

New architectures for bottom-up science diplomacy: Learning from the evolving Portuguese diaspora in the UK

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Abstract

Scientific diasporas and related non-state actors have increasingly been coming into play to permeate and promote modern science diplomacy. However, these non-formal collaborative architectures are particularly complex to sustain, and their systematic and long-term action rely very much on conjunctural and, above all, individual engagement. The paper provides a multi-stakeholder perspective that analyses the creation, during the lead-up to Brexit, of the first ever scientific advisory board (SAB) at a Portuguese Embassy. In particular, it focuses on the interplay between bottom-up diaspora initiatives and top-down government actions. Our evidence is based on the experience of the development of a non-formal and non-hierarchical collaborative architecture established between Portuguese diplomats and the Portuguese scientific diaspora in the United Kingdom in the time of Brexit. The paper draws on lessons learnt that could be useful to other countries when engaging with their respective scientific diasporas.

1 | A NEW SCIENCE DIPLOMACY LANDSCAPE: NOVEL ACTORS AND SHIFTING STRATEGIES

Science diplomacy is an umbrella term that has gained conceptual space as a field of research and practice over the last decade (Flink & Schreiterer, 2010; Lord & Turekian, 2007; Royal Society, 2010). At the level of states, it encompasses a diverse set of activities at the intersection of science and foreign policy, and it has come to replace or complement what is more traditionally referred to as international science and technology policy (Flink & Rüffin, 2019; Ruffini, 2020).

At the global level, the picture that is emerging over the last two decades is not very much different from that discussed by Sylvia Ostry and Dick Nelson in the early 1990s (Ostry & Nelson, 1995): It is one of increasing internationalisation of private business strategies and techno-globalism. Yet, government innovation policies and science-funding agencies remain overwhelmingly national. This is leading to new dilemmas for national

and international innovation policies as well as to new sources of international friction. In turn, this places specific demands on the science diplomacy strategies of states.

It is under this context that the evidence built in Portugal has shown that it is critical to complement the traditional incentives for building-up economic and scientific capacity inside the country with a set of other innovative schemes that are internationally focused. These have included the creation of strategic international organisations (e.g. the Atlantic International Research Centre, AIR Centre in 2017) and strengthening international partnerships with leading scientific institutions worldwide under the so-called 'Go Portugal Program – Global Science and technology Partnerships Portugal'. In parallel, the establishment of international and collaborative networks through the promotion of the Portuguese scientific diasporas have been experienced to be particularly relevant, acting well beyond their traditional formal academic, scientific and economic remit.

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While it is important to note the sensationalist discourse of some science diplomacy advocates and its potential effects (Flink, 2020; Rungius & Flink, 2020), one emerging issue is therefore to understand how the scientific diasporas have organised themselves to benefit their home country (and, respectively, how governments have leveraged their scientific diasporas). Indeed, many authors have emphasised the potential power of the collective intelligence of interconnected communities. For example, Joseph Henrich (2016) stated that the '*secret of our species' success resides not in the power of our individual minds, but in the collective brains of our communities*', showed that larger and more interconnected societies produce more 'know-how' and that '*the challenge has always been how to prevent communities from fragmenting and social networks from dissolving*'.

Based on an historical recount, this paper is a multi-stakeholder perspective that analyses the creation, during the lead-up to Brexit, of the first ever scientific advisory board (SAB) at a Portuguese Embassy. In particular, it focuses on the interplay between bottom-up diaspora initiatives and top-down government actions. It shows that scientific diasporas and related non-state actors have increasingly been coming into play to permeate and promote modern science diplomacy, including participating in a state's foreign policy and influencing its practice and strategy. These scientific diasporas act as cultural movements that can increase the relative influence of a country, particularly in a context of increased fragmented production at a global level. However, these non-formal collaborative architectures are particularly complex to sustain, and their systematic and long-term action rely very much on conjunctural and, above all, individual engagement. Therefore, this paper draws on lessons learnt that could be useful to other countries when engaging with their respective scientific diasporas.

