pattern channeling communication and activities in two main directions:

1. Introducing activities and actors from the home country (government policies, researchers, startups, etc.) to the local environment.

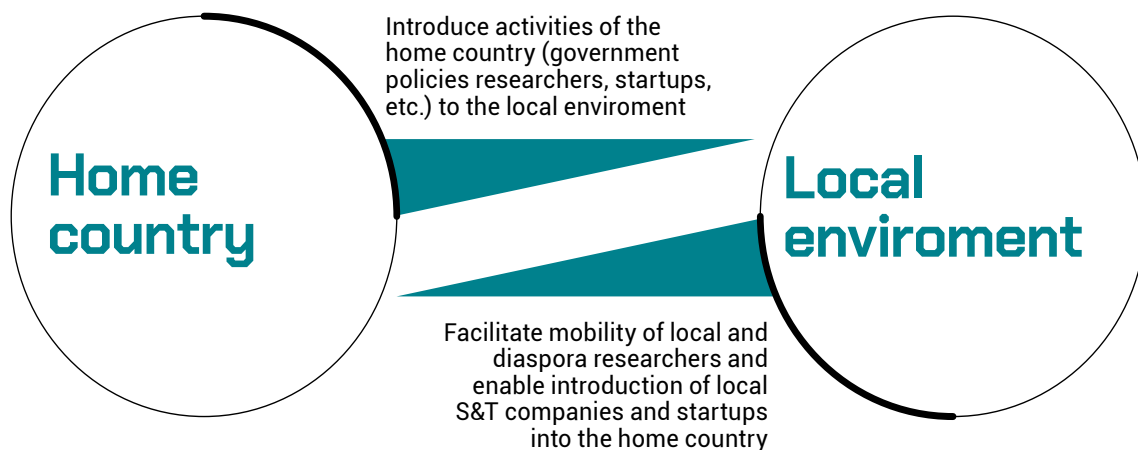


Figure 4. The overarching STI diplomatic framework understood as a bridge between the home and host country

2. Identifying opportunities within the local ecosystem for home countries (e.g. facilitating entry of local academics, researchers, and entrepreneurs; reporting local STI and policy developments to the capital).

Many countries operating in Boston focus on leveraging these two aspects, balancing the time spent on both or emphasizing one more than the other. In addition, some countries devote time or emphasis to other activities, such as actively engaging in public diplomacy on S&T issues. Science attachés usually have the freedom to decide how to achieve their goals and perform their tasks, with limitations relating to internal factors such as staff availability or financial resources.

The research shows that science attachés work on the following areas:

- A. Engaging with the private sector;
- B. Facilitating academic collaborations;
- C. Providing horizon-scanning for the home government;
- D. Transferring STI policy best practices;
- E. Engaging in public diplomacy;
- F. Reaching out to involve diaspora for the benefit of the home country;
- G. Negotiating and implementing S&T agreements.

A. Private sector engagement

Science attachés often follow the arrival of companies from their home countries to the Boston innovation area.³⁶ The relocation or expansion of international companies keeping abreast of research is an indicator of a region's potential to evolve into an innovation hub. In many cases, the international branches of the businesses serve as the first entry point for governments into the local STI ecosystem.

With respect to the private sector, science attachés work with startups, small and medium enterprises (SMEs), and large companies from their home country to scope, advise on, and connect them to strategic opportunities in Boston.

- *Support of S&T-focused startups*

Science attachés provide access and exposure for their home-country startups through efforts ranging from ad hoc introductions to tailored services, while keeping familiar with the Boston startup scene and promoting country visibility. The most common model is to design and facilitate a week-long visit for a home country delegation of pre-approved startups, composed of targeted visits, introductions, and opportunities for pitches and product/service demonstrations.

Most startups come to Boston looking for development opportunities ranging from research to capital-specific or a mix of both. When talking about research opportunities, startups seek introductions to potential research collaborators and access to costly, in-demand equipment housed in a specific university or research lab in Boston. Startups also come to Boston to attract investors and to seek facetime with sector-specific venture capitalists or major companies known for their in-house venture funds.

The Danish representation in Boston offers structured consulting services to startups, tech companies, and universities seeking guidance on how to penetrate the US STI scene. They charge a fee for this service, that is partially subsidized for SMEs. It is free of charge for universities.

Beyond strategic consulting, the Québec government office in Boston offers to connect Quebec startups and

companies to local technical services, ranging from legal advice, administering local US hires, or maintaining product compliance with US federal regulations.

Science attachés provide startups with opportunities to secure coveted seats in Boston incubators and accelerators (see insert) through short-term in-residence programs or, if possible, to occupy the more traditional seats open to US peers. For example, InnovationQuarter, a Dutch regional development agency, and Greentown Labs launched BOSTeRDAM in 2018³⁷ via the Holland Innovation Network (HIN).³⁸ In support of market expansion, and essentially designed as an international exchange opportunity for Dutch and US startups, it allows participants to spend two highly tailored, intensive weeks overseas exploring a new market and accessing local expertise, resources, and contacts.

Larger representations are able to host startups at their locations, embedding them for a longer period into the fabric of the Boston innovation ecosystem. For example, swissnex offers a US launchpad opportunity for Swiss startups, providing desk space in swissnex's Cambridge or New York City locations, and letting them tap into their advice, bootcamps, and introductory services for a set period of time. There is a fee for this service for startups partnering with swissnex outside of an Innosuisse³⁹ camp or partner program.

At the same time, science attachés also work to attract Boston-based startups to their home countries through targeted programming and services designed to clarify home-country innovation ecosystems, introduce strategies to 'hack' the ecosystems for maximum benefit, and promote economic incentives (such as more affordable salary models) for engagement with the home country.

At both national and sub-national levels, the home government often seeks to persuade Boston-based companies to expand their footprints to the home country. The Bulgarian government works to attract tech companies and talent to the Sofia Tech Park, which serves as the leading aggregator and hub for STI in the country. However, it can be very difficult to incentivize Boston-area companies to expand or even relocate to home countries. Given the highly sought-after expertise found in Boston, the competition is fierce, and the incentive packages have to be outstanding. These packages can include major grant and research opportunities, tax breaks, set-up services, and more.

STI trends in Boston are a constantly moving target, especially in the startup scene. Countries need to consider how best to adapt to the dynamic environment.

To support consistent awareness and insight into the Boston STI scene, and recognizing the constrained capacity of its staff, the Consulate-General of Mexico drafted 25 STI experts from the Mexican diaspora to serve in a dedicated advisory group. The group meets monthly at the CIC (where the consulate maintains an office) to update the consular staff on priority themes and issue areas and keeps an ear to the ground in the STI startup sphere. The UK, Dutch, and Québec representations in Boston, to name just a few, also maintain their primary offices either inside or close to various CIC locations to stay in touch with the vibrant startup scene.

