The Need for American Scientific Diaspora Networks

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Executive Summary: The global nature of science and technology enables professionals in science, technology, engineering, and mathematics (STEM) to emigrate in pursuit of educational and professional opportunities abroad. To support and access these highly skilled expatriates, many countries develop scientific diaspora networks. These networks act as hubs to connect diaspora scientists to each other and to their country of origin, strengthening research collaborations and scientific diplomacy between nations. The U.S. does not have any formal networks for its scientists working abroad. These émigré researchers therefore represent an untapped resource of soft power and diplomacy. U.S. networks would help provide information on current innovation strategies worldwide, promote positive and peaceful relations between the U.S. and the host country, and foster cross-country research collaborations. We recommend the development of scientific diaspora networks for U.S. researchers abroad. We review three organizational and funding structures that the U.S. can use as models to develop its own science diaspora networks: government affiliated, NGO-managed, and grassroots-initiated. Given these, we make the following policy recommendations: 1) The Department of State and other federal agencies should help develop and support U.S. diaspora networks, 2) The U.S. government should create a 'network of networks' to scale support and resources for U.S. diaspora networks, and 3) The U.S. government and philanthropic groups should fund programs to establish professional organizations for U.S. scientists abroad.

I. Global talent circulation in STEM

Highly skilled professionals in science, technology, engineering, and mathematics (STEM) fields increasingly seek educational and professional opportunities outside their countries of origin (De Domenico, Omodei, and Arenas 2016; Netz, Hampel, and Aman 2020). While previously this mobility was framed for countries of origin as "brain drain," or the loss of talent, investment, and future economic growth, more recent work instead suggests a model of "brain circulation" (Docquier and Rapoport 2012; Poetscher 2021). When countries of origin maintain positive connections with their researchers abroad, these individuals can promote the exchange of cultural and technical ideas, scout trends and local innovation practices, and facilitate channels for soft-power or science diplomacy objectives (Zewail 2010; Poetscher 2021).

The mobility of researchers and regular flow of expertise can benefit the economies and contribute to socio-technological advancements of all countries involved. Brain circulation also leads to more diverse and inclusive scientific communities and creates networks of individuals collaborating to solve international challenges (Poetscher 2021). It is therefore important to facilitate brain circulation

through policies, funding, and organizations that support researchers living abroad.

II. Science diaspora networks

Over the past few decades, many countries concerned about the expatriation of their STEM talent have been creating networks of researchers living in diaspora. Termed "diaspora knowledge networks" or "scientific diaspora networks," these networks strengthen international and individual connections back to their countries of origin, and often have no explicit goal for researchers to return to their country of origin (Butler et al. 2022). Instead, these scientific diaspora networks foster community, provide professional and social opportunities to members, help connect subject matter experts, and cultivate transnational research collaborations and interdisciplinary partnerships (Meyer 2001; Brown 2002; Barré et al. 2003; Mahroum et al. 2006).

Despite the range of activities and events hosted by the networks, their management is often quite modest. Even some of the most formally structured groups only have a few dedicated managers and a small budget to host events and connect members. Communication is often managed through a listserv, and recruitment is often via word of mouth, especially for groups not connected with embassies (Butler et al. 2022). While this creates some operational challenges for networks, it also means they can be developed with minimal bureaucratic or infrastructural investment.

III. How to structure diaspora networks for U.S. scientists abroad

North America is notable for its absence of diaspora networks. While it acts as a host location for many diaspora networks from other countries, to our knowledge the U.S. does not have a formal diaspora group of its own in any other country. The most similar U.S. program was the Networks of Diasporas in Engineering and Sciences (NODES), a group formed through the collaboration of the American Association for the Advancement of Science, the U.S. Department of State, and the National Academies of Science and Engineering. However, NODES connected individuals from foreign diasporas within the U.S. to federal officials; it did not network U.S. scientists living in other countries. NODES last convened a forum in 2018 and is not currently operating.

There is an opportunity for U.S.-based organizations to support the development of American science diaspora networks of Americans abroad. If they do so, they could leverage the presence of émigré STEM professionals in other nations to support research priorities, infrastructure development, and diplomatic goals to increase U.S. competitiveness in the global economy. The outcomes of such networks depend on their stakeholders, which we describe below. Ultimately, the relatively minimal investment required to develop these diaspora networks is offset by the benefits of cultivating relationships with U.S. researchers living abroad.