The paper is structured as follows. The next section briefly describes the Portuguese evolving dynamics in science and technology, S&T, including main government policies in developing human infrastructures. Section 3 discusses the entanglement of 'top-down' and 'bottom-up' initiatives, considering the specific case study of the Portuguese scientific diaspora in the United Kingdom in period 2016–2021. Section 4 presents lessons learned and considerations to develop science diplomacy strategies in tandem with scientific diasporas. The final section summarises the main conclusions of the paper.

2 | PORTUGAL'S EVOLVING DYNAMICS IN S&T AND ITS IMPACT ON THE QUALIFICATION OF THE DIASPORAS

In 2020, more than 45 years after the installation of democracy in Portugal, the country finally achieved two important European goals, namely having more than

40% of the resident population aged between 30 and 34 with a higher education diploma (when it was only 15% in the 1990s and around 10% at the end of the 1970s) and having more than half of the 20-year-olds residing in the country studying in higher education (when it was only 20% in the early 1990s and around 15% at the end of the 1970s) (MCTES, 2022).

Ambitious national policies led to an increase of the overall research expenditure from 0.5% in the early 1990s to ~1.7% of GDP in 2021 which was still below the European target of 3% for 2030. In the private sector, R&D expenditure grew by more than 80% in the period 2015–2021 (~1% of GDP in 2021 compared to 0.6% in 2015), along with a significant increase in exports of higher value-added goods and service. This was achieved together with a significantly positive *Technological Balance of Payments* (which was negative until 2007 and balanced until 2017). In 2021, Portugal registered one of the largest relative concentrations in Europe of technology-based companies with market valuations above 1 million Euros (i.e. 'unicorns', including Sword Health, Farfetch, Outsystems, Feedzai, Talkdesk and Remote), with an estimated value equivalent to around 16% of GDP.

Persistent human-centred science policies over the last three decades have resulted in an increase of the number of researchers working in Portugal, reaching one of the highest European figures of 11 researchers per thousand people in 2021 (compared to 7.4‰ in 2015 and well below 4‰ in the early 1990s (DGEEC, 2022; EUSOSTAT, 2021)). The population of doctorate holders in Portugal also became younger mostly as the result of public policies fostering a steep increase in the number of students through doctoral grants. Whereas in the 1970s, the total stock of doctorate holders (with less than 400 doctorate holders) comprised only individuals over 55 years old, in the 2000s, the stock increased to over 25,000 people, 92% of whom were below 55 years old, including 67% below 44 years old. The number of doctorates awarded in the period 2015 to 2020 was greater than that of previous periods and those awarded in the 2000 to 2010 was greater by 48% than the total number of doctorates awarded in the three previous decades, from 1970 to 1999 (Heitor et al., 2014).

2.1 | The evolving qualification of the diasporas

In parallel to the national context, there was a stepwise development of a skilled diaspora, including doctorate holders working in many leading research and innovation institutions in the United Kingdom, continental Europe and the USA. Over the years, these diasporas formed knowledge-based associations or networks (i.e. 'Knowledge Diaspora Networks'), first emerging in the USA in 1998, in the United Kingdom in 2008 and then in Continental Europe in recent years. They represent a new type of association of Portuguese migrants,

taking on the role of sharing knowledge and maintaining social or cultural capital related to the country of origin, which has often been met with governmental support. Examples of such associations include the Portuguese-American Post Grad Society (PAPS), the Portuguese Association of Researchers and Students in the United Kingdom (PARSUK), as well as the Association of Portuguese Postgraduates in Germany (ASPPA), the Association of Portuguese Graduates in France (AGRAFr), the Association of Portuguese Students, Researchers and Graduates in Belgium, Netherlands and Luxembourg (APEI BeNeLux), and more recently Association for Portuguese Graduate Professionals & Researchers in the Nordic Countries (SPOT Nordic) and Association of Portuguese Graduates in Switzerland (AGRAPS). These types of networks have also included, at a global level, confederations and chambers of commerce, the diaspora of nurses or clubs and societies of alumni in many Universities and Colleges worldwide. All of them have a 'cultural and social' mission to unite and represent Portuguese scientists, researchers and skilled graduates in the places or contexts in which they operate. They offer networking and professional development opportunities and help building a dialogue with institutions, either in Portugal or in their own countries of operation, with the country's representations abroad and with their international counterparts.