- *Work with SMEs*

SMEs seek out the Boston STI ecosystem to pursue very specific goals in terms of their development. For example, they may be looking for research or innovation not available in their home country (e.g. a forestry company seeking a robotic arm to help with their tree nurseries), or seeking to attract investment capital to further their growth. In this case, the science attachés act as a conduit between the needs of SMEs and the local STI ecosystem.

- *Work with branches of large international companies*

With respect to large S&T-oriented companies, science attachés also provide scoping, advising, and introductory services to the Boston innovation ecosystem, though more often it is in support of companies' ambitions to access the local market and to form strategic partnerships with local actors. If companies already have some measure of presence in Boston, science attachés will endeavor to stay regularly connected to leadership within their local offices. As a notable example of the increasing links between Boston and the Netherlands, HIN facilitated a visit from KLM's leadership, introducing it to the growing STI ecosystem. KLM subsequently decided to start a new, direct flight from Amsterdam to Boston three times a week.⁴⁰

It is important to note that the relationship between large S&T companies and governments extends beyond local cooperation in supporting each other's goals. On the international level, S&T companies and governments cooperate to address global policy issues – including climate change, health, cybersecurity, and bridging the digital divide. However, the basis for such cooperation – and oftentimes solutions – is arguably the actual local STI ecosystem, either in Boston or elsewhere. It is therefore an indispensable part of the science attaché's work to be cognizant of the big picture and to anticipate policy developments.

B. Academic collaborations

One of the traditional ways to further the home country's S&T capacity is to develop joint academic collaborations and to attract local talent to the home country. Even though these collaborations can be established by scientists directly, science attachés can play an active role in setting up new ones. While this is the best-known part of a science attaché's work, many countries indicated that they are actually not devoting the majority of their time to it.

- *Establishing joint academic collaborations*

Joint research projects in basic and applied sciences can be mutually beneficial to researchers, giving them access to new collaborations and opening possibilities to pursue new funding and resource opportunities. While these academic collaborations are often started by researchers themselves, sometimes a government has an explicit strategy to foster collaborations in specific areas it wants to develop at home, which then becomes part of the science attaché's agenda. For example, the Dutch government is interested in increasing connections with the Boston STI ecosystem on regenerative medicine research, while Israel is focusing on developing academic partnerships and training opportunities in the cybersecurity domain.

Joint collaborations may start at the academic level by fostering connections at an early stage, from co-sponsoring scholarships and student exchanges, to creating joint programs and degrees at the PhD level with advisors from both the home and host country. Countries looking to further their scientific capacity in strategic areas take advantage of Boston's universities to create systems that make it easier for their PhD-level scientists to work at those institutions and allocate funding to joint academic training programs. As an example, Egypt is establishing joint academic programs enabling students to do research PhDs in the United States on areas declared to be of importance for Egypt, such as water desalination and renewable energy.

Science attachés have an important and proactive role in joint collaborations at the institutional level by building partnerships between local universities and home academia and helping formalize these interactions into memorandums of understanding (MoUs). Sometimes, even helping to organize a workshop between scientists in home and host universities can lead to significant and specific results. For example, the UK consulate in Boston organized a workshop with leading deep-sea ecosystem scientists from the United Kingdom and the United States in 2008 at Woods Hole Oceanographic Institute and these researchers developed a science

plan for a transatlantic deep sea coral research programme that evolved into a €9.3 million Horizon 2020 grant to continue and expand their research with partners from Canada and Europe.⁴¹

Countries use different strategies to entice local universities to develop ties with their home academic ecosystem. For example, as an EU country with access to EU funds such as Horizon 2020, Bulgaria works on partnering with US universities to file joint-research grants, which can help jump-start research campuses in the home country.

- *Attracting talent to the home country*

Countries want to attract local Boston based talented researchers to consider career options in their home country. The expectation is that these individuals will contribute to the development of the domestic S&T sector in the future. For this reason, countries and regions have developed mechanisms to attract and retain desired talent. One of the roles of the science attaché is to actively market their home research ecosystem and explain its opportunities to local researchers. They can attract top foreign researchers through specific incentives, such as the Quebec region which offers competitive tax breaks and simplifies the process of obtaining a visa for a researcher's partner, whatever their marital status.

Beyond the academic realm, governments also work to attract individual research talent to the private sector at home. As an example, to help facilitate talent attraction, the government of Taiwan runs an annual two-week program in cooperation with the US State Department that allows companies from Taiwan to spend time in Boston and Boston-area graduate students to spend time in Taiwan. In addition, countries try to attract US startups and companies themselves to the home country by advertising the advantages (e.g. more affordable salary models). For example, France's YEI program (Young Enterprise Initiative)⁴² promotes business and R&D partnership opportunities in France.

Science attachés can also help find leading US researchers or subject matter experts for advisory roles and academic positions in the home country to enhance the development of home research institutions and/or academic collaborations. Some countries also tap into local academics, scientists, and researchers willing to advise the home government on S&T issues. This was the case of the successful efforts of the Consulate-General of Mexico in Boston which helped connect Mexican and American researchers from Boston to the government of Mexico City to lead research and advise on Mexico City's air quality.⁴³

C. Horizon scanning and STI watch

Science attachés are the eyes and ears of their governments and are constantly scanning the horizon.⁴⁴ They observe, document, and inform the capital about what is happening within the Boston ecosystem. This can be helpful for the home government in order to have an opportunity to react to scientific developments and technological disruptions that may have an impact on their research ecosystem or economy at large, as well as in setting domestic and international strategies. Some countries, like Brazil, when in the early stages of developing their S&T presence in Boston, used their consulates as observation posts and performed horizon-scanning for the purpose of defining a strategy and determining the best way to leverage the Boston ecosystem to further develop their STI activity. In addition, other countries try to connect the latest S&T research in Boston with the need for solutions in their home countries (see insert).

Mexico's approach

As it began focusing on S&T issues, Mexico's consular staff devoted some of its time to S&T watch, identifying research taking place in Boston which could be helpful in solving some of the problems that Mexico was facing. Early on, the staff itself would attend S&T-themed lectures and conferences, brainstorm internally, and report useful information up to the Ministry of Foreign Affairs. Because of the consulate staff's limited understanding of technical S&T issues, they created an Advisory Group, leveraging the large Mexican diaspora with relevant STI expertise in the Boston area. The group also helps Mexican startups and companies navigate the Boston innovation ecosystem, and has successfully delivered adequate technical solutions to real problems in Mexico. For example, upon learning that shrimp farmers in the state of Sinaloa were experiencing major shrimp stock losses for unknown reasons, the Consulate and the Advisory Group connected them to relevant researchers in the Boston area. These scientists tackled the issue and eventually developed a revolutionary non-intrusive water filter which drastically reduced the shrimps' high rates of mortality.

