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CITY-LED SCIENCE DIPLOMACY: Building urban sustainability and resilience at the science-policy interface

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With the growing importance of cities in the transition to sustainable development, there is an ever-greater need for knowledge about our planet from an urban perspective that can support local governance and help to build local government capacity to anticipate, mitigate, and adapt to risks.

In the context of shifting power structures in the multilateral system, new forms of science diplomacy have emerged that are no longer driven by states and their interests but by the scientific community itself together with various other actors engaged in present-day global policymaking.

While, traditionally speaking, promotion of international scientific cooperation has not been part of the jurisdiction of local governments, cities around the world have begun to engage in science diplomacy in close collaboration with their local STI ecosystems.

City-led science diplomacy initiatives are a multi-stakeholder effort in which municipal authorities work with many partners, including universities and research centres, technology companies, and policy organisations.

Cities value science diplomacy not only for its more established functions of international promotion, place-branding, and talent attraction, but also because they increasingly recognise it as a tool for boosting urban sustainability and resilience through transnational scientific cooperation that can inform local policymaking.

Today's global challenges, from climate change to health and digitalisation, are of unprecedented scientific complexity and transcend national borders, rendering isolated action ineffective. A prime example in this regard, the COVID-19 pandemic has drawn attention to the need for more science-informed public decision-making and international scientific collaboration on solutions to global crises, once again making science-policy interfaces and science diplomacy a priority for governments worldwide.

At global, regional, and national levels of governance science-policy interfaces, fostering relations between scientists and policymakers to enable joint formulation of knowledge and policy solutions, are today widely established. Many of these mechanisms are also platforms for science diplomacy, which advances scientific collaboration across countries to address shared problems. Notable examples include the Intergovernmental Panel on Climate Change (IPCC) and its sister organisation the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), the Joint Research Centre (JRC), which is the science and knowledge service of the European Commission, and national science academies like Germany's Leopoldina.

At city level, by contrast, there are still few formal mechanisms to strengthen the science-policy nexus. However, with estimates projecting that two-thirds of the world's population will be living in urban areas by 2050, and with the growing importance of cities in the transition to sustainable development, there is an

ever-greater need for knowledge about our planet from an urban perspective that can support local governance and help to build local government capacity to anticipate, mitigate, and adapt to risks (Acuto *et al*., 2018).

In recent years, some first steps in this direction have been taken by actors including the EU, city networks, and cities themselves. The European Commission's research and innovation programmes are increasingly engaging local authorities and, in 2019, the JRC launched the Cities Science Initiative to strengthen the ways in which science and research can help local policymakers address urban challenges. Leading city networks like C40 Cities, ICLEI, and Metropolis that focus on climate and sustainability issues have made collaboration with research centres part of their operating model. Furthermore, many cities are working with local universities to develop strategies for localising the Sustainable Development Goals (SDGs) of the UN 2030 Agenda.

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A new trend in this emerging field of city-science partnerships is city-led science diplomacy (Roig *et al.*, 2020). While, traditionally speaking, promotion of international scientific cooperation has not been part of the jurisdiction of local governments, cities around the world, among them Barcelona, Geneva, Mexico City, Miami, and Kigali, have begun to engage in science diplomacy in close collaboration with their local Science, Technology, and Innovation (STI) ecosystems. Crucially, these cities value science diplomacy not only for its more established functions of international promotion, place-branding, and talent attraction, but also because they increasingly recognise it as a tool for boosting urban sustainability and resilience through transnational scientific cooperation that can inform local policymaking.

Cultivation of these two mutually enhancing functions of science diplomacy is a broader phenomenon that can be observed across all scales of government. However, at city level, broadening the objectives of science diplomacy to boost urban sustainability and resilience is a particularly potent project. On the one hand, it can foster urgently needed local science-policy connections to tackle complex problems and, on the other, it can contribute to transforming global science-policy interfaces in ways that situate, at the centre of concern, urban challenges and scientific knowledge about them.

