JIAS
JOHANNESBURG INSTITUTE FOR ADVANCED STUDY
AN INITIATIVE BETWEEN THE UNIVERSITY OF JOHANNESBURG
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SCIENCE DIPLOMACY IN AFRICA

Concepts, praxis, prospects

Edited proceedings of a workshop held on 15 April 2016 in collaboration with the University of the Witwatersrand; the Centre for the Advancement of Scholarship at the University of Pretoria; and the Department of Science, Technology, Engineering and Public Policy at University College London.

WORKSHOP SERIES NO 1

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NANYANG TECHNOLOGICAL UNIVERSITY

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Edited proceedings of a workshop held at the Johannesburg Institute for Advanced Study on 15 April 2016, and organised in collaboration with the following institutions:

Department of International Relations, University of the Witwatersrand

Centre for the Advancement of Scholarship, University of Pretoria

Department of Science, Technology, Engineering and Public Policy, University College London

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ABOUT THE WORKSHOP

THE GROWING role of science diplomacy and its significance for South Africa and Africa were examined at an international workshop held in Johannesburg in April 2016.

The workshop was organised by the University of the Witwatersrand; the Department of Science, Technology, Engineering and Public Policy (STEaPP) of University College London (UCL); the Centre for the Advancement of Scholarship at the University of Pretoria; and the Johannesburg Institute for Advanced Study (JIAS).

Held at JIAS, it brought together academics, policy-makers, practitioners and others from South Africa, the United Kingdom, the United States and Canada to consider this increasingly important concept in international relations theory and practice, and its significance for South Africa and Africa.

Aspects covered included conceptual models of science diplomacy; science diplomacy in context; the role of science diplomacy in southern Africa; the role of science diplomacy in fostering co-operation and development; the science academy perspective; and the future of science diplomacy.

Welcoming the participants, **Prof David Hornsby**, associate professor of international relations and assistant dean of humanities at the University of the Witwatersrand, said the workshop provided a valuable opportunity to discuss science diplomacy in Africa with international scholars, including those from UCL, with whom he had been collaborating and held a joint grant from the British Academy. It was also valuable to have participants from government and esteemed science academies to talk about this cross-cutting issue. Among others, they would consider how science diplomacy related to South Africa's engagements beyond its borders, but also Africa's projection and engagement on the international stage.

INTRODUCTORY OVERVIEW

Dr Jason Blackstock, head of UCL STEaPP and senior lecturer in science and global affairs at UCL, said the term 'science diplomacy' had come into popular use in the last decade and a half, mostly from a practitioner side as opposed to a scholarship side within international relations literature. STEaPP had begun to run projects with a variety of international collaborators, including Wits University, to try to assess the value of talking about science diplomacy.

Its work was prompted by the fact that scientists were increasingly participating in major international negotiations around issues such as climate change with no prior experience of or training in international politics. Therefore, one of STEaPP's main motivations was to consider how scientists and engineers were being prepared for their growing roles in shaping global affairs.

IR scholars had examined the way in which science and technology and technologies themselves had shaped global affairs, but had paid less attention to the role of scientists and engineers as individuals within those systems. The conversation around science diplomacy should focus on this issue. Royal societies and national academies of science which were playing a major structuring role in funneling scientific expertise into the discussions through to the more recent interna-

tional processes such as the Intergovernmental Panel on Climate Change (IPCC) had themselves become governance structures, but were often not governance structures of the state.

'Therefore, one of the main things we have been trying to conceptualise in thinking about the role of scientists in international affairs is the extent to which they are playing a role within the state, or as actors on behalf of the state, and the extent to which they are acting instead as independent diplomatic actors in trying to frame issues, establish norms, and set standards, in ways that aren't necessarily controlled by the state but are much more independent.'

Whereas diplomats were motivated by state objectives, scientists were motivated by a different set of objectives and goals which were more cosmopolitan, and more oriented around issues that transcended boundaries.

Dr Blackstock noted that current thinking about science diplomacy was influenced by a report entitled *New Frontiers in Science Diplomacy* (2010), published by the American Association for the Advancement of Science (AAAS) and the Royal Society in the United Kingdom. The report had identified three activities:

Science in diplomacy was the basic idea that diplomats representing states or international organisations often had scientists or engineers as technical advisors. Their role in this instance was not to set the agenda, but to advise on technical issues.