D. Transfer of STI policy best practices

Beyond reporting the latest S&T developments, countries use science attachés to learn about STI best practices and policy in the Boston area and potentially replicate and deploy them in the home country. One such example is mimicking startup accelerator and incubator programs from the Boston ecosystem. Facilitated by the various delegations in Boston, MassChallenge has been deployed outside the United States to Switzerland, Israel, and Mexico, helping local startups accelerate using the Boston model.⁴⁵

The best practices from the home country can also be advertised by the science attaché and replicated in the local ecosystem. The home country does not benefit directly from such involvement, but it helps enhance the visibility and image of the country delivering the solution and as such can serve as a form of soft power. For example, the Quebec science attaché organized a visit of Massachusetts representatives to Quebec to learn from the supervised injection facilities (SIFs),⁴⁶ which might soon be deployed to the Boston area. The city of Cambridge, MA is preparing its own report that will consider whether to recommend opening a SIF. And legislation that would allow a pilot SIF is once again before the Massachusetts state legislature.

E. Public diplomacy

A limited number of countries in the Boston area also engage in public diplomacy, or diplomacy of influence, to communicate and advocate for their S&T policy objectives to the local ecosystem. This allows for greater overall visibility related to specific areas of S&T that others might not have, such as environmental policies, marine protection, or the promotion of equality.

While most of the political and policy strategic engagement happens at the embassy level, public diplomacy can be deployed by regional representations as well. For example, France's initiative *Make Our Planet Great Again* was communicated via various consulates across the United States,

including Boston. The Consulate-General of France in Boston organized targeted conferences to help raise public awareness on climate change issues to support the French government's objectives of laying the groundwork for the upcoming COP21 negotiations.⁴⁷ Similarly, one of the four pillars of the United Kingdom's Science and Innovation Network (SIN) is dedicated to this diplomacy of influence and defined as 'strengthening the UK's foreign policy influence through science and innovation.'⁴⁸ Smaller countries also devote a significant amount of their time to S&T policy issues they care about. For example, the Embassy of the Principality of Monaco in Washington, D.C. organized the visit of Prince Albert II to the Boston Area⁴⁹ as part of Monaco's ocean and marine protection agenda. Likewise, regions can gain visibility from advertising some of their more socially innovative policies, such as when the Quebec government organized events promoting female entrepreneurs, both at home and within the Boston ecosystem.

Science diplomacy can be combined to drive progress on societal issues. As part of a social innovation-meets-science diplomacy strategy, science attachés in Boston organize panels and workshops, collaborate on conferences, and even build components into trade delegation visits. This serves to highlight pressing social and sustainability issues of importance to home countries in terms of critical challenges within the STI community that need to be addressed, as well as ways in which STI can advance the social and sustainability agendas.

For example, SIN, at the British Consulate-General in Boston, collaborated with the Science Diplomacy Center at Tufts University to design a workshop highlighting key speakers and evidence-based strategies for closing the gender gap in Science, Technology, Engineering, and Mathematics (STEM) at the 2018 UN STI Forum in New York.⁵⁰ Boston science attachés have begun participating in events organized by MIT Solve,⁵¹ which acts as a platform for tech entrepreneurs driving social change and developing solutions to sustainability challenges to grow their work and build partnerships across

the Solve community. Launched in 2017, swissnex is home to the International Committee of the Red Cross (ICRC) Collaborative Platform,⁵² through which the two can advance the application of STI to humanitarian work.

F. Engaging the diaspora

For countries with a large diaspora, public diplomacy extends to these actors as they can play an important role in helping the government understand how to best shape policies in the home country. For example, the Consulate-General of Brazil in Boston has concentrated efforts on meeting actively with the local Brazilian scientific, academic, and entrepreneurial diaspora to better understand their interaction mechanisms and their transnational business connections with partners in Brazil and in third countries. By providing relevant information about these aspects to the Brazilian MFA, other ministries, institutions, and the private sector, the initiative intends to promote a better understanding of ways to meet present challenges, streamline transactions and investments, boost Brazilian startups in the United States and foster internationalization of Brazilian companies, with the goal of contributing to the country's socio-economic development.

Most of the representations in Boston liaise with either cultural or professional associations and business chambers, extending their network and talent search within the diaspora. Taiwan, for example, is involved with the Taiwanese Biotech Association,⁵³ an organization of 350 biotech professionals of Taiwanese descent, and the Taiwanese Association of America⁵⁴ in Boston.

G. Negotiating and implementing S&T agreements

One of the science attaché's missions is to work toward and enable the fulfilment of international S&T agreements between countries. These agreements, which can be cross-cutting in nature (from natural to social sciences to innovation), help secure a country's position as a global leader in research and result in major funding being deployed.

For example, SIN officers at the British Consulate in Boston were involved in supporting the US–UK Agreement⁵⁵ signed in 2017. The agreement is a foundation for the US–UK partnership to grow even closer. The Agreement also opens new paths to new collaborations between US and UK government agencies, national labs, and universities across a range of priority sectors (e.g. AI, energy storage, space exploration).

In another example, in 2013, Thailand signed an Agreement Relating to Scientific and Technical Cooperation Between the Government of The Kingdom of Thailand and the Government of the United States of America,⁵⁶ since then extended multiple times. Under the agreement, a joint Thai–US Committee meets on a regular basis to define common areas of cooperation and their implementation.

3.2 Measuring the success of science attachés

Embedding a science attaché into Boston or other S&T hubs is a commitment where the results and progress are often not specifically defined. S&T collaborations do not blossom overnight, nor are their results immediately tangible. Similarly, startups might grow into successful companies over long timelines. Science attachés therefore naturally face challenges in measuring the impact and benefit of their work, and diplomats can find it hard to make the case for the need to deploy science attachés in specific cities like Boston. Many report that their work is difficult to track and lacks clear indicators of success.

In addition to the nature of the work, the interest of governments in leveraging S&T in Boston is fairly recent, and such indicators have not yet been developed to the levels of the ones used in trade work, for example. Some science attachés report qualitatively on their weekly activities in diplomatic cables, while others report self-designed key performance indicators (KPIs) that contribute to their overall set objectives. For now, most countries track their impact and success in straightforward terms:

- Number of events organized and number of attendees;
- Numbers of MoUs signed between local and home universities;
- Numbers of papers with co-authorships between Boston-based researchers and the home country;
- Amount leveraged in research funding for universities or investments made into startups (funding raised, jobs created, revenue, etc.);
- Satisfaction and feedback via surveys of clients, for those representations providing services to the companies (e.g. capturing feedback from a major company's visit to Boston, or from a startup that was advised and coached by the science attaché to leverage the local ecosystem) and non-promoter scores (NPS);
- Tracking some of the influence objectives of the home country, such as the number of countries and/or entities that signed onto a white paper aligning with its policies;
- Specific success stories, such as spotting a useful product or solution to import to the home country (e.g. whether a US policy, an innovative type of institution, or an STI mechanism imported to the home environment was successful); and
- Concluded projects evaluated in light of their financial and networking impact, with valuable lessons derived to inform future strategies: these could be self-reported or in tandem with home ministries.