In this article we examine the potential of city-led science diplomacy to create new local and transnational channels for science-policy collaboration that can foster deeper understanding of today's urban problems and generate ideas for possible policy solutions. After giving a brief account of the role of science diplomacy in the ever-changing arena of twenty-first-century international relations, we provide an overview of emerging city-led science diplomacy initiatives and trends and how, beyond promoting international talent and investment attraction, they seek to foster urban sustainability and resilience. The initiatives we examine address challenges ranging from localising the SDGs to climate change and health. The final part of the article highlights several evolving areas of action that will be important for further consolidating and strengthening city-led science diplomacy.

Science diplomacy as a tool for global governance

Science diplomacy became central to the conduct of international relations in the second half of the twentieth century, which witnessed the Cold War Space Race, the UN Treaty on the Non-Proliferation of Nuclear Weapons, and the International Treaty for the Protection of the Arctic. Traditionally, it is understood as consisting of three components: 1) the use of *science in diplomacy* to advise and inform foreign policy objectives; 2) the use of *diplomacy for science*, whereby classical diplomacy tools are used to facilitate international scientific cooperation; and 3) the use of *science for diplomacy* when cross-border research and scientific networks are used to improve relations between states (Royal Society, 2010).

Recently, this tripartite definition has been revised to reflect today's more practical applications of science diplomacy, including actions designed to directly advance national interests, such as the exercise of soft power or economic interests; to address cross-border needs, such as preservation of ecosystems that stretch across countries; and to tackle global challenges, such as climate change and the COVID-19 pandemic (Gluckman *et al.*, 2017).

In large part, the pragmatic reframing of science diplomacy has been a response to the ecological crisis and the importance of science in securing the future of the planet. Since the 1990s, science-based discourse on sustainable development and environmental protection has played an increasingly greater role in global policy. One milestone was the creation of the IPCC by the UN in 1988 to facilitate international scientific consensus on climate change and translate it into policy recommendations. The novelty of the IPCC was that it is both a scientific and an intergovernmental

organisation. It established science and its values (for example, rationality, accountability, and transparency) as a common language for tackling globally shared challenges, marking a new model of science diplomacy as a tool for multilateral cooperation and global governance (Van Langenhove, 2016). This approach was further consolidated with the Millennium Development Goals (MDGs) and, subsequently, the SDGs, which require transnational scientific input and collaboration in the forms of new science and technology, data collection, and analysis and scientific evaluation of policy options.

The increasing involvement of scientists in global agendas that address environmental and other challenges is symptomatic of shifting power structures in the multilateral system. The intergovernmental multilateralism of the second half of the twentieth century is gradually giving way to a more open system in which a multiplicity of actors—from the scientific community to NGOs, civil society, the private sector, and subnational governments—are gaining in influence by developing solutions to global problems that national governments can no longer solve by themselves.

The increasing involvement of scientists in global agendas that address environmental and other challenges is symptomatic of shifting power structures in the multilateral system.

As part of this search for solutions, new forms of science diplomacy have emerged. They are no longer driven by states and their interests but by the scientific community itself together with various other actors engaged in present-day global policymaking (ibidem). The engagement of a growing number of cities in science diplomacy, is part of this broadening of the field of science diplomacy. With over half the world's population now living in urban areas, cities and other urban stakeholders are increasingly engaged in tackling global problems in their territories and fostering relations between local policymakers and the transnational scientific community.

Towards city-led science diplomacy

Many cities have come to recognise the potential and lasting benefits of promoting science and technology innovation, including new economic development opportunities, data-driven decision-making, and more efficient and sustainable infrastructure. Building on this experience, a growing number of cities are now going a step further and are engaging in transnational science diplomacy by leveraging the capacities and infrastructure of STI working in their territories.