The findings presented in this paper suggest that these networks facilitate the co-evolution of human capital formation in both public and private sectors in the country, enable the growth of new forms of international collaborative frameworks and can even feed back into the country's science diplomacy strategy.

While at first glance counter-intuitive, the active strengthening and support of the scientific diasporas while at the same time avoiding any form of active bureaucratic or administrative control instrument or service, is of critical importance. These movements operate in a decentralised way and, above all, on a voluntary basis, which should be understood as a founding principle for their success. In the specific case of Portugal, successive governments over the last 25 years have maintained an 'informal' relationship with these movements, which avoided any possibility of their political instrumentalization. Our findings also show that there is a need to develop agile policies and institutional structures that enable to further support the voluntary actions of these networks when they actively seek it and that this should be integrated into science diplomacy strategies, in tight collaboration with the diasporas.

2.2 | Government policies in developing human infrastructures at the national and international level

In a global context of increased uncertainty, compounded by the financial disruption induced by the

global crises of 2010–2014, the Portuguese government elected in late 2015 launched a series of actions oriented to foster the scientific and innovation capacity of the country, oriented towards promoting knowledge-based exports, with the net results described above. This included specific actions on science diplomacy, which are considered in this paper.

They were oriented to valuing inter-knowledge, communication and cooperation in the field of education and science, which is an essential dimension of Portugal's relationship with other countries, whether bilaterally or multilaterally. It should be noted that science diplomacy was understood as the coherent and systematic use of resources and initiatives in the area of science and technology to pursue the purposes of Portuguese foreign policy within the framework of Europe. In particular, it included the promotion of the image and national interests, opportunities for knowledge, communication and reciprocal collaboration between Portugal and other States, people-to-people contacts and public diplomacy.

While many governments in Europe, Asia or Latin America, have explicitly attempted to attract their scientific diasporas through specific funding programmes and 'inward-looking' strategies focused on internal markets, the build-up of the Portuguese scientific and economic capacity also involved actions in external markets through strategic international partnerships and the development of the scientific diaspora.

The government action was advocating for a '*close articulation between science, technology and higher education and foreign affairs on the European and external front*' (Government of Portugal, 2016). Beyond a series of other measures, there was a clear political orientation decided at the Government level to '*stimulate the relationship with the diaspora's scientific research in the world, in close articulation with embassies and consulates with the scientific diaspora*'. This included '*valuing the relationship with the resident Portuguese academic and scientific communities abroad*', by encouraging and supporting the academic and scientific associations, as well as '*maintaining and promoting contact with researchers and qualified staff, facilitating and reinforcing their relationship and eventual integration in scientific institutions and companies in Portugal*'.

3 | THE ENTANGLEMENT OF 'TOP-DOWN' AND 'BOTTOM-UP' INITIATIVES: THE PORTUGUESE SCIENTIFIC DIASPORA AS A CASE STUDY

In this article, we focus on the most relevant and illustrative case of Portugal-UK relations in times of Brexit, which were considered an important priority at the Government level, and how it attempted to promote

added value in association with the unique characteristics of the emerging Portuguese scientific diaspora in the United Kingdom.

This had particularly grown in consequence of the financial crises of 2010–2014 in direct association with brain drain from the country and above all to the United Kingdom. It is in this context that it is important to understand the critically relevant role played by PARSUK and to analyse the interplay of the top-down government strategies and the bottom-up initiatives related with the largely grassroots-led and impactful repercussions on the state's science diplomacy strategy (see Figure 1).