These indicators only provide a partial picture. For example, many events could be organized without necessarily leading to tangible benefits. Additionally, some of the science attaché's work might not be adequately captured. Hence some countries have developed KPIs in a way that more closely maps the actual workflow of a science attaché. Following the workflow, they track the number of initial meetings, then count the number of opportunities that follow from these original meetings, and keep track of term sheets, non-disclosure agreements, and MoUs signed and whether they were implemented in practice. Finally, they look at the actual work output and funding leveraged as a result from these.

4. Models of representations and cooperation in Boston //

4.2 Models of representation

Another consideration for countries beyond setting the responsibilities of attachés is to determine how to structure their operations to meet the goals of the position with the available resources. While in some cases, countries follow the traditional diplomatic representation via their embassy in Washington, D.C. and a consular network, several have chosen a different way to represent their interests in Boston, embedding their science attachés within a consulate, a government office, an innovation center, an academic institution, a nonprofit, or relying on an informal network. The choice of model of representation is affected by personnel and financial resources.

A. Embassy in Washington, D.C.

Many countries cover S&T developments from their embassies in Washington, D.C. For example, Egypt does not have any diplomatic representation in Boston, yet has counsellors dealing with specific issues such as trade and economy, education, and health which are related to S&T issues, and whose portfolios include STI developments in Boston. The Office of Technology at the Thai Royal Embassy⁵⁷ plays a similar role and the main areas of cooperation (i.e., energy, marine debris, health, and water resource management), which are coordinated from the embassy for all of the United States. This office is not under the Thai MFA, but under the Ministry of Science and Technology and cooperates with other agencies within the Thai government.

If a country has a network of science attachés located in various cities across the United States, a science counselor usually handles its coordination. In this case, the science counselor at the embassy in Washington, D.C. covers a wide range of S&T issues between their home country and the United States and liaises with US authorities to implement their country's science diplomacy strategy and initiatives. For example, at the Embassy of France in Washington, D.C., the Ambassador works with a science counselor who coordinates the Office for Science & Technology⁵⁸ network throughout the United States, including all science attachés posted at consulates in various cities. The French science attachés have different agendas depending on where they are posted. Embedded within the Embassy of France is a science attaché for environment and sustainable development; a science attaché for technologies for information, communication, and security; as well as delegates for French research institutions.⁵⁹

B. Consulate with an embedded science attaché

Countries with a consular presence in Boston have varied approaches to structuring the work of the consulate and its set-up in order to accommodate their work on STI issues.

One way is to embed their science attaché directly within the consulate in Boston. In this case, the consulate covers the traditional consular agenda such as assisting and protecting the citizens of the home country. The science attaché is solely dedicated to STI issues. The work of the science attaché may be thematic and coordinated by the science counselor at the embassy in Washington, D.C. French science attachés specialize in one particular scientific discipline, but may take on other disciplines, as the need arises within their geographical region (e.g. life sciences in Los Angeles, CA; agronomy in Chicago, IL; physical sciences and nanotechnology in Houston, TX; AI and robotics in San Francisco, CA; and higher education and scientific cooperation in Atlanta, GA). In Boston, the French science attaché focuses on innovation. The Consulate-General of France in Boston has its own offices, plays a traditional diplomatic role, and follows the traditional structure.

Other countries that currently have a consular presence in Boston, such as Brazil and Mexico, have included the portfolio of S&T issues on the agenda of more traditional attachés, such as trade attachés or higher-education attachés. In some cases, the trade or economic attaché focuses almost exclusively on STI issues due to the nature of the economy of its home country. This is the case of Israel, where the Director of Economic Affairs deals with a large portfolio of S&T-related issues. As mentioned, the reason for such a set-up is the economy of the home country. Israel is one of the most technologically advanced market economies in the world,⁶⁰ with one of the highest research and development spending as a percentage of GDP.⁶¹ The overlap between S&T and the economy is particularly strong, resulting in the dual role. While some of the trade and higher-education attachés are capable of carrying out the S&T part of their portfolio, many mentioned that it would be beneficial to have a full-time science attaché given the size of the S&T portfolio in Boston.

C. Consulate with an S&T agenda (STI consulate)

Alternatively, certain countries have adapted the agenda of the consulates to better suit their purpose

in Boston. In these cases, the consulates are diplomatic outposts headed by a diplomat (consul), but their traditional agenda is minimal and their main focus is on STI issues. They mainly provide services to governmental agencies and companies (startups) from their home country, serve as a networking outpost for Boston area, and support academic and scientific exchanges between the countries. Depending on the home country, the STI consulates may have a range of freedom to decide themselves what STI agenda to pursue, given the local environment and possibilities.

Depending on the country, such dedicated STI consulates can be stand-alone or part of a network (swissnex, see Insert). As a rule, the STI consulates have very strong marketing and branding, including references to innovation centers and hubs in order to reach their targeted audience within the STI community in Boston.

The financing of these models can be different from the traditional consulates. STI consulates are usually responsible for raising a portion of the funds

themselves (up to two-thirds), whether in the form of partnerships and contributions or by charging the businesses coming from their home country for the services provided in Boston. This way, the STI consulates become a blend of diplomatic representation and business enterprise.

One such example is the Danish representation, which is registered as a consulate but is promoted as the Innovation Centre Denmark (ICDK) in Boston. This center is the newest addition to the Danish network of eight innovation centers worldwide. ICDK Boston is currently focusing on local networking and seeking out new opportunities, forging connections with academia (such as MIT), and specializing in pharma and life science, AI and robotics, renewable energy, and technology. It is based on an innovative business model that charges companies (not academia) a fee (reduced for startups and SMEs) for its consultancy services. A partnership between the Danish MFA and the Ministry of Higher Education and Science (MHES) in Denmark and as a part of a

swissnex Network

Starting with its first office in Boston in 2000 and decisive funding from the private sector, Switzerland established swissnex as a worldwide network of science, innovation, and education outposts. Currently consisting of five main offices (Boston, San Francisco, Shanghai, Bangalore, and Rio de Janeiro, along with several smaller satellites), swissnex has grown into a network that some countries hold as a paramount example of a successful model to deal with the increasingly complex STI issues worldwide. The swissnex network also includes some 20 S&T offices and counselors based at Swiss embassies worldwide.

swissnex is an initiative of the Swiss State Secretariat for Education, Research, and Innovation (SERI), managed in cooperation with the Federal Department of Foreign Affairs. In Boston, swissnex has the legal status of a scientific consulate. The so-called swissnex Committee advises the State Secretary on strategic issues relating to the swissnex Network. It comprises ten high-ranking representatives from the most important Swiss Education, Research & Innovation (ERI) institutions, philanthropic institutions, and the public and private sectors.