The ways in which cities engage in science diplomacy vary. While the majority are involved in individual, fragmented initiatives that promote transnational scientific exchange, a few pioneering cities have developed a comprehensive science diplomacy strategy. However, what all these endeavours share is that they strengthen the science-policy nexus at city-level and foster cross-sector cooperation in local STI ecosystems and beyond.

City-led science diplomacy initiatives are typically a multi-stakeholder effort in which municipal authorities work with many partners, including universities and research centres, technology companies, and policy organisations. Moreover, the contours of city-led science diplomacy are often blurry and overlap with other international outreach actions, including city-to-city cooperation, city networking, talent and investment attraction, and the hosting of international organisations (IOs) and global policy events. However, despite these overlaps, clear trends can be identified in the ways in which cities are stepping up efforts to promote and benefit from transnational scientific collaboration.

In order to outline some of the main trends in city-led science diplomacy, we shall now describe the science diplomacy initiatives of eight cities: Barcelona, Bangalore, Mexico City, Geneva, Berlin, Helsinki, Miami, and Kigali. While each case contains elements of more than one trend, their most striking features have been singled out for the purpose of analysis (see Figure 1).

Between local and multi-level action

Barcelona, the seventh European city in terms of scientific production and the second city in life sciences, has a tradition of innovation that has increasingly shifted towards an STI-based approach. It was the world's first city to formulate a comprehensive science diplomacy strategy, illustrating how cities are — systematically and independently of regional and national governments — engaging in science diplomacy to enhance their international influence and urban sustainable development agenda. In 2018, SciTech DiploHub, the Barcelona Science and Technology Diplomacy Hub, was launched as a non-profit public-private partnership backed by the city council, leading research centres, universities, non-profits, start-ups, and corporations. This multistakeholder initiative

reflects the diverse interests of its support network: it mobilises the global network of Barcelona-educated scientists and technology experts to foster international cooperation; strengthens the local science-policy nexus to inform policymaking; organises international events to connect Barcelona with other innovation hubs; and offers training programmes in science diplomacy.

One of the core goals of Barcelona's science diplomacy strategy is consolidation of Barcelona as an innovation capital that is ready to meet the SDGs through science and technology. In 2020, the city's multistakeholder science diplomacy partnership was the first to be included as a member of the United Nations Sustainable Development Solutions Network, and the OECD Observatory of Public Sector Innovation featured it as a best practice for boosting the science-policy nexus.

Many cities that have no comprehensive science diplomacy strategy in place are pursuing science diplomacy actions by building on and leveraging the international connections and networks of research institutions and talent they host.

Another city that is creating synergies between its STI ecosystem and internationalisation efforts but without a fully-fledged strategy in place is **Bangalore**, also known as India's Silicon Valley. In 2018, the Forum for Indian Science Diplomacy (FISD) launched a science diplomacy programme in Bangalore to strengthen the city's capacity to engage in science diplomacy; develop international networks that can promote Bangalore's STI sector; mobilise India's diaspora working in science and technology to improve Bangalore's international outreach; and harness scientific knowledge for strategic thinking about the city. Bangalore's programme illustrates how top-down science diplomacy efforts, fostered at the national level, can be key enablers of city-led science diplomacy in ways that are mutually beneficial to both.

Leveraging local scientific and technological capital for city-led science diplomacy

Many cities that have no comprehensive science diplomacy strategy in place are pursuing science diplomacy actions by building on and leveraging the international connections and networks of research institutions and talent they host. **Berlin**, which has a rich science and technology ecosystem, has opted for this path. Through the initiative Brain City Berlin, the city engages local scientists and representatives of local research institutions as ambassadors who promote Berlin as a leading international research hub. A related initiative, the Berlin-Partner Network, further aims to strengthen the innovation potential of Berlin by fostering collaboration between local research institutions, private businesses and government, following the triple helix model.