3.1 | 'Top-down' science diplomacy: Government-led initiatives and insights

The set of actions taken by Portuguese government in 2016 were carefully prepared over almost 1 year and on the basis of the lessons learned from the evolving dynamics of research and innovation in Portugal since the mid-1980s (See, for example, Conceição & Heitor, 2005; Heitor et al., 2014). They built on the idea of *inclusive learning* (Conceição et al., 2003), entailing a process of shared prosperity following specific local conditions by emphasising the relative importance of *infrastructures* and of *incentives*, although it has been recognised the increasingly important role of formal *institutions*, as well as other non-formal and non-hierarchical processes, including in association with science diplomacy. This is because learning societies will increasingly rely on 'distributed knowledge bases', as a systematically coherent set of knowledge, maintained across an economically and/or socially integrated set of agents and institutions.

The mere fact that in the economics literature 'knowledge diffusion' processes have largely been explained in terms of externalities and *spillovers*, shows that 'knowledge sharing' processes are largely an unintended consequence and, in fact, a disincentive for private agents to invest in knowledge creation. Thus, the logic of government intervention, namely in terms of research, innovation and foreign policies that tackle these market deficiencies, has been to provide incentives to enhance knowledge generation, namely through formal mechanisms promoting infrastructures, incentives and institutions. The right incentive structure builds on the science and technology infrastructures and enables the generation of virtuous learning cycles that foster the generation of new knowledge that ultimately lead to long-term growth. Learning, in this context, reflects the idea of sustainable knowledge creation and diffusion.

The main policy issue that arose was exactly about the extent to which those formal processes should be complemented by non-formal ones to address global markets and, in particular, those affecting the global position of Portugal. This is becoming a central issue of modern science diplomacy in an increasingly fragmented system of global production.

It should also be noted that the growth of the international collaborative innovation processes, including those incorporating the development of public and semi-public goods, does not seem to be a hostage of the traditional forms of services' international commerce. It may derive its uniqueness from the very nature of research communities and from the strong meritocratic and universalistic ideals that prevail in science on an international scale. In addition, it is also driven by the flow of students and researchers, and by the citizen's sense of being part of a 'mission' for scientific and social development that motivates



FIGURE 1 Non-exhaustive list of intertwined bottom-up, diaspora-related initiatives (through PARSUK) and top-down government-based initiatives, over the period 2016–2019.

some of the best professionals in academic institutions worldwide. However, under which conditions is such a model sustainable?

To answer this question, [Table 1](#) summarises major lessons learned from the Portuguese experience in setting-up formal and informal international research networks and other collaborative arrangements (Heitor, 2015).

It considers **formal processes** under three major steps, including: (i) investing in people, mainly through formal education and training and including co-hiring of young researchers and exchange programmes for faculty and researchers; (ii) the promotion of formal R&D activities through projects, programmes and thematic networks, facilitating the integration of researchers and scientific institutions in international thematic networks with local relevance; (iii) formal institutional building, by adequate organisational conditions promoting the role of science and innovation institutions in society, their links with the private sector and adopting policies that foster the creation of critical mass, including those oriented towards fostering R&D consortia and, above all, good job creation.

In addition, it also considers **informal processes** under three major steps, including: (i) informal individual relationships with science, economic and political leaders; (ii) informal diplomatic incentives; (iii) informal collaborative networks with scientific diasporas.

The analysis of the formal and informal policy instruments described in [Table 1](#) reveals two main issues that should be emphasised in terms of understanding science diplomacy. First, innovation with impact in global markets must be considered together with competence building and advanced training of individual skills through the complex interactions between formal and informal qualifications and in close interaction with diplomatic actors. Second, strengthening experimentation in international social networks necessarily involves flows of people, independently of their socio-economic level. It is the organised cooperation among networks of knowledge workers and diplomatic relationships, together with different arrays of users across the entire social fabric of our societies that will help diffuse innovation and the development of products and services and their exports in global markets.

But establishing these innovation communities requires the systematic development of routines of collaboration on the basis of formal and informal processes, and a diversified and non-structured array of informal processes of networking with the labour market and the firms, at large.