The strength of swissnex lies in its broad agenda, its independence in setting its own goals and activities, the diversity of its staff, and its entrepreneurial culture based on lean management structures which facilitate its involvement with the local ecosystem.

swissnex Boston is directly responsible for acquiring partner organizations and securing up to two-thirds of its funding, with the remainder coming from SERI. This model enables swissnex Boston to initiate new activities and better leverage the local environment.

The swissnex model is based on four basic principles:

- **Strategic location selection:** swissnex offices are located in leading regional and global innovation hubs and in emerging markets with significant economic and scientific potential. The science counsellors, on the other hand, are located in the political capitals of important ERI partner countries to conduct bilateral cooperation;
- **Partnership funding model:** Partners at swissnex locations include public and private stakeholders in the Swiss and local ERI landscape. These partners cover at least two-thirds of the costs of swissnex's activities;
- **Autonomy and decentralized governance:** The swissnex Network has lean management structures and decentralized governance; and
- **Entrepreneurial organizational culture:** The driving forces behind the swissnex locations are entrepreneurial, open-minded, and creative employees who strongly identify with swissnex's mission and organization culture. swissnex leaders and their teams see themselves as connectors, scouts, and knowledge brokers.

UK Science and Innovation Network

The United Kingdom's Science and Innovation Network (SIN) is one of the largest networks with about 110 officers in over 40 countries. The main goal of SIN is enhancing UK growth and exports, connecting innovative UK industries and scientific expertise with international opportunities, delivering solutions to global challenges, strengthening the UK's foreign policy influence through science and innovation, supporting international development goals, and matching UK expertise to international need. Thematic programs for 2018/2019 are health and life sciences; agri-tech and food; clean energy; and the digital economy, AI, and robotics. In the UK context, science attachés are referred to as SIN officers. In terms of structure and funding, SIN officers

depend both on the Department of Business, Energy and Industrial Strategy (BEIS) and the Foreign & Commonwealth Office (FCO).

In the United States, SIN officers help support UK-US STI collaborations, monitor and influence US STI policies, develop UK policy using US insights, and identify opportunities for the UK business and innovation sectors.

In Boston, the S&T agenda has become one of the main activities of the consulate. The consulate spends a significant amount of time on the S&T agenda, together with two full-time science attachés (SIN officers) and a number of trade attaches with portfolios that include S&T related issues.

network, it has headquarters in Copenhagen. ICDK headquarters and ICDK Boston communicate with each other on a regular basis, and are in touch with the Danish ministries every three months. Some of the eight Danish innovation centers have created an advisory board for the purposes of networking and sharing mutual advice within their network. ICDK offices also have yearly summits in the capital for strategic and training sessions.

D. Within a university

Embedding a science attaché within a university is an innovative solution that a few governments have chosen or are currently contemplating. It allows for flexibility, lowers the cost of operations, and gives direct access to the heart of ongoing research and innovation, while benefiting both the government and the local university. This can lead to a faster introduction of the science attaché to the innovation ecosystem (the university staff can provide introductions) without the need for a pre-existing structure or administrative staff (provided by the university) or for office space within an innovation hub. In turn, the university has quicker and privileged access to the science attaché's home country ecosystem.

For example, Wallonia-Brussels International (WBI),⁶² the agency in charge of international relations of Wallonia-Brussels, signed a cooperation agreement with Tufts University in 2013. The science attaché holds an office within the technology transfer department and is under the US J1-visa status, a non-immigrant visa allowing a foreign national to work within a university as a scholar or specialist, among other categories. While the work and mission of the attaché do not differ from their counterparts in

the Boston area, it is important to note that as such, the science attaché does not have diplomatic status. There may be ways in which a diplomat can be embedded within a US university, but the arrangement needs to be further explored by interested parties.

E. Establishing a nonprofit

Countries can also choose to establish nonprofits as a way to deploy their science attachés. Chile does not have a consulate in Boston, though it operates traditional consular services with the help of honorary consuls. However, given Chile's interest in getting involved in the STI sphere in Boston, the President of Chile and the State of Massachusetts signed an MoU in 2011, referred to as the ChileMass Plan, focusing on the areas of education, technology, energy, and human development. From 2011 to 2015, one person was deployed by the embassy in Boston to implement the plan. After moving into an office at the CIC in 2014, Chile decided to create a nonprofit organization called the Chile Massachusetts Alliance Inc. (ChileMass), with a match-making model supported by the Production Development Corporation, a Chilean governmental organization (CORFO),⁶³ which has been operating since 2017. In these two years, it has collaborated in public-private projects, events, and activities like ChileMass Innovation Day. It has a staff of two, soon to increase to three and is considering expanding its footprint at the CIC to be able to host Chilean nationals and startups who want to explore the Boston STI ecosystem for a few months. None of the staff members has diplomatic status, as they are hired by the nonprofit, but they collaborate through a person employed by the embassy and financial support from the government of Chile.

Other countries are also developing their network of science attachés using existing nonprofits. This is the case of Turkey, which is currently implementing this model in many different areas around worldwide, including in Washington D.C., through its Yunus Emre Institute⁶⁴ network. Referred to as the Academic and Scientific Cooperation Project of Turkey (TABIP), it serves as a vehicle for academic and scientific exchanges to improve cooperation, contribute to the economy, ensure the transfer of know-how, enhance the quality of human resources, and engage in science diplomacy activities.

F. Other means of representation

Honorary consul

Yet another way in which countries establish their presence is through the honorary consul, who is a representative of the sending state, but is not a governmental employee and does not have to be a citizen of the country they represent. They can be a great resource when establishing a local presence. In an ideal situation, the honorary consul would work in a field related to science and academia, as is the case of the Czech Republic. Unlike traditional diplomats, honorary consuls are in a position to create a local network over time, as they are not subject to diplomatic rotations.

Taiwan's approach

Although not having official diplomatic relations with the United States, Taiwan has local representation in Boston through TECRO, the Taipei Economic and Cultural Representative Office in the United States. This office works with the MFA and the Ministry of Science and Technology in coordination with the Ministry of Education. The Boston office of TECRO specializes in connecting with local researchers and academia. It also works with their diaspora in biotech and research, as well as venture capitalists from Taiwan and plans to set up platforms with MIT and Harvard.