Cities like **Helsinki** follow a similar strategy by focusing their science diplomacy efforts on a specific sector in which they have a proven track record and competitive advantage, namely healthtech. Helsinki regularly features as a prime location for technology and innovation enterprises and start-ups in global city rankings, an achievement related to Finland's education system which produces many students educated in Science, Technology, Engineering, and Mathematics (STEM). Building on these strengths, several leading institutions and municipalities in the Helsinki metropolitan area launched the project Health Capital Helsinki (HCH) with the aim of building the city into a globally prominent healthtech capital by boosting connectedness between the local health and technology sectors, supporting the growth of innovation-driven health and life science start-ups, and helping international investors to enter the city's healthtech ecosystem.

Tackling global challenges by strengthening the science-policy nexus

The formulation of evidence-based public policies is a pressing concern for city governments worldwide as they seek to address the impact of global challenges in their territory. Some cities are engaging in science diplomacy to strengthen informed decision making. For example, in 2019, **Mexico City** presented the Science-Policy Interface Fellowship Programme ("*Programa de Estancias de Interfaz Ciencia-Política*"). The initiative aims to tackle the disjuncture between local policy and scientific expertise by developing a training programme for specialists working at the science-policy intersection. It is envisaged that these specialists will become central actors in coordination between policymaking and scientific advice by improving scientists' understanding of policy processes and producing workable recommendations that can feed into public policies. The project is an integral part of the city's internationalisation strategy: working in the framework of the SDGs, it aims to promote science as a common language for tackling challenges shared by cities around the world.

A related trend in the science diplomacy of cities is the creation of multi-stakeholder partnerships that bridge the divide between policy and science actors to promote sustainable development solutions. Here, **Geneva's**

efforts to better connect its local STI ecosystem with global governance organisations based in the city stand out as an example.

Geneva hosts the headquarters of a large number of UN agencies and other IOs, many of which are science and technology related. One of Geneva's major science diplomacy initiatives is the Geneva Science and Diplomacy Anticipator (GESDA), a joint programme by the Swiss Federal Council and the Canton and City of Geneva that connects locally-based IOs and actors with the city's industry, universities and philanthropy, and fosters knowledge sharing, especially with regard to technological innovation for tackling global development challenges. Furthermore, in 2018, the city's leading universities and research centres launched the Geneva Science-Policy Interface (GSPI) to promote dialogue with Geneva's IOs and facilitate evidence-informed policymaking on complex global problems. Another notable initiative is the Geneva 2030 Ecosystem, a multi-stakeholder platform that seeks to translate research produced by Geneva-based policy and science organisations working on the 2030 Agenda into actionable knowledge products that can support implementation of the SDGs in Geneva and around the world. One striking aspect of the multiple initiatives launched in Geneva is the way they "do" science diplomacy within the space of a city but with the objective of providing global solutions.

City-led science diplomacy for climate adaptation and mitigation

Another trend in city-led science diplomacy can be found among cities that are highly vulnerable to the impacts of climate change. A growing number of such cities are beginning to engage in science diplomacy to enhance local capacity and preparedness for climate adaptation and mitigation.

Miami, the coastal economic hub of Florida and one of the cities most affected by sea level rise (SLR), is a good example. The fight against climate change and SLR have become key priorities of Miami's international cooperation and the main motivation for its venture into science diplomacy. In a pioneering case of city-to-state diplomacy, Miami signed an agreement with the Dutch Ministry of Infrastructure and Water Management in 2019 to set up an office of the Global Centre on Adaptation (GCA) in order to assist North American cities with developing climate adaptation and resilience strategies, and learn from Dutch cities like Rotterdam about how to protect urban areas against SLR. Miami is the only city in the United States to host a GCA bureau and the office has become its main platform for science diplomacy.