It is under this context that this paper argues that the creation of non-formal relationships with scientific diasporas have become important policy instruments to complement and strengthen 'organised forms' of international collaborative ventures and the necessary

critical masses to compete at an international level. The main challenge is that such 'non-formal relationships' cannot be of any kind, but should follow some structural constraints (Leydesdorff, 2012), in a way to promote co-operative R&D and innovation to access external markets; guarantee the necessary organisational structure oriented towards institutional building, together with resource base development.

Understanding new paradigms of science diplomacy in a global system of free circulation of people and increasingly fragmented knowledge production will gain from our increasing understanding of the operational advantages and shortcomings of large international research consortia and organisations. It also requires considering the local characteristics of the processes of technical change and of their specific regulatory and institutional constraints and it calls upon our knowledge of the social construction of technological systems.

3.2 | 'Bottom-up' science diplomacy: PARSUK Initiatives and insights

To understand bottom-up architectures in science diplomacy and the related cultural movements they are able to generate, we need to recall John Ziman some 55 years after he launched the discussion on *Public Knowledge* (Ziman, 1968) and 45 years after his work on *Reliable Knowledge* (Ziman, 1978). To appreciate the significance of scientific knowledge in complex diplomatic processes, one must understand the nature of science as a complex whole. In *Real Science*, (Ziman, 2000) we are reminded that 'science is social', referring to 'the whole network of social and epistemic practices where scientific beliefs actually emerge and are sustained'.

The Portuguese Association of Researchers and Students in the United Kingdom (PARSUK) started with a few hundred post-graduate students in the United Kingdom in 2008 and grew to over 2000 members by 2021. The latest survey focusing on active members revealed that ~38% are staff and scientists in UK universities and scientific institutions, 36% are research students in UK universities, 15% are graduate workers in business firms operating in the United Kingdom and 11% work in the public service or third sector institutions.

As a result of the UK's decision to depart from the European Union and foreboding the challenges that Portugal would face, the PARSUK leadership identified science diplomacy as an important topic. This was in part influenced by the Portuguese government action in 2016 (in particular the November's Resolution of the Council of Ministers (Government of Portugal, 2016)) and by specific initiatives taken by the Portuguese Embassy in London during the preparation of Portugal's position to face Brexit. It included, for example, the action of the Portuguese foreign trade

TABLE 1 Major formal and informal policy instruments to foster collaborative research networks and science diplomacy, with international relevance and local impact, as used in Portugal (2016–2021).

Type of instrument	Major objectives and policy instruments	Justification	Sample illustrative examples and cases
Formal	<p>People: Human infrastructure Formal training, attract and employ researchers in all areas of knowledge, fostering their mobility and career development, together with professional assistance and management bodies</p> <p>Formal incentives for research and innovation activities</p> <p>Facilitate the integration of researchers and scientific institutions in international networks for the production and dissemination of fundamental knowledge with local relevance and facilitating ideas for markets worldwide</p>	<ul style="list-style-type: none"> Sustain excellence and internationalisation in higher education programmes; Foster and systematise the hiring of researchers and the development of young research careers, together with professional assistance and management bodies. Reinforce international partnerships and foster participation in international knowledge-based networks as a way to improve scientific quality and the employability of researchers, including those focused on fundamental research and basic science; Foster S&T thematic networks in terms of test beds and living laboratories that can boost companies' capacity to export and access emerging markets. 	<ul style="list-style-type: none"> PhD training programmes (FCT) Scientific employment programmes (FCT) Skilled job creation (includes European Structural funds, ESF); Specific actions and programs of national development agency, Institute Camões Go Portugal Program, Global Science and technology partnerships, Portugal (Includes MIT-Portugal, CMU-Portugal, UT Austin-Portugal Programs; as well as Fraunhofer Portugal joint venture); PERIN, Portugal in Europe Research and Innovation Network; Specific actions and programs of national innovation agency, ANI, together with global trade agency, AICEP Specific actions and programs of national development agency, Institute Camões INL, International Iberian Nanotechnology Lab, as created in 2007 and particularly promoted in the period considered; Fraunhofer Portugal Research Association, as created in 2008 and particularly promoted in the period considered; AIR Centre—Atlantic International Research Centre, as created in 2017
Informal	<p>People: Informal individual relationships with science, economic and political leaders</p> <p>Informal diplomatic incentives</p>	<ul style="list-style-type: none"> Strengthen institutional diversification, clarifying different roles for different institutions; Reinforce institutional assessment/evaluation mechanisms, in order to improve systemic and organisational efficiencies Adopt policies that foster activities able to promote the creation of critical masses, including policies oriented towards fostering R&D consortia. Promote the training of scientists, together with a new generation of technicians and other human resources to support R&D activities Foster scientific and technological culture in society Promote the creation of Knowledge diasporas and their voluntary association Adopt policies that foster activities able to promote activities by knowledge diasporas, including conferences, events, workshops Reinforce the diplomatic support for the activity of international partnerships and foster the informal participation in international knowledge-based networks, including those focused on fundamental research and basic science; Foster diplomatic, economic and social relationships, namely informal relationships, in association with S&T thematic networks as well as activities that can boost companies' capacity to export and access emerging markets. Adopt policies that foster activities able to promote the creation of 'Scientific and Economic Advisory Boards' in Embassies 	<ul style="list-style-type: none"> Support to PAPS, PARSUK and other associations, as well as their meetings and joint events; Specific actions and programs of national development agency, Institute Camões Specific action of national Innovation agency, ANI and of external trade agency, AICEP; Specific actions and programs of national development agency, Institute Camões UK embassy, with specific creation of an 'Scientific Advisory Board'