4.2 Hierarchy and dependencies

In terms of structure and reporting, countries operate in a variety of ways. Science attachés and the structure in which they are embedded can be part of the MFA, the Ministry of the Economy, the Ministry of Science, or a mix of any of these, depending on their core mission and funding scheme.

- *The Ministry of Foreign Affairs*

In the most traditional sense, science attachés act as diplomats under the auspices of the MFA.

This is the case for countries with a longstanding science attaché network such as France (its network falls under the sub-directorate of Research and Scientific Exchange of the Cultural, Academic and Research Cooperation Directorate at the MFA). Countries that are in the process of expanding their science diplomacy presence in Boston and already have an established consular presence would also have their science attachés as diplomats under the authority of the MFA. For example, in the framework of the Diplomacy for Innovation program led by the Brazilian MFA, the country decided to reinforce or expand its presence in consulates located in thriving S&T ecosystems, as in the case of Boston.

- *The Ministry of Economy*

Some science attachés and their structures fall directly under the Ministry of Economy, especially when the reason behind their position stems from the desire to focus on economic development, but also when the bulk of their portfolio revolves around innovation. For example, HIN and its Boston office, is part of the Dutch Ministry of Economic Affairs. Before the HIN office was set up in Boston, STI engagement was coordinated from the embassy in D.C., and sometimes from the New York consulate, but remote follow-up was difficult. An assessment led by the Dutch Ministry of Economic Affairs together with the MFA (with the D.C. embassy and the Consulate-General in New York) resulted in the Ministry of Economic Affairs setting up the Boston office in 2014. In the case of Quebec, the innovation department within the Ministry of Economic Development, Innovation and Export Trade, was originally responsible for the creation of the science attaché position, a structure still in place today.

- *The Ministry of Foreign Affairs with the Ministry of Economy*

In some instances, science attachés maintain responsibilities and hierarchy linked to both the MFA and the Ministry of Economy. In the case of the United Kingdom, SIN Officers depend both from the FCO and the BEIS in terms of structure and funding.⁶⁵

- *The Ministry of Science*

Other countries choose to place their science attaché network under their Ministry of Science. The Office of Technology at the Thai Royal Embassy⁶⁶ in Washington, D.C. is placed under the Ministry of Science and Technology, and not under the MFA.

- *The Ministry of Foreign Affairs with the Ministry of Science*

Alternatively, some science attachés are placed under a combination of both the MFA and the Ministry of Science. For example, Denmark deploys two posted staff in Boston, one from each of the two ministries – MFA and MHES). In addition, the center is hiring three local staff to deal with STI issues and two local staff to deal with trade issues. The MHES provides the overall funding. Technically, the joint venture is a collaboration between the MHES and the Trade Council within the Danish MFA.⁶⁷ Similarly, Switzerland’s swissnex Network depends both on the Federal Department of Economic Affairs, Education and Research and the Federal Department of Foreign Affairs (see insert on swissnex).

- *No direct ministry dependence*

Some science attachés do not depend on a particular national ministry, either in terms of hierarchy or to set their strategy. This is obviously the case for science attachés deployed by subnational entities. For example, WBI leads the network of ALS (*Agents de Liaison Scientifique*, or scientific liaison agents) posted in various cities worldwide. However, the science attachés report to the institutions, universities, and companies that make up the network. At the national level, science attachés embedded in a nonprofit may also fall in this category. While they are not linked to the traditional national structure and often report to a board that is non-governmental, their operations and salaries may be funded by national agencies or even the country’s embassy in D.C.

4.3 Models of cooperation within the Boston representation

It is a given that the work science attachés do in Boston is competitive on many levels. However, local representations team up to pursue specific areas or achieve specific goals and find it useful to collaborate, either bilaterally or multilaterally. Other times, in order to keep their edge or if the issues are sensitive, local representations pursue them separately. Yet, as was mentioned and is a common understanding in Boston, S&T is one area where countries need to collaborate in order to be competitive.

A. *Bilateral*

Some countries have developed bilateral relationships that ultimately strengthen their

national pursuits. For example, the Embassy of the Principality of Monaco is accredited to Canada, as well, and handles its public affairs and works with Canada’s Ministry of Innovation, Science and Economic Development. Some countries even help others define their own S&T diplomacy mandate and can provide useful introductions to their contacts in Boston. For example, swissnex helped HIN develop its Boston network in its early stages and in turn, officials from the Embassy of Denmark had discussions with swissnex and HIN to best devise their science diplomacy strategy in Boston. Discussions about operational practices may happen on a bilateral level, too. For example, representatives of the Consulate-General of Brazil and the Brazilian Trade and Investment Promotion Agency (APEX-Brasil) discussed the Boston cycle of the StartOut Brasil⁶⁸ program with ChileMass in Boston, regarding good practices and exchange of experiences. As is typical in other areas, countries aligned on S&T policy issues can also work together to increase their influence on international and US policy issues.

B. *Between multiple representations*

Beyond the bilateral relationships that some countries may develop, one of the unique features of the Boston area is the creation of an organization that cultivates multilateral science diplomacy collaboration in the local setting. The Science and Technology Diplomatic Circle (S&TDC, see insert) was founded by swissnex at the end of 2013 to foster greater networking among science attachés and facilitate access to local institutions, companies and nonprofits of the Boston area as a group. While a country on its own might have difficulty in securing a particular visit and interaction with an actor of the Boston area, the S&TDC makes it easier.

S&TDC

Many science attachés with a newly established presence in Boston report that the S&TDC was crucial in helping them develop their science diplomacy strategy and connect to various actors in the area. In contrast, some with a well-established foothold in the region see it only as a marginal benefit, while others had only recently heard about the S&TDC, despite having been in Boston for some time. It should be noted that while the S&TDC facilitates networking and the exchange of information, best practices about missions and models of representations, such as the ones highlighted in this report, are seldom discussed within this multilateral context.

S&TDC's collaborative and organized model is innovative and other cities are looking to replicate it. Not only was it successfully replicated in Shanghai⁶⁹ in early 2018 by swissnex, but it has now inspired

other cities outside of the swissnex Network such as Barcelona and its recently launched SciTech DiploHub.⁷⁰

5. Backgrounds, attributes, and training of science attachés //

Just as models of representation and portfolios can be vastly different across countries, so can the professional background and training of the science attachés. They can be diplomats from the home country deployed to the Boston/D.C. area, local hires (e.g. American citizens, or foreign citizens with proper US work authorizations) with knowledge of the local environment, or scientists in service of the representation. The Boston ecosystem provides interesting insights into the right profile and the necessary preparations for officials posted there. Analyzing the background and training of the science attachés can be helpful in considering how countries can maximally leverage their representatives with respect to their objectives for the role. While the focus was on Boston, the insights gained in the process of studying this ecosystem are broadly applicable to the overall position of a science attaché regardless of the posting, and conclusions reflect this wider perspective.