Science for diplomacy comprised activities in which scientific endeavours such as the European Organisation for Nuclear Reserach (CERN), the international space station, or the exchange of scientists during the Cold War played a vital role in establishing other diplomatic channels. It was often led by international institutes, and resulted in track two diplomatic processes. It had led to a set of relationships and networks that built cultural networks and cultural exchanges, but was not necessarily driven by the state because the scientists were engaging directly around scientific issues. **Diplomacy for science** involved diplomacy around science and technology agreements.

Those three frameworks were useful from a practitioner point of view, but did not take account of international relations theory. This was why STEaPP had set out to expand this framework, and ask what other roles scientists might be playing.

In a subsequent discussion, a participant noted that most of the conversation around science diplomacy was about the natural sciences. However, it was important to recognise that human rights, for example, had been spread by people active in the humanities.

Responding, **Dr Blackstock** said the incorporation of the social sciences was one of the major questions in science diplomacy. The conversation thus far had predominantly focused on the natural sciences and engineering. There was no cross-fertilisation with the social sciences and their vital role, which raised issues about the boundaries for the discussion.

Another participant noted that there was a need for dialogue between the natural sciences and the humanities because of the way in which key problems addressed by science diplomacy was embedded in society. For instance, there was a growing awareness that unless environmental problems and global warming were addressed from the point of view of the humanities, little progress would be made. This was because these issues also involved human behaviour and embedded cultural norms. The question then was how the humanities should be employed to understand these problems.

Responding, **Dr Blackstock** agreed that issues of interdisplinarity were central to the conversation. Talking about science diplomacy tended to focus the conversation at the international level. However, most issues around climate change, including issues of equality and resource use required behaviour change on the ground.

One could not have a discussion about the relationship between science and society at the international affairs level only, without having it at the local cultural level — about how it related to national, regional and city decision-making, and social conversations around these issues. These levels had to be interlinked, and appropriate models found for doing so.

PRESENTATIONS

Dr Isayvani Naicker

South African Department of Science and Technology

Dr Isayvani Naicker, *c*hief director: international resources in the South African Department of Science and Technology (DST), spoke about the department's extensive efforts at science diplomacy, aimed at levelling the playing fields for Africa. In contrast with many other countries, South Africa had established a dedicated department of science and technology that managed programmes dealing with socioeconomic innovation, technology innovation and research, and development support. It also managed a major programme of international co-operation, primarily comprising diplomacy around science. This included bilateral and multilateral relations with a range of countries and institutions, as well as dedicated science counsellors in the region, Europe and Asia.

The DST worked closely with South African scientists and scientific organisations as well as international partners. Examples of engagement with science diplomacy included the European Developing Countries Clinical Trials Partnerships; the Group on Earth Observations; the Square Kilometre Array (SKA); and the Accelerating Excellence in Science in Africa programme. These efforts included brokering formations such as BRICS and the G-77, in which developing countries were taking joint positions to counter the hegemony of the developed world.

The DST worked in the framework of national policy, but also the AU's Science, Technology and Innovation Strategy for Africa (STISA). South Africa had its own positions, but it took relations with Africa very seriously, and had to ensure that it followed an African position as well. Among other things, science diplomacy was about resources, and investment in science. In working with its partners, the DST sought to access resources, expertise and partnerships for South Africa as well as its African partners.

The clinical trials partnership was a major public–private partnership between Europe and sub-Saharan Africa aimed fighting infectious diseases through capacity-building clinical trials. Significantly, it was marked by African co-leadership and co-investment.

Group on Earth Observations was an international alliance for harnessing earth observations to improve policy-making for sustainable development. Africa had played a leadership role equal with the Americas, Asia and Europe since the programme's inception. Among other things, the

programme allowed South Africa to express the concerns of the developing world around 'data democracy', and the need to start its own data gathering capacity-building initiatives.

The SKA was a global partnership to build the world's largest radio telescope in South Africa and Australia that had captured the global and local imagination. Africa would not only host the infrastructure, but would co-design, co-fund, co-build and co-use the instrument as well. It demonstrated how, by exploiting comparative advantages, and through its own smart investments, Africa could win a seat at the global research table.

The SKA presented specific challenges, and South Africa was engaged in constant discussions with its African partners, who wanted to understand the role they were playing. SKA remained an international organisation, soon to become a treaty organisation, and the infrastructure would be owned by all the countries investing in it. Countries would need to pay a million euros to become a member of the treaty organisation, which was already a barrier to entry. Therefore, the traditional power brokers were still playing a dominant role. However, the project was important because it gave South Africa and Africa access to capacity-building around science technology and innovation. In this sense, it was hoped it would do for Africa what CERN had done for Europe.