agency, AICEP, and their operation in the Portuguese embassy in London, which also dealt with the promotion of innovation through informal relationships with PARSUK members.

However, PARSUK took a proactive stance and independently organised specific actions. For example, at the 10th PARSUK annual event (i.e. 'LUSO 2017'), where both Ministers of Science and Foreign Affairs participated, PARSUK organised a working group on science diplomacy to help Portugal tackle these issues. Following a careful selection of experts from academia, the industry and non-profit, this working group was organised in September 2017. In the following months, PARSUK delivered to the Portuguese Ambassador to the UK and the Portuguese Government a position paper on science diplomacy (Lacerda & Góis, 2017), which included recommendations to appoint a *science attaché* at the Embassy in London in order to support, among others, the development of science advice mechanisms to navigate uncertain periods of scientific cooperation.¹ As a result, PARSUK was subsequently tasked to draft recommendations on such a position. In addition, at the 2018 Portuguese Science Summit, in July 2018, the Government announced that PARSUK would lead a science diplomacy pilot project to establish, for the first time, a science advice mechanism within a Portuguese Embassy worldwide (Canal, 2018).

After sets of discussions regarding the type of mechanism that should be put in place, a Scientific Advisory Board (SAB), to be constituted of experienced members of the community, was chosen over the more traditional position of a *science attaché*. This choice was the result of the following constraints and possibilities, which frame science diplomacy: (i) the capacity of the Portuguese Embassy in London to formulate adequate issues for analysis and, above all, support the operation of the SAB (this relates with the interaction of the embassy with the various parts of the government and public administration to set adequate issues for science diplomacy); (ii) the capacity of PARSUK to help promoting structured discussion, particularly on the basis of the voluntary nature of the association; (iii) the financial, institutional and human resources limitations and constraints imposed by the Portuguese public administration processes in terms of the potential recruitment of adequate professional services for the UK embassy.

Following the decision to create the SAB, a formal protocol was signed between PARSUK, the Portuguese Embassy in London and the Portuguese Science and Technology Foundation (DN, 2019)² with five main goals:

- (i) Operationalise the structure of PARSUK so that it can act as a vehicle for science diplomacy and strengthen the bilateral relationship between

- Portugal and the United Kingdom in terms of research, development and scientific culture;
- (ii) Advise the Portuguese Embassy in London on opportunities relevant to Portugal's strategic development plan in research and innovation, such as the establishment of new investment funds that increase collaboration with the United Kingdom;
- (iii) Ensure liaisons with political power, both at the governmental and diplomatic levels, with various initiatives/associations related to the dissemination/support of the Portuguese Diaspora, namely at the level of Science;
- (iv) Allow a more frequent exchange of practices between the institutions that oversee science policy in Portugal and Portuguese researchers in the United Kingdom, as well as transmit opportunities for the development of a scientific career in Portugal; and
- (v) Support the planning of investment in research and innovation in strategic areas for Portugal, through a careful assessment of the best existing resources in the country, which areas of the future to invest in and which gaps are identified at present.