Several network models have been developed by other nations, which the U.S. government and associated institutions could implement to connect with American researchers living abroad. These models depend on the type of institution that manages and funds them. Here we present examples of three distinct models—government funded, non-government organization (NGO) managed, and grassroots diaspora networks—and some of their associated benefits and drawbacks. Ideally, all of these network models would be used, either distinctly or as hybrids, depending on the needs and circumstances of the particular scientific diaspora.

i. Government-affiliated diaspora networks

Networks managed directly by embassies and science attachés provide the greatest opportunities for researchers in the diaspora to directly collaborate on diplomatic goals. These groups typically employ full-time staff dedicated to managing the group, and often have physical spaces to facilitate meetings and events for membership. These networks can provide human capital for innovation projects and bi- or multi-lateral science diplomacy initiatives. Additionally, affiliation with an embassy or consulate provides a clear and consistent hub for members' needs, professional development opportunities, and science and technology innovation initiatives.

EURAXESS, a network funded by the European Union, is a pan-European group for STEM professionals living in diaspora. It is a particularly successful example of this type of network model. It has nine office hubs globally, and forty-two national "portals" for members of the European diaspora. The network assists with immigration questions, creates community, and assists members in adapting to their

host country's culture and research funding models. The network's success is in part because it incorporated existing networks (e.g., a network of Spanish scientists in Australia) and supported them. This pooling of resources stabilized smaller diaspora organizations and created a network of networks that has further reach and influence than independent organizations.

Individual countries also operate large networks. Spain operates a similar network of networks, RAICEX, which has eighteen chapters throughout the globe. Austria manages and benefits from dual networks that are either closely tied to the embassy (RINA) or community run with government funding (ASCINA). These network models allow for broad support for expatriate STEM talent of both countries, with a high level of local flexibility to adapt to the needs of various diaspora communities.

Occasionally, government managed networks have an added mandate of helping repatriate scientists, but more commonly, networks provide a knowledge and talent resource or point of connection for countries of origin. For example, OSTA was used in the early days of the COVID-19 pandemic to provide a network of experts that advised the Austrian government; members of RAICEX provide subject matter expertise and develop relationships with policymakers in their host country; and the Netherlands Innovation Network (NIN) explicitly connects its members to business interests across countries and technology sectors to facilitate collaboration and commercialization of research outputs.

A disadvantage of federally affiliated networks is that they require federally designated budgets and personnel subject to administrative and Congressional priorities that may not align with researchers' goals (Schroeder 2017). Additionally, they would be difficult to manage in nations with which the U.S. has hostile or tense diplomatic relations, or in regions that are not formally recognized as countries by the U.S. government.

ii. NGO-managed diaspora networks

The majority of current global diaspora networks are managed by non-governmental organizations (NGOs). NGO status provides diaspora networks with more flexibility and independence than government affiliated networks. These groups are able to legally operate organizational bank accounts, develop bylaws, and receive donations. This allows them to rapidly respond to member needs and provide services that most benefit the diaspora without the delay of bureaucracy and potentially competing interests of government actors. Members and managers can also operate as informal representatives of their country of origin regardless of formal diplomatic relationships. In active diaspora networks, members often reach across cultural barriers to initiate dialogues and collaborations that their governments could not. For example, the Marie Curie Alumni Network uses geography-based groups to connect researchers and will often facilitate scientists from countries with hostile relationships working together. This allows for networks to be hubs of "soft diplomacy" that can, at minimum, create stable relationships even in difficult diplomatic situations, and at best, pave the way for future transnational relations and bridge-building.

Network NGOs can be formed by individuals or under the direction of another organization. The Italian Scientists and Scholars in North America Foundation (ISSNAF) is a successful NGO network founded by thirty-six Italian scholars that serves roughly 3,000 members. Alternatively, the Society for the Advancement of Science and Technology in the Arab World (SASTA) represents an NGO-managed network established by the World Economic Forum. In either case, the legal framework afforded by NGO status allows for initial support, financial or otherwise, from an outside organization that can help new networks achieve operational independence, stability, and success more quickly.

However, the operation of networks by NGOs has drawbacks. For one, NGOs are more financially precarious than federally managed groups. This obstacle can be mitigated by philanthropic or government grants and other mission specific funding. Additionally, managers of these networks often face logistical problems, such as redundant programming borne of operating in isolation, which can reduce network efficiency. This can be alleviated by proactive management of managers, and creating connections between network managers (Butler et al. 2022).

iii. Grassroots networks

Groups of émigrés may also independently form grassroots networks to address their own needs for social and professional support. These tend to remain small, operate on skeleton budgets and volunteer work, and focus primarily on maintaining a sense of community within the host region. Groups often emerge from single institutions with a sufficient density of researchers originating from a shared country or region, or in cities with a large international researcher population.