These three partnerships illustrated different aspects of science diplomacy at work in the DST, including the challenges they generated, but also the huge opportunities they provided for engagement. Among other things, science was a global competition for resources, and access to resources. Given that Africa could not compete on an equal basis, it was losing many of its best people to other countries and regions. However, the DST was trying to ensure that proper investments were made in South Africa, Africa and the global South to arrest and reverse this one-way movement of people.

It was also examining the latest trends in science, technology and innovation in order to establish South Africa's comparative advantages. These included the southern skies, utilised for the SKA, as well as the Benguela Current, which was key to understanding climate change. The challenge was to form Southern research alliances for understanding this global resource instead of allowing Europe to continue doing so.

Prof Renfrew Christie

Royal Society of South Africa

Prof Renfrew Christie, fellow of the Royal Society of South Africa and retired Dean of Research at the University of the Western Cape, spoke about the ethics of science diplomacy, and its importance to Africa and African states. Scientific truth, he said, was difficult to know and use. Both science and diplomacy inevitably involved dishonesty, although the vast majority of scientists and diplomats were not crooked.

The population of Africa would more than double in the coming 35 years. This need not be a Malthusian disaster, but could be a wonderful opportunity. The techniques to make it an opportunity were diplomacy and natural as well as social science. Diplomacy to avoid war was vital to Africa's future. Science, put to use – as originally intended by the Royal Society – to find new ways of feeding and housing people and keeping them healthy was equally vital to the African future. Crooked science and dishonest diplomacy would have substantially negative effects on Africa's future — not least, war.

Hoping to make science more honest, the world's academies of science had signed off on a global code for practising science in an ethical way. Associations of world academies of science had led a process to arrive at an agreed code of how to do science responsibly, in which he had participated.

This had resulted in a report on responsible conduct in global research (2012), as well as a book entitled *Doing Global Science: A Guide to Responsible Conduct in the Global Enterprise* (Princeton University Press, 2016). While it had been difficult to arrive at a globally agreed text, it was the first attempt to codify scientific integrity at the world level.

Recent evidence that randomised drug trials had been improperly influenced by pharmaceutical companies showed just how serious the problem of dishonest science might be. 'Scientific diplomacy in Africa cannot afford such things going forward.'

Joseph Senona

SA Department of Science and Technology

Joseph Senona, a senior official in the South African Department of Science and Technology, spoke about South Africa's science and technology (S&T) diplomacy in Africa. Strategic challenges in respect of science and technology were to:

- Increase South Africa's investment in research and development, by increasing expenditure on R&D from 0,7% of GDP to 1,9% by 2019. A related goals was to develop more accurate measures of R&D investments in both the private and public sectors.
- Expand research and innovation capacity by increasing the number of PhDs from 1 800 a year to 6 000 a year, reaching 100 000 by 2030; reducing inequalities in terms of race, gender, and regional or institutional distribution; and pursuing the Centre of Excellence and South African Research Chair initiatives.
- Improve innovation capacity and technology transfer, among others by addressing the innovation gap and capitalising on social innovation.
- Improve international co-operation (i.e. science diplomacy), which was vital for reaching the targets set out by the National Development Programme (NDP).

S&T diplomacy was an extension of South Africa's evolving post-apartheid foreign policy in Africa, and formed part of the African renaissance. In this context, there was a debate about South Africa's role on the continent as a pivotal or hegemonic state. Given this, it was incumbent on South Africa to avoid unilateral action, and adopt an approach marked by multilateralism, consensus and regionalism. This target was constrained by ideological and conceptual inconsistencies in foreign policy.

S&T diplomacy complemented political, economic, commercial and cultural diplomacy. It had several specific components. Diplomacy in Africa was bi-directional, aimed at observing or reconciling national developmental interests as well as the interests of South Africa's partners. Processes and role players included government departments, agencies, public–private partnerships and transnational corporations, working from the top down and from the bottom up. Instruments employed included bilateral, trilateral, multilateral and regional diplomacy as well as aid diplomacy.

The S&T agenda included continental and regional policy goals spelled out in the NDP. It was pro-development, aimed at addressing joint systemic challenges via co-operation.

The pro-development science, technology and innovation (STI) agenda included addressing challenges in respect of poverty, unemployment and inequality by means of R&D, and encompassed activities in agriculture (bio-technology and bio-innovation), energy (renewable energy), indigenous knowledge systems, natural resources, and space science and technology.

The pro-competitive STI agenda included technology-based commercial diplomacy; industry-based sector priorities, including diversification, beneficiation and commercialisation; intra-African technology transfer; and joint investments and partnerships in technology platforms and innovators. The continental STI agenda included NEPAD as well as AU and SADC sector policies.