5.1 Backgrounds and attributes of science attachés in Boston

The interviews and research show a high diversity of professional backgrounds of science diplomats in Boston. This was clearly reflected in the professional backgrounds of the science attachés. Some are scientists with a Master's or PhD, who sometimes have had an extensive scientific career before crossing into diplomatic work. Others are career diplomats, while several have had an extensive career in business or law. Many have significant experience, a dual academic background, or seniority in the administration. They have gained the trust of their governments and in some cases have independence in decision-making. In any case, it is clear that these individuals had to achieve a certain status in order to be considered for the posting as science attaché in a city like Boston.

Science attachés were asked themselves to define the characteristics needed to be successful in their position:

- STI experience and an understanding of the STI community (how it functions, mindset, funding, etc).

- Prior international experience, cultural sensitivity, and intellectual curiosity;
- Prior knowledge or business experience in the STI startup scene (development phases, pitches, funding rounds and venture capital, etc.);
- Natural networker with an approachable personality;
- An understanding of the basics of diplomacy (stakeholder mapping, negotiation techniques, knowledge of public diplomacy, diplomatic etiquette);
- Knowledge of how to write reports, notes and briefs, and to draft MoUs and letters of intent in the diplomatic context;
- An understanding of the organizational structure, institutions, scientific organizations, and various stakeholders in the home country and internationally, and the knowledge to quickly map and engage with the local ecosystem.

In addition, after mapping the local ecosystem and engaging with the science attachés in particular, common soft skills became evident, such as agility and flexibility, and the ability to quickly learn on the job, grasp new concepts, see the big picture, and anticipate policy and business developments based on scientific progress.

5.2 Science diplomacy training opportunities

The position of science attaché is multifaceted and requires a wide range of skills. Part of the study looked at what training or preparation science attachés received before taking up their position in Boston.

Some science attachés were trained for their postings, ranging from formal diplomatic training to spending a certain amount of time in the ministry or at the agency responsible in setting the S&T engagement agenda, and interacting with relevant stakeholders to understand the needs of their home ecosystem. Others reported no prior training. In some cases they did not receive specific information on the S&T agenda of the home country. Some reported having taken online classes (including

DiploFoundation classes in the case of Mexico). Overall, most of them stated that they had to learn on the job.

To zoom out, we wondered what kind of training or preparation, if any, could benefit preparing the science attachés of tomorrow, similar to how diplomats in several countries are briefed or trained on cultural aspects of their upcoming posting. Given the diversity of missions and national strategies, targeted preparation for a science attaché posting would need to be tailored and adjusted to the particular context, target audience, and purpose. Identified here are relevant groups and possible areas of training for them.

- *Considerations for the training of scientists taking on a science attaché posting*

The variety and number of issues a modern diplomat has to be able to fully comprehend and navigate are enormous. It would not be realistic or effective to expect an official to have deep knowledge of the full scope of issues they will deal with. Yet, in certain settings, a deeper understanding of issues outside the scope of traditional diplomacy or a specialization in a narrow issue is essential. For example, United States foreign service officers responsible for ESTH (environment, science, technology, and health) issues receive orientation-type training that surveys relevant S&T-related policies before being deployed overseas.⁷¹

Training also should be given on specific scientific issues, depending on the area a diplomat might be focusing on. For instance diplomats working on environmental issues will need to receive training focusing on environmental science, which will be different from training for those looking into lethal autonomous weapons or AI. The purpose of such training would be to provide the diplomat with a sufficient base and orientation in the topic and enhance their ability to tap into proper subject matter expertise.

- *Considerations for the training of scientists taking on the role of science attaché*

It is fairly common for countries to fill the positions of science attachés with people who have training as scientists. The larger networks can afford to appoint specialists in the specific area of need (e.g. a PhD in life sciences, if the goal is to enhance academic collaborations in this realm between Boston and the home country). Yet some of these specialists might lack an understanding of the larger STI ecosystem, STI policies of the home country, diplomatic aspects of their postings, and various



government and diplomatic institutions, both at home and abroad. Training to address these issues would give scientists an improved understanding of their posting, hierarchies, and interdependencies.

- *Approach to training for a multiplicity of backgrounds*

As evidenced by the wide diversity in backgrounds among the science attachés in the Boston area, these are not only diplomats and scientists. Indeed, many also hail from the business sector or have extensive legal backgrounds. Sometimes in line with the overall mission (if the goal is to develop S&T startups, for example), these individuals would benefit from training in specific S&T topics pertaining to the area they are being deployed in as well as general knowledge of diplomatic protocols.

However, this does not mean that the diplomats or lawyers need to become scientists, nor should scientists or economists be expected to see through the lens of government officials. Assisting all groups in understanding each other; finding a common language and productive ways to work together; and understanding each other's worldview, goals, and professional culture will benefit all sides.

- *Science diplomacy capacity building*

Beyond training future science attachés lies the bigger issue of the lack of awareness about the increasing importance of STI issues for the practice of diplomacy, foreign policy issues, and economic development. Many of the Boston actors mentioned the difficulty in communicating the importance of their work back to their capitals. This might indicate that training explaining the relevance of STI hubs and the work of science attachés, as well as the larger implications of STI for diplomacy, is needed. Similarly, many scientists are unaware of the policy implications of their work and lack the knowledge and tools to engage with governmental actors, or efficiently identify interdependencies.

Over the last few years, science diplomacy training has also been developed by places like AAAS and its Center for Science Diplomacy and other non-profit organizations. For example, since 2014, AAAS has partnered with The World Academy of Science (TWAS) to run week-long courses that have exposed hundreds of young scientists, diplomats, and policymakers from various developing countries to concepts and tools to address science diplomacy from global and regional perspectives.⁷²



DIPLO © 2014

What does GMO stand for?



What do they mean by negotiation techniques?

DiploFoundation has worked on sensitizing diplomats to the importance of science through various initiatives and events. Both organizations have engaged with groups including United Nations bodies, who have similar interests in training scientists and diplomats to take up these types of positions.

Academic institutions have also taken up training activities. Together with MIT, the Science Diplomacy

Center at Tufts University in Boston led science diplomacy training workshops for young S&T researchers and early-career science attachés in 2017 and 2018.⁷³ Institutions outside of the United States are also developing their science diplomacy training activities (Spain,⁷⁴ Brazil,⁷⁵ etc.) and countries are increasingly exposing their diplomats to science diplomacy or incorporating science diplomacy into their diplomatic training (e.g. Mexico).

6. Conclusion and recommendations //

With the understanding that STI plays an increasingly important role in international relations and economic development, and influences the current practice of and actors in diplomacy, many governments are paying close attention to the latest developments emerging from leading S&T hubs worldwide. Embedding science attachés in these hubs can be an effective way for diplomatic posts to build the necessary bridges between the home country and a bustling local ecosystem. This can lead to many benefits, such as enabling private sector development, facilitating academic collaborations, and linking domestic policy-setting with innovation trends and developments in other countries.