These networks tend to focus on community building activity using their limited funding to host network events, talks, and cultural holidays. Due to minimal budgets, the initial resilience of grassroots networks is low, but their continued existence demonstrates a strong need for their presence in the local expatriate population.

In spite of the challenges, some of these networks have become quite large and successful, such as the Immigrant and International Women in Science Network (IWS), which has been in operation for four years and manages ten chapters across Canada. Other networks survive by banding together, as with the collection of diaspora groups present at the NIH. There, each diaspora group operates independently, but they are advertised collectively to increase the visibility of groups. Other groups subsist off of connections to more powerful entities like embassies or companies, who can provide them with non-monetary donations of time, connections, or physical space (Butler et al. 2022).

These networks require no funding or infrastructural support from the government. This lack of federal affiliation also removes the governments from responsibility for networks' actions, enabling networks to operate in nations that formally have complicated diplomatic relationships with their country of origin. However, the lack of consistent financial and personnel resources can make grassroots networks ineffective at meeting mission objectives, let alone diplomatic goals, and vulnerable to instability and even dissolution.

IV. Policy recommendations

While the U.S. remains a popular destination country for many internationally mobile scientists, the landscape of STEM investment is rapidly changing, and American scholars are increasingly emigrating to pursue unique opportunities abroad in countries where there are more resources and funding devoted to science (Anand, Hoffman, and Glass 2009; "Nondefense Discretionary Science Surfey: Unlimited Potential, Vanishing Opportunity" 2013). As greater numbers of U.S. STEM professionals seek opportunities overseas, the federal government would benefit from investing in networks to support these researchers. These groups offer a unique opportunity to capitalize on innovative international collaborations and contribute to science diplomacy goals.

The type of network will depend on the country of operation and its diplomatic relationship with the U.S. In countries that cannot be formally recognized, or where relationships remain tense or hostile, grassroots or NGO-operated networks with limited government interaction can provide useful structures. In countries with established diplomatic relationships, diaspora networks can be managed with the support of U.S. embassies.

With these parameters in mind we recommend:

i. The U.S. Department of State should facilitate the creation of networks, and source diaspora network management from within U.S. Embassies and the foreign service.

In areas with friendly diplomatic relationships, the Department of State can establish formal government networks. This will require codifying the structure of the network and the duties of network managers. Embassies can then create, fund, and recruit for specific network management roles, or delegate to current embassy staff.

We suggest formalizing network manager positions to ensure funding, efficacy, and retention of the managers, which will increase the network's impact. In some cases, Science Attachés at U.S. embassies could be reinstated to manage networks. Where that is not feasible, network managers could be recruited from fellows at the Embassy Science Fellows Program, former Science Envoys, or other STEM professionals with foreign policy and management experience. Ideally, diplomatic relations and budgets would allow for a dedicated manager to oversee an American STEM diaspora network.

Policy benefits

- Keeping the network under the management of the embassy and State Department allows for greater alignment with diplomatic goals, and lets members provide direct feedback to government actors and influence policy.
- Formal structures and connection to the State Department ensures more stable funding, lower management turnover, and higher retention and codification of institutional knowledge, which increases network efficiency and impact.
- Once established, networks and managers will incur relatively small maintenance costs.

Potential limitations

- This program will require both explicit funding and non-monetary resources to develop.
- Networks will require time to gain membership and grow, and this startup lag will affect their initial efficacy.
    - This could be mitigated by utilizing NGOs as a supplemental source of infrastructure during startup.
- By nature of government oversight, the network will be less agile, and managers will have to balance the needs of the embassy with the needs of members, which do not always align (Butler et al. 2022).

ii. The U.S. government and other organizations should fund seed grants and provide legal status for U.S. researchers planning to establish professional organizations in other countries.

In countries where direct embassy involvement is not possible, the U.S. government can support grassroots diaspora networks by providing NGO status in the U.S. This would allow networks to obtain U.S. bank accounts and set up formal organizational structures, which contributes to operational stability, particularly if the host country is unwilling to register or formally recognize foreign groups.

Seed grants should be made available to groups to help new networks with operational expenses, infrastructure, and events. These could be part of a targeted initiative by governmental departments with international affairs offices or NGOs focused on advancing innovation and diplomacy. The U.S. could also leverage current grant funding programs to create alumni networks for scientists living in diaspora. The Marie Curie alumni network is a robust example, and programs like the Fulbright Scholarship or the NSF's Graduate Research Fellowship Program (GRFP) create alumni networks with international components.

Grassroots networks could also be formed and supported within private industry or specific research centers. In the U.S., there are multiple science diaspora networks at the NIH alone, and companies that attract a similar level of international research talent in other parts of the world could foster networks internally. Companies in particular would have an incentive to help international researchers settle into new countries to increase productivity, and this is one of the most cited benefits of networks (Butler et al. 2022).