Modalities and platforms for S&T diplomacy included bilateral diplomacy, multilateral diplomacy, and resource mobilisation and engagement. Among other things, South Africa had 23 African bilateral partners. Multilateral diplomacy included helping to set and govern relevant agendas for the AU and SADC.

Prof Coleen Vogel

University of the Witwatersrand

Prof Coleen Vogel of the Global Change and Sustainability Research Institute at the University of the Witwatersrand spoke about the IPCC and its implications for science diplomacy. Drawing on her experiences as co-ordinating lead author for the fourth assessment, and a lead author for the chapter on human security in the fifth and most recent assessment, she said the IPCC was an interesting case because it undertook forms of science diplomacy.

The IPCC had developed around 1988, and had assumed various forms. It basically tried to reach consensus and generate a set of essential messages around phenomena like global warming, which could be taken into climate change negotiations. It dealt with very difficult issues, not least the complexity of the scientific challenge.

Assessments were done every five or so years. Participants were nominated by governments and IPCC observer organisations, and their participation was voluntary. Essentially, their role was to draft and formulate the texts, particularly the final summaries, which were aimed at enhancing science–policy interactions. The texts went through various reviews and iterations, including government reviews, amounting to a very thorough audit, and eventually yielding a 'gold standard' in the form of a summary for policy-makers.

One of the problems surrounding the IPCC was its burgeoning size. In the beginning, only natural scientists were involved, but as soon as one tried to bring in social, economic and other factors, the teams expanded.

Various climate models and other science showed that Africa was one of the continents most at risk. Issues had arisen, for example, around the use of gray literature. These included questions of interpretation, which generated extensive debates.

All this raised a range of issues around the next set of assessments – about how the process should be bounded, and whether the science and resulting forms of diplomacy should primarily be regional or international. Some scientists who had participated in the IPCC continued to call for greater trans-disciplinarity, co-production, and co-design as a means of strengthening the research on these kinds of issues and agendas. The problem was that there was a lot of talk about these sorts of processes, but little solid evidence of their efficacy.

Some scientists involved in the IPCC were part of an organisation called Future Earth, which sought to enhance the use of knowledge for global change by engaging in knowledge action networks.

Broader issues raised by the climate change community around science–policy engagement included:

- Whose knowledge counts? Gray literature, for example, was interesting, but the veracity of the data remained a challenge.
- Many scientists still employed a linear model of communication in which they 'threw their work over a wall' in the hope that it would be picked up.
- Allied to this, some scientists were still working with a 'deficit model' in terms of which they undertook science for science's sake, and assumed that the public had little scientific knowledge.

Prof David Hornsby

University of the Witwatersrand

Prof David Hornsby presented a case study of science diplomacy in African food safety governance. Besides its importance for human health, food safety governance was central to African economic development. The World Trade Organisation (WTO) sanitary and phytosanitary agreement (SPS) essentially stated that trade in food could only be restricted on a scientific basis. This placed food safety in an economic frame. In this context, a growing need was evident for African input into the SPS discussions and science-based regulation as a means of addressing its economic interests. This was an example of science for diplomacy.

Attending to the SPS agreement and other international regulations required significant scientific capacity, which most African countries lacked. South Africa was an exception, but also faced certain challenges.

Food safety was governed globally by a set of overlapping and interconnected institutions. The WTO, through its SPS agreement, was arguably the key institution in the global regulation of food safety. There were also sets of institutions involved in setting up standards. In Africa, regional economic communities, including SADC, ECOWAS and the EAC, played significant roles in efforts to implement international food standards.

International institutions translated down into the functioning of states, and how they approached their own food safety governance and food safety systems. In South Africa, different institutions had different sets of relationships with the international food safety complex, at the international and national level. There seemed to be no connections between the DST and food safety governance. However, the Department of Agriculture Forestry and Fisheries, the Department of Health, and the Department of Trade and Industry all played prominent roles.

The international food safety complex was engaging with Africa in a process of diplomacy for science – trying to deal with the capacity deficit in African states, and their desire to participate in food safety governance. In particular, a large portion of the Standards and Trade Development Facility budget was directed towards Africa, with 32% of funding going to Africa-related projects. Similar initiatives existed in other institutions. This was aimed at increasing African engagement

with the SPS agreement, but also its capacity to challenge trade-restricting food safety regulations.

From 2008 to 2014, different institutions had undertaken specific interventions, resulting in an increase in the number of African countries contributing to development standards, complying with those standards, and demonstrating a capacity to comply through notifying new regulations via the International Food Safety Complex. African states also increasingly challenging food safety-related trade barriers.