The paragraphs above highlighted how top-down (government-led) and bottom-up (grassroot-led) initiatives enabled the creation of a new science diplomacy mechanism for Portugal. 3 years after the creation of this unusual mechanism of science diplomacy it is now possible to take stock of its creation and activities as well as to derive considerations that may be useful both for its own future and to other countries who wish to enhance their science diplomacy strategy.

The next section discusses some of the main issues to be considered, including the necessary incentives, the relevant institutional structures and the political motivation needed to enable coordinated action with non-state actors, like qualified diasporas, as well as how they can help co-develop and deliver sustained science diplomacy strategies.

4 | LESSONS LEARNED: CONSIDERATIONS TO DEVELOP SCIENCE DIPLOMACY STRATEGIES IN TANDEM WITH SCIENTIFIC DIASPORAS

This historical recount showed the high promise of engaging with a motivated scientific diaspora, if established in an informal and non-directive way: In addition, it informs what it can achieve, even when it is largely reliant on volunteers. The creation of PARSUK's Scientific Board proved to be a success, as it revitalised the mapping of Portuguese researchers abroad

and their ongoing UK-Portugal collaborations, and further strengthened scientific cooperation between the United Kingdom and Portugal through dedicated funding. Throughout this process PARSUK has mobilised the engagement of Portuguese institutions, in addition to the UK government and other European diaspora associations. This has led to increased interest in science diplomacy activities and new efforts of connecting the United Kingdom with the European Union have since been developed.

Looking at the illustrative Portuguese case in London at the time of Brexit, a broad science diplomacy strategy was defined to be '*stimulating*', '*valuing*' and '*reinforcing*' the relationship between the government institutions and qualified diasporas. In part due to the right mix of top-down and bottom-up science diplomacy initiatives, this success may inspire scientific diaspora associations to develop related articulation processes with local embassies and develop specific activities that align with foreign policy objectives. In addition, our analysis is relevant to inform governments to use the right 'informal' policy instruments to enable these activities to blossom without instrumentalising the diasporas.

Indeed, the engagement with the scientific diasporas can be a difficult balancing act, as noted elsewhere. (Moreno et al., 2017) On one hand, it is important to guarantee that diaspora remain independent and foster their own integrity, but on the other hand, their efforts are at risk to wither out without proper institutional support and refined strategy.

In the paragraphs below, we reflect on lessons drawn from the process of the creation of PARSUK's Scientific Advisory Board, which may serve as insights for the development of science diplomacy strategies in other contexts.

4.1 | On the importance of communication, clarification of roles and the co-development of a science diplomacy strategy

Our experience has highlighted that the first step to develop science diplomacy strategies in tandem with scientific diasporas is to ensure that a strategic reflection on science diplomacy continues at the highest level, in tight coordination between government and non-state actors. Indeed, it is crucial to take an *adaptive policy approach* as the relationship evolves. This is critical to maintain and develop adequate communication channels, identify further needs for support (institutional, financial, training needs, etc.) and clarify roles and strategy.

Building on recent research on science diplomacy together with the metaphor of 'Triple Helix' of university-industry-government relations and

considering related international dimensions, our analysis shows that those new relationships must consider accommodating new configurations of knowledge production by establishing alliances with an increasingly large range of 'knowledgeable' institutions (Nowotny et al., 2001).

Bringing together civil servants and diplomats together with the scientists and innovators of the diasporas (as well as other relevant stakeholders) can create the necessary conditions to explore the full potential of opportunities stemming from the 'top-down' and 'bottom-up' initiatives described above.