Policy benefits

- In countries where the U.S. diplomatic relationship is tenuous, networks would have more freedom to operate if they have or appear to have fewer ties to the Department of State or other government entities.
- If part of larger organizations, these groups would have similarly formal structures as a U.S. government-run network, providing funding stability, reducing turnover, and improving efficiency.

Potential limitations

- Without support from larger organizations, these networks would be vulnerable to dissolution and instability.
- Minimal or no contact with government actors would render these networks an underutilized resource for science diplomacy goals, especially if members were unaware of their ability to influence policy outcomes in either country.
- Where networks come into conflict with the host country, the U.S. government may still be held responsible for negative outcomes.
- These networks would likely still require some amount of monetary support through government grants, without the ability for in depth governmental oversight.
- For grassroot networks formed by private industry or within a research center, this would not connect all the researchers in a given country or even city, and would not

necessarily have the same diplomatic effect as a network with government funding or ties.

iii. The U.S. Department of State should consider the creation of a "network of networks" (similar to that of EURAXESS or RAICEX) to provide support and resources to U.S. STEM diaspora networks.

An American Association of Scholar Diaspora Networks (AASDN) would provide a point of contact for all forms of U.S. STEM diaspora networks. Similar to formal networks, this "network of networks," will require full time staff and codified structure. As with individual networks, the decision to associate this meta-network with the Department of State or an NGO will depend on the diplomatic considerations and scope of the networks it will manage.

Ideally, the Department of State would coordinate a large meta-network, with regional meta-network nodes that operate with similar structures and fully funded staff. Structural funding and grants should be made available to all networks through the State Department, and meta-network nodes would serve as hubs for network managerial best practices, immigration resources, and other regional information and coordination. Individual networks could then choose their level of involvement with the meta-network based on their diplomatic situation, increasing flexibility and the potential to strengthen bilateral or regional ties through scientific collaboration via the networks. This type of network could be recognized as an offshoot of the U.S. Science Envoy program (Witze 2009; Mclaughlin et al. 2021). Alternatively, it could be managed by national STEM professional organizations, such as the American Association for the Advancement of Science (AAAS).

Policy benefits

- Housing the meta-network within or supporting networks only through an NGO would provide more flexibility, particularly within countries or regions where the U.S. has more strenuous diplomatic relationships
- In countries or regions where the U.S. has strong, friendly diplomatic relationships, the Department of State could explicitly run this meta-network, which would strengthen diplomatic relationships and build trust.
- Meta-networks build communities across diaspora networks, coordinate even larger collaborative efforts, and increase network efficiency by creating shared resources and developing and disseminating best practices for network managers.
- Once established, the operating costs for the meta-network, as with the individual government affiliated networks, would remain relatively low (Butler et al. 2022).

Potential limitations

- Housing the meta-network under an NGO would hinder the ability of the network to anticipate or achieve diplomatic goals set by embassies or the Department of State.
- There will be regions or countries where any collaboration with the State Department, real or perceived, will impede networks' function or cause discord with the host.
    - In these cases, networks will need to independently form meta-networks, or create structure for sharing information and resources among network managers in the region (Butler et al. 2022).
    - The governmental meta-network node in the corresponding region could serve as a resource for initial setup and best practices, or coordinate indirectly through other networks operating under more lenient regional governments.
- As with individual networks, this network would require startup funds and have an initial lag period while setting up infrastructure, hiring staff, recruiting membership, and developing materials.
- This meta-network would require explicit monetary and non-monetary resource support.

V. Conclusion

As countries increase their investment in STEM disciplines and recruit international talent, U.S. researchers will take advantage of these professional opportunities abroad. Many countries are leveraging their spending to recruit talented international scholars. The United Kingdom's Rutherford Fund, China's Thousand Talents Program, and France's Make Our Planet Great Again initiative are all examples of nationally sponsored recruitment efforts that include competitive salaries, funding for relocation, and lab start-up costs.

In this environment, diaspora networks present a solution to 'brain drain,' and instead utilize these internationally mobile researchers to further science diplomacy and innovation. They have demonstrated benefits to both the careers of individual researchers and to national interests. These networks contribute to brain circulation while facilitating multilateral research and innovation projects and interdisciplinary initiatives that address global challenges.

Networks provide unique opportunities for science diplomacy, especially in countries where explicit diplomatic efforts are difficult or impossible. The benefits that diaspora networks provide outweigh their initiation and start-up costs. Without these networks, the increasing number of U.S. émigré researchers risk isolation in their host countries and remain untapped resources for science diplomacy, innovation, and development goals.

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