One example was the issue of GM foods and the EU. When the EU restricted or banned all GM foods, African states had to prove that none of their products were GM-related, but did not have the capacity to challenge those regulations. They just had to accede to them in order to gain market access. This had significant economic implications for African countries; however, they were increasing challenging these sorts of issues.

In terms of science for diplomacy, one could see an increase in how African states were engaging in trade-related food safety discussions, and utilising scientists and scientific information to help advance their economic interests. South Africa was currently doing this in three instances.

The first was the EU citrus black spot concern. South African citrus fruit was essentially banned from access to EU markets because of this fungus. However, scientists were actively questioning the regulations. This process was ongoing, but showed a significant change in how South Africa in particular was utilising science for diplomacy in its own economic interests.

The second was the dynamic around the AGOA agreement which provided South Africa with preferential trade access to US markets. The US wanted access to South African markets for poultry products, and used the threatened withdrawal of AGOA as a bargaining chip. South Africa maintained serious SPS concerns around American poultry products, particularly in respect of avian flu, and had succeeded in ensuring that all imported chicken products were certified.

South African scientists had also tried to restrict Brazilian pork imports due to swine flu. Again, the negotiations featured scientists advancing South Africa's economic interests.

Dr Adrian Tiplady

SKA South Africa

Dr Adrian Tiplady, site bid manager for SKA South Africa, spoke about the SKA as a prominent example of an African project incorporating various aspects of science diplomacy. The SKA, he said, would form part of a family of next-generation astronomical facilities. Given increasing improvements in technology and the performance of radio-astronomy facilities, the number of locations where radiotelescopes could be built had decreased to the point where this effectively enforced multinational collaboration on establishing any new facilities.

The SKA would be a multinational mega science facility, 100 times more powerful and sensitive than anything built previously. This was a significant jump that imposed significant new requirements in terms of technology. The cost of the first phase would be capped at about 650 million euros, and the cost of the second phase at about 3 billion euros.

The project started in about 1990, when astronomers sat down to determine what kind of instrument would be needed to answer the most pressing scientific questions. Given that it would take

some 20 years to build, it had to be future-proof.

The next step was a competitive bid process, which was run by an international committee, and lasted for about eight years . The final recommendation in 2012 was that the SKA should be co-hosted by southern Africa as well as Australia and New Zealand. On the way to winning the bid, the South African team faced the challenge of defeating Afro-pessimism in the form of widespread doubts that an African country could host this type of facility. In the end, the decision was taken by a panel of policy scientists, policy-makers and others.

In 1993, a Large Telescope Working Group (URSI) was established. This was followed by a memorandum of understanding between eight institutions in six countries in 1997, and the formation of an international SKA steering committee in 2000. An international SKA project office was established in 2005, and called for proposals to host the SKA. An international collaboration agreement was concluded in 2008, providing for a science and engineering committee and a project development office. This led, in 2011, to the establishment of the SKA Organisation, a private company registered in the United Kingdom, which still managed the project today.

Nine countries were represented on the board in various different ways. Given this, the SKA Organisation was limited to preconstruction activities, and an international consortium comprising companies, universities and other institutions had been established to design the first phase of the SKA facility. It was self-organised and self-funded to the tune of 150 million euros.

Recognising that a private company was not an appropriate vehicle for procuring, constructing and operating the SKA, the board decided to establish a multinational organisation in the form of a treaty organisation. This was an innovative decision, given that there were no pre-existing examples of a private company turning itself into a treaty organisation and transferring its obligations, responsibilities and decisions to such a new entity.

Italy was appointed to facilitate the negotiation process. Talks began in November 2015, aimed at developing an SKA Observatory convention and financial protocol that would be ratified by future members of the SKA Observatory. Four working groups were established to deal with other policy issues.

This process faced several major challenges. The first was to make appropriate arrangements for transferring the obligations of the existing company to a future treaty organisation. The second was to align policy timelines with engineering timelines.

The third was to deal with the expectations of the negotiating parties, notably to persuade them that the treaty organisation would be able to take effective decisions, and that they did not need to take all the major decisions up-front.

The fourth and most difficult challenge was to deal with returns on investment. Countries liked to invest in projects that would show domestic returns in terms of research and technology, and did not like investing in the research infrastructure of others. Therefore, when governments invested in a multinational project like the SKA, they expected contracts with roughly the same value to revert back to their own economies. This amounted to a culture clash with the astral community, traditionally an open scientific community marked by international collaboration in which any astronomer could gain access to any facility in the world based purely on scientific merit. By contrast, governments seeking returns on their investments tended towards restricted access. This

created the challenge of maintaining a reasonable balance of 'science versus politics', in order to ensure that significant access to the facility would remain science-based.