The Rwandan capital, **Kigali**, which regularly suffers from droughts, floods, windstorms, and landslides caused by extreme weather events, is another case in point. It is employing science diplomacy tools to gain both greater international influence and foster regional cooperation on climate action and resilience. In 2013, with the support of UN-Habitat, Kigali organised a regional workshop on energy efficiency in buildings that set new regional standards. In 2021, the city, with the support of ICLEI, will host the Climate Chance Summit Africa, bringing together different non-state and non-government actors to discuss climate solutions for African countries. Currently, the city is also developing Kigali Innovation City, an innovation hub that will specialise in green technologies and will include four universities and start-up incubators to promote pan-African talent.

A growing number of cities are beginning to engage in science diplomacy to enhance local capacity and preparedness for climate adaptation and mitigation.

Figure 1. Overview of cases of city-led science diplomacy and the trends and uses of city-driven science diplomacy they exemplify

Barcelona	Enhancing the city's international influence and sustainable development agenda through a comprehensive local science diplomacy strategy.
Bangalore	Enabling city-led science diplomacy through top-down, nationally led initiatives.
Berlin	Leveraging the international networks of local research institutions and talent to promote the city as a research and innovation hub.
Helsinki	Leveraging the city's track record and competitive advantage in a specific STI sector to promote it as a research and innovation hub.
Mexico City	Strengthening city-level science-policy interfaces to promote science as a common language for tackling the SDGs.
Geneva	Stepping up multistakeholder cooperation to foster science-policy cooperation for global sustainable development solutions.
Miami	Enhancing local capacity and preparedness for climate adaptation.
Kigali	Fostering regional cooperation on local climate mitigation and adaptation.

Leveraging urban sustainability and resilience through science diplomacy

The trends described above show how cities engage in science diplomacy for several reasons. In part, their motivation is to advance broader local interests related to promoting themselves internationally and attracting talent and investment. However, many

cities also increasingly promote transnational scientific collaboration to strengthen science-policy interfaces that can contribute to sustainable development solutions, both in their territory and beyond. These cities are putting into practice what Luk Van Langenhove (2016) has called "a 'global commons' driven science diplomacy", which aims to tackle shared global problems rather than blithely serving self-interests.

Typically, the global commons are defined as areas that fall outside national jurisdiction, such as the high seas, the atmosphere, and Antarctica. However, with urbanisation rapidly advancing around the world, leaving few places and ecosystems free from its impacts, urbanisation and its associated challenges have also become a globally shared problem. The 2030 Agenda addresses these challenges in SDG 11: Sustainable Cities and Communities.

To tackle urbanisation and turn it into a positive force in the transition to sustainable development, the complexity and magnitude of the problems that cities face require deeper scientific understanding and effective application of this knowledge by policymakers.

To tackle urbanisation and turn it into a positive force in the transition to sustainable development, the complexity and magnitude of the problems that cities face require deeper scientific understanding and effective application of this knowledge by policymakers. In this vein, the 2018 *Science and the Future of Cities* report (Acuto et al.), which assessed the state of urban science policy-interfaces, called for a "global urban science" that enables "greater connection between scientific ways of understanding cities and practical modes of setting policies to govern cities the world over".

City-led science diplomacy is emerging as a tool for building and strengthening much-needed policy-science interfaces around urban challenges at both local and transnational levels. While most cities do not have a comprehensive science diplomacy strategy in place, the individual initiatives they are developing are a first step towards rethinking, strengthening, and professionalising relations between local policymakers, urban STI ecosystems, and the global scientific community.

Moving forward, the following action areas will be of particular importance for consolidating city-led science diplomacy in ways that foster the science-policy nexus at local level and promote urban sustainability and resilience:

1) *Promote the benefits of the multistakeholderism of city-led science diplomacy*: The multistakeholderism of city-led science diplomacy is one of the outstanding features that distinguishes it from national science diplomacy programmes, which are usually run by specialised government agencies or ministries. Lacking the jurisdiction and resources to replicate these programmes at the local level, city authorities have taken a collaborative ecosystem approach, partnering with STI institutions and actors in their territories to jointly foster transnational scientific cooperation. While born out of necessity, this multistakeholder approach constitutes an opportunity to work within a quadruple helix framework that brings together government, research, industry, and civil society. Its benefits include strengthening of local alliances and networks in ways that extend their transnational reach, and cross-sector cooperation that can accelerate innovation and promote evidence-informed policymaking. If city-led science diplomacy is to become consolidated as a viable practice worthy of funding and investment, these benefits need to be better analysed and promoted.