Reflecting these trends, the number of countries deploying science attachés to Boston, one of the STI hubs in the United States, has grown rapidly over the last decade. This report provides an overview of the innovation ecosystem of the Boston area, highlighting major topical areas (biotech, cleantech, etc.) and its S&T actors (universities, businesses, local government, and nonprofits).

Governments position their science attachés within Boston in a number of places. While some use a traditional consular structure, others have developed more innovative solutions, from creating an STI-dedicated consulate to embedding a science attaché within a university or setting up a government office or a nonprofit. This report presents the different responsibilities and models of operations with examples from countries using them.

Of the countries that have appointed science attachés in Boston, these positions have broad mandates including strengthening ties to the private sector, developing academic collaborations, horizon-scanning the local trends, engaging in public diplomacy, leveraging the diaspora, transferring STI policy best practices, and negotiating and

implementing S&T agreements. The emphasis given to each depends on the science diplomacy strategy of the country (if one exists).

Science attachés in Boston, and indeed elsewhere, hail from different backgrounds. They are usually multifaceted, seasoned professionals, selected for a specific skill set. Their area of specialization can be directly linked to the target goals that the country has set within the STI hub. While some have had specific training prior to or during their deployment, many felt they had to learn on the job. During the research, we developed a list of skills necessary for success in the science attaché role and recommendations for how to usefully prepare people with different backgrounds for these postings.

Various types of science diplomacy training opportunities have emerged in the United States and abroad, which may help governments further understand how to train their staff in a world with an increasingly important interdependence of STI and diplomacy. The need to accept that science helps address a variety of global challenges is essential for diplomats and government officials. It is important for them to not be apprehensive about harnessing the power of STI. It can enhance their work (seeing problems more holistically, supporting evidence-based policymaking) and benefit their country's economic and other goals (anticipating policy issues relevant in the future directly spurs the growth of the home economy).

This report could be useful to the different governments operating in the Boston area and similar STI hubs when considering modes of operations, missions, best practices, and training for their local science representatives. It also shows how bilateral and multilateral discussions on these topics can support their success in this endeavor. The S&TDC could provide an ideal model and body for facilitating such discussions. It also makes a case that

further training opportunities for anyone working in these positions could be brainstormed in partnership with nonprofit, academic institutions, and government representations in the area.

It is the hope of the authors that this report will also serve as an inspiration and a guide to those thinking about deploying a science attaché in Boston or any of the S&T hubs worldwide.



Recommendations for governments

The following recommendations may help you to decide on the format of your representation in Boston:

1. Know what you need

What are the main issues your country is dealing with and how can scientific or technological solutions help? Is it water desalination, coast deterioration, public health concerns, or need for specialists in a certain area? Know the strengths and weaknesses of your country's S&T ecosystem. You may find more resources at home than you expected.

2. Know where to find it

Which S&T hub fits your needs best? Consider the availability of academia, scientific and research opportunities, national funding, and institutions in the target country as a whole, as well as in the specific STI hub. Look at your current local representation, the presence of business companies, and the diaspora population. These can be your launch pads.

3. Build bridges

Explore the potential for opportunities between the home country and the target country's local ecosystem. Involve relevant home stakeholders with diverse STI perspectives from academia (universities, national laboratories) to government (various ministries) and from businesses (S&T companies and startups) to civil society (human rights groups, others dealing with the needs of certain population groups). Where are your connections and overlaps?

4. Decide on the agenda

Decide on the portfolio of the science attaché with regard to subject matter and time frame. What are your specific goals and objectives? Which ministry should the science attaché be under? How will you fund this mission?

5. Decide on the model

What model of representation will you use to embed your science attaché? Consider the possibilities depending on your country's structure and available resources, as well as its needs. Are you launching a string of representations worldwide with a specific approved agenda or sending out one person with the freedom to pursue the country's aims as they see fit? Is your model scalable?

6. Find the right person

Who would best fit your science attaché profile? Should it be a scientist, a diplomat, or maybe a

business person? What personal qualities should your future science attaché have? What level of experience and seniority? A person with dual training (S&T and diplomacy) and practical experience (STI business and network-building know-how) is ideal. If your agenda is narrow, a specialization might be better. A focus on academic partnerships and research development will require an understanding of the S&T academic sphere, but a focus on innovation and startups may better benefit from knowledge of venture capital.

Do not limit your search. Think outside the box.

7. Provide skills to be successful

Once you have found your science attaché, objectively evaluate their experience and skills, and compare them to your objectives. They are about to enter a very competitive STI ecosystem. Consider whether to let them learn on the job or to provide them with tailored training to be successful. Examine the need to hire support staff, whether local or from the home country.

8. Establish your presence

Tap into someone already located in the STI hub of interest or deploy a person (potentially the one considered to be the future science attaché) to the local STI ecosystem. Shadow an existing science attaché of a country willing to host you or learn through experience at a place like CiC for Boston or a university. If able to find local diaspora talent, create a local board to further connections inside the innovation ecosystem and with the home country's researchers, government institutions, and companies.

9. Use the experience

Communicate to government officials the importance of S&T hubs like Boston, and how it can benefit the home country. Are there STI models and set-ups abroad that could be replicated or adjusted for the home country? Are there disruptive discoveries in the near future that need to be considered within the home country? Is there a need for science diplomacy education and how do you address it?

10. Other considerations

Once established, expand the agenda of the science attaché to include public policy. Take advantage of having representation in STI hubs to promote the objectives of your country. Consider wider cooperation between the countries and its potential, including STI agreements and long-term commitments. Use the current science attaché as a stepping stone to further your agenda locally, nationally, and internationally.



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DiploFoundation is a non-profit organization dedicated to making diplomacy and international governance more inclusive and effective. In particular, Diplo is working to:

- Increase the power of small and developing states to participate meaningfully in international affairs.
- Increase international accountability and inclusivity.
- Increase the legitimacy of international policy-making.
- Improve global governance and international policy development.

Diplo's main activities

Capacity development: Diplo's capacity development support begins with individuals, but through the activities of these individuals, our impact reaches into the larger systems of which they and their organizations are a part. Our approach includes online training, policy research, policy immersion, and the development of communities of practice, combined in various ways, as appropriate to each policy context. Capacity development topics include Internet governance, e-diplomacy, public diplomacy, humanitarian diplomacy, and global health diplomacy.

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Diplo was established in 2002 by the governments of Malta and Switzerland and has offices in Msida, Malta; Geneva, Switzerland; and Belgrade, Serbia. Diplo has had consultative status with the UN ECOSOC since 2006.

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