One of the key reasons for investing in the MeerKAT telescope as a precursor to the SKA was precisely to deal with Afro-pessimism – to prove to the world that South Africa could design, host and operate a major radio astronomy facility. While the SKA would be 100 times bigger and better than MeerKAT, the latter would still be five times bigger and better than any existing facility. So even this was considered to be a next-generation facility. It would be completed in 2017.

Dr Kaera Coetzer-Hanack

Global Change and Sustainability Research Institute

Dr Kaera Coetzer-Hanack, a post-doctoral fellow of the Global Change and Sustainability Research Institute (GCSRI) at the University of the Witwatersrand, reported on a study aimed at identifying the reasons for poor collaboration among scientists, policy-makers and practitioners in biodiversity conservation in southern Africa.

The conservation literature acknowledged the notion of a disconnect among science, policy and practice. However, it tended to blame this on incomprehensible academic jargon and inaccessible scientific journals, and the solution offered was to improve the packaging of information. In her work in the conservation arena, she had become increasingly dissatisfied with this diagnosis, as well as the proposed solution. Put differently, the problems were more deep-seated than a communication disconnect caused largely by scientific jargon and journals.

Informed by the work of Peter Haas on epistemic communities, and the work of Claire Dunlop on mechanisms for negotiating knowledge use, she set out to gain a better understanding of the views of conservation actors – effectively forming different knowledge communities – involved in science-policy-practice relations in this field. This included their perceptions of the dialogue; their views of their roles and the roles of other actors in shaping conservation outcomes; and their personal and organisational motivations for engagement.

At issue was the sharp contrast in habitat between communal rangelands and adjacent conservation areas such as the Kruger National Park. Communal rangelands were used in many different ways, notably for subsistence agriculture. Impacted land use and settlement had resulted in a steady decline of intact habitat outside the park, which were increasingly affecting the park.

By 2018, if current trends continued, the Kruger habitat would cross a transformation threshold beyond which its ecological resilience would start to suffer. The park was an open protected area. There were often no fences between the park, Zimbabwe and Mozambique, and where they existed they were increasingly permeable. In the past ten years, human activities had gained malicious intent, as demonstrated by holes in the Kruger–Mozambique fence line with poaching implications, and holes in the Kruger–Zimbabwe fence line made to get livestock into the park. These developments began to raise questions around the future of these protected area systems.

Added to this, climate change predictions were that southern Africa would experience a temperature increase of 2–3 degrees above the global mean, and a decrease of up to 20% in precipitation. This created increasing uncertainty about the degree to which current conservation strategies would be able to respond to future challenges. This required more responsive biodiversity governance, and therefore better science–policy–practice relations.

The study comprised an online survey, followed up with telephone interviews. Respondents included members of academic and non-academic research institutions; government officials; science advisors to policy consultants; communication experts; and conservation practitioners and land managers. Most respondents were based in South Africa, but other southern African countries were also represented.

Preliminary results showed that all the respondents identified a need for better science–policy–practice relations. The three main issues identified were access to knowledge; perceptions of other actors; and issues of trust. Factors affecting access to scientific knowledge included inaccessible academic language; the costs of accessing research literature; the disconnect between the format of academic articles and the needs of decision-makers; and long delays in publishing peer-reviewed articles. By the time research was published, one respondent said, the practical world had long since moved on, or sourced alternative information.

Recommendations by researchers often failed to take account of the social, economic and political climate in which decision-makers had to operate. This perpetuated the belief among practitioner groups that science was largely unusable, and did not lead to actionable decision-making. This in turn perpetuated a preference for established pathways of knowledge, notably experiential or tacit knowledge within practitioner groups.

Negative perceptions of other professional groups undermined further engagements. This included the belief in the research community that practitioners preferred the inputs of other practitioners over those of researchers. As a result, they were disinclined to engage, even while recognising that collaboration needed to take place. Practitioners felt that academic researchers' superior attitudes towards non-academic professions was a major impediment to collaboration. This negatively influenced the likelihood of practice-to-science engagements.

All respondents acknowledged that published research increased the legitimacy of the decision-making process. However, trust among professional groups were limited, and views differed on what constituted trustworthy information. Researchers universally trusted the academic culture of accredited research, i.e. peer review, and saw individuals as less important than practitioners. By contrast, practitioners favoured personal relationships over other avenues of knowledge provision, indicating that other practitioners were preferred information suppliers, and that the 'vetting' of information by practitioners might be an important factor.