Yet, one unsurprising issue that may stifle progress are the different cultures of science and diplomacy, and the different understanding of what constitutes a science diplomacy strategy. The different understanding of government processes and institutions on the one hand, and of the preoccupations of a scientific diaspora on the other hand can complicate the communication. A co-designed science diplomacy strategy would therefore rely first on organising joint training and events in order to bridge cultural differences and foster a mutual understanding of science diplomacy. A shared 'manifesto' would then need to be developed to encapsulate the needs and potential contributions of all stakeholders.

4.2 | A need for agility and engaging non-state actors to promote institutional innovation

Our narrative is particularly associated with the way Portugal prepared the impact of Brexit on the long-standing economic relations between Portugal and the United Kingdom, in that our societies are entering critical times that require the creation of conditions able to strengthen institutions fostering change through knowledge-based international cooperation. This is well beyond the boundaries of 'national systems of innovation' and requires people trained to act in quite diversified and global environments in a global system of increasing fragmented production (See, for example, Breznitz, 2021). Universities and scientific institutions may play part of that role if their internationalisation and specialisation path is understood as a key element in a new era of international affairs, where governments and industry intervene through knowledge.

Beyond these actors, there is also an opportunity to explore novel policy instruments with the scientific diaspora since their activities are fundamentally different from the traditional role of universities or scientific institutions (involving, most of the time, various forms of insight into political and diplomatic processes, and forms of economic appropriation of knowledge). However, breaking the otherwise traditional boundaries

of 'national systems of innovation' and involving scientific diasporas in the co-development of science diplomacy strategies brings new institutional challenges. In particular, there is a need to integrate the scientific diaspora associations with traditional (governmental and other) actors responsible for setting national science and diplomatic priorities that goes beyond 'extracting' their 'services'.

It is well-known that countries, at large, continue developing their science diplomacy strategies, sometimes with the support of corresponding bureaucratic structures to clarify and adequately support some of the ongoing activities of their embassies. However, it is also important to highlight the interplay between government's complex dynamics, the bureaucratic system and the competition for resources, which can make quite complex the creation of novel institutions in public administration, such as inter-ministerial task forces on science diplomacy or formal positions in embassies worldwide (i.e. *science attaches* or similar traditional mechanisms of *science advice*).

5 | CONCLUSION

Diplomacy has evolved into practices that integrate both government, international or transnational actors, as well as non-state actors. In this new context of diplomatic interaction, it is crucial for governments to continuously revise and adapt their policies.

This paper argues that scientific diasporas and related non-state actors have increasingly been coming into play to permeate and promote modern science diplomacy. Our evidence is based on the experience of the development of a non-formal and non-hierarchical collaborative architecture established between Portuguese diplomats and the Portuguese scientific diaspora in the United Kingdom in the time of Brexit. These bottom-up types of arrangements may act as agents of change in modern science diplomacy, including participating in a state's foreign policy and influencing its practice and strategy, although their systematic and long-term action depends on specific conjunctural conditions.

Overall, the challenge of informal architectures based on scientific diasporas to foster science diplomacy oriented to promote *global value and local welfare* has become an opportunity for the *development of public and semi-public goods* through the collaborative work of economic, social and cultural actors with scientific and academic institutions. They may clearly contribute to the sustainable development of locally and globally relevant initiatives.

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CONFLICT OF INTEREST STATEMENT

The authors do not have any conflict of interest to disclose.

DATA AVAILABILITY STATEMENT

All data used in the paper is referenced. Details about PARSUK were provided by internal documents and could be available upon request.

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ENDNOTES

- 1 The resolution of the Council of Ministers mentions that both the Minister of Foreign Affairs and the Ministry of Science (through FCT) would "nominate post-PhD researchers as scientific advisors to diplomatic missions, wherever it proved adequate to highlight science activities and networks of Portuguese science, technology and higher education";
- 2 Protocol signed between PARSUK, FCT and the Minister of Science Technology and Higher Education in June 2019.

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