2) *More multilevel cooperation and coordination is needed:* City-led science diplomacy is driven by city governments and local STI ecosystems. However, to become a fully established field of practice, it requires more political and financial support from regional and national governments, the EU, and the UN. In order to obtain this support, it is important that cities should evaluate the impacts of their science diplomacy actions in the areas of sustainable urban development and resilience. More coordination between national and city-led science diplomacy initiatives is also needed to make them more effective at both levels. In this case, it is important to overcome misleading notions of national and local science diplomacy as conflictual, and move towards a paradigm of cooperative engagement, in which both can benefit from stronger synergies and more strategic collaboration.

3) *Strengthen science-policy collaboration through urban experimentation*: Effective science-policy interfaces at city level, including city-led science diplomacy, require two things. First, they need to mobilise STI actors to address urban problems and, second, to translate the knowledge they produce into information that can be used by policymakers. One way to achieve this is to link city-led science diplomacy initiatives with urban experimentation projects around issues such as climate and smart city transformations (for example, the case of Miami described above). In recent years, cities have become sites of what urban scholars Harriet Bulkeley and

Vanesa Castán Broto have termed "government by experiment": processes that test new socio-technical and governance solutions in urban-living labs and—if they are successful—upscale them. Thriving on cross-sector collaboration, this new form of urban governance has become central to the ways in which contemporary cities address sustainability and resilience challenges. It is fertile ground for policy-science collaboration, and city-led science diplomacy can further enhance this potential by connecting local with international experimentation projects and the knowledge derived from them.

4) *Add a citizen-science nexus to city-led science diplomacy*: Local governments pride themselves on being the closest level of government to citizens. However, so far, city-led science diplomacy initiatives have not lived up to this image as they mainly engage local scientists or highly qualified talent. More could be done to engage citizens by connecting city-led science diplomacy with "citizen science" initiatives. In seeking to build public understanding and trust of science, governments and research institutions worldwide have launched "citizen science" programmes that aim to democratise science by giving citizens a chance to participate in the scientific research process. City-led science diplomacy that is geared towards enhancing urban sustainability could greatly benefit from connecting with these programmes, which tend to support engagement and participation around a more sustainable future by raising awareness and informing and supporting people in adapting to risks. Furthermore, if the science-policy nexus of science diplomacy was complemented with a citizen-science nexus some of the inequalities and socioeconomic divides that exist between cities' internationally connected STI ecosystems and the wider population could be addressed.

5) *Make cities protagonists of "a 'global common's driven science diplomacy"*: Cities could play a key role in fostering the shift towards a global-commons-driven science diplomacy that fosters transnational scientific cooperation to address shared global challenges by moving beyond the self-interest of traditional national science diplomacy strategies. The pragmatism and network logic by means of which cities have engaged in transnational relations and global governance since the 1990s—described by the late Benjamin Barber in his book *If Mayors Ruled the World: Dysfunctional Nations, Rising Cities* (2013)—has been geared towards providing technical solutions to the impacts of pressing global challenges in cities worldwide. The success of global collaboration between city governments stands in sharp contrast to the gridlock and growing tensions between nation states that have characterised large parts of the multilateral system. City-led science diplomacy could be a powerful tool, on the one hand, to further strengthen shared efforts by cities to address global challenges in their territories, and, on the other, to foster a new form of pragmatic science diplomacy that operates beyond political and ideological differences to work for the common global good.

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