The study had begun to unpack the motivations and beliefs that drove a willingness to collaborate within and among professional silos. It had found that the way people viewed themselves and others shaped their willingness to use new pathways of knowledge, which affected the likelihood of true knowledge co-production in turn. It had confirmed that the issue was not confined to a 'communication disconnect', a finding which opened the way to building mechanisms for supporting improved collaboration.

Dr Carla Washbourne

UCL STEaPP

Dr Carla Washbourne, lecturer in environmental science and policy at UCL STEaPP, spoke about science diplomacy in cities in the form of knowledge use in respect of green infrastructure.

Ongoing interest at UCL-STEaPP in the interface between academics and policy-making had led

to a project aimed at understanding and improving the use of physical science and engineering knowledge in decision-making around urban green spaces.

Key questions were how physical science and engineering knowledge were mobilised in urban decision-making and design; how physical science and engineering knowledge were being applied in the quantitative and qualitative assessment of urban green spaces; how these topics were discussed by scientists, engineers, decision-makers and local communities; and which tools, methods and approaches could contribute effectively to decision-making in this area.

The intended outputs were academic and practical insights into knowledge generation and mobilisation and decision-making processes around urban green space, as well as the development of toolkits and guidance in collaboration with stakeholders.

The project involved research partners in London, the Gauteng city region, Birmingham, Singapore and San Francisco. Two prominent case studies were UCL-STEaPP's work with the Greater London Authority and its Green Infrastructure Task Force, as well as with the Gauteng City Region Observatory, a partnership between the University of Johannesburg, the University of the Witwatersrand and the Gauteng provincial government.

In London, growing interest in the greening of urban spaces had led to the formation of a Green Infrastructure Task Force, comprising scientists, engineers, planners and decision-makers. Following intensive research, data-gathering and analysis, the project resulted in a report entitled *Natural Capital: Investing in a Green Infrastructure for a Future London,* which provided a framework for thinking about green infrastructure going forward.

Similar work by the GCRO had resulted in a report entitled *State of Green Infrastructure in the Gauteng City Region* (2013). The GCRO had also held a series of meetings called Green Infrastructure Citylabs where decision-makers and practitioners gathered to discuss the findings, and plot the way forward. She hoped to discuss these and other aspects of the project with role players in the following weeks.

Prof Francis Thackeray

Royal Society of South Africa

Prof Francis Thackeray, president of the Royal Society of South Africa, spoke about science diplomacy from a science academy perspective. In his view, science diplomacy operated at the international, national, institutional and individual level.

Examples at the international level included the International Council for Science (ICSU), which worked, among other things, on climate change, sustainable development and the universality of science; CERN, established in 1954 by 12 western European countries, and with 21 member states today; and the AAAS, which ran a centre for and publication on science diplomacy. Relevant examples at the continental and subcontinental level included the African Scientific Institute, established in 1967; and the Paleontological Society of Southern Africa.

Examples at the national level included the National Research Foundation; the Royal Society of South Africa, the Academy of Science of South Africa, and the recently established Centre of Excellence in Palaeosciences, hosted by the University of the Witwatersrand, in which the newly formed Evolutionary Studies Institute (ESI) played a key role.

As regards the individual level, staff at organisations such as the ESI were all science diplomats, interacting with government, overseas visitors, and a range or national and international institutions. Those attending the Pugwash Conferences on Science and World Affairs did so in their personal capacity, and did not necessarily represent their countries.

Prominent scientists in South Africa who could be said to have played a science diplomacy role included the paleontologists Robert Broom, who not only practised science but also played a major role in promoting the public awareness of science; and Phillip Tobias, who also played a prominent role in upholding human rights in South Africa.

Another example of science as science diplomacy was the 'Walk Through Time', a series of granite slabs at Sterkfontein in the Cradle of Humankind, telling the story of human evolution over 14 billion years. A project of the Royal Society of South Africa, and undertaken from 2000 onwards, it was supported by the then ministry of arts, culture, science and technology and many other institutions, including Wits University, the Transvaal Museum, and others. These stones were seen by young people from all over the country, as well as people from all over the world, including role players in global politics visiting the caves.

Against this background, science diplomacy could be defined as 'the promotion of science and good relations within and between institutions and nations, from the individual to the international level, aimed at the attainment of a healthy society and a stable planet, thereby stemming the sixth extinction.'

Dr Tolu Oni

South African Young Academy of Science

Dr Tolu Oni, senior lecturer in public health at the University of Cape Town and co-chair of the South African Young Academy of Science (SAYAS), spoke about science diplomacy from a science academy perspective. She also spoke on behalf of the Academy of Science of South Africa (ASSAf).

While science diplomacy in action also encompassed science in diplomacy as well as co-operation to advance scientific disciplines, she said she would focus on science for diplomacy, involving co-operation and engagement with society and policy-makers.

A notable example of science diplomacy in Africa was the Next Einstein Forum initiative, essentially aimed at raising the profile of science for development on the continent, which had led to a global gathering in Dakar in March.

ASSAf's pursuit of science for diplomacy included engagement with policy-makers; engagement with wider society; supporting the training of scientists to engage with policy-makers and wider society; and advocating the importance of science advice and communication skills. To this end, ASSAf managed a major science advisory programme encompassing health; science, technology, engineering and mathematics (STEM) education; biosafety and biosecurity; climate change; humanities; and the reduction of poverty and inequality. SAYAS was represented in these standing committees.

Young academies were a new global movement comprising about 25 national young academies, including ten in African countries. Most were affiliated with senior academies. Members were

post-doctoral scientists younger than 40, elected in like members of senior academies, based on academic excellence and a commitment to science for society.

In line with this, an active engagement with society, among them schools, was one of SAYAS's key strategic goals. Another was to provide emerging scientists with training appropriate to a post-normal era, enabling them to engage across disciplines, and adopt a more dynamic approach to science. In these and other ways, SAYAS sought to remain in tune with emerging issues of societal relevance.

Besides focusing on increasing science literacy in society, SAYAS believed it was important to focus on increasing the societal literacy of scientists – thereby not just placing the onus on society to understand science, but on scientists to engage bidirectionally, and understand relevant social issues.

SAYAS proactively addressed issues around disciplinary representation and gender equity, as it believed one could not relate to society without being representative of society. SAYAS was also working to step up the Africa chapter of the International Network for Government Science Advice (INGSA), notably by building science diplomacy and science–policy interface training into the training of young and emerging scientists.

Against this background, Dr Oni offered a definition of science diplomacy as 'science-driven policy advocacy to improve collaboration in science and promote development'. She also quoted the following definition by sir Peter Gluckman: 'The way science engages with both society and the policy process, and the way these both engage with science, will shape our progress as nations and as a global society.'

Prof Jeremy McNeil

Royal Society of Canada

Jeremy McNeil, Helen Battle Professor of Chemical Ecology at Western University in London, Ontario, and foreign secretary of the Royal Society of Canada (RSC), spoke about the society's activities as well as contemporary challenges surrounding 'evidence-based' policy decisions.

Established in 1883, the RSC comprised three academies of arts and humanities, social sciences and sciences. It had also played a role in establishing the College of New Scholars, Artists and Scientists, a national system for recognising emerging Canadian intellectual leaders established in 2014.

The RSC interacted with government by appointing expert panels to examine relevant issues. The subjects were not only chosen by fellows, but also by members of the public. Some subjects, including oil sands, end-of-life decision-making and marine biodiversity, had been taken up by other countries.

It participated in the Council of Canadian Academies, an independent organisation funded by government which also produced expert reports. The government submitted subjects, upon which the panels were set up.

The RSC also interacted with other national academies. A recent project was 'Frontiers in Science', a gathering attended by 25 young British scientists and 25 Canadians on a range of scientific subjects, aimed at fostering interdisciplinary interaction among young people who would become

collaborators over time. It had also undertaken joint projects with the Royal Society of Edinburgh and the Israeli Academy of Sciences and the Humanities.

The RSC was also a member of the Inter-American Network of Academies of Science, aimed at supporting the growth of science academies and scientific strength throughout the Americas. Among other things, the network worked in energy, water, women in science, and science in education. A recent report on water had been downloaded more than 500 000 times.

The RSC had participated in the InterAcademy Partnership (IAP) conference and general assembly for 2016, hosted by the Academy of Science of South Africa (ASSAf). It also participated in a global human rights network that took a position when people were imprisoned for academic activities.

Governments – including the Canadian government under Justin Trudeau –were increasingly undertaking to base policy decisions on scientific evidence. This raised worrying issues around the integrity of scientific evidence as well as its interpretation.

McNeil cited numerous instances where scientific evidence had been falsified. Often, scientific communities as a whole were at fault. Politicians could also not be trusted. Therefore, academies needed to collaborate to maintain the integrity of evidence used as a basis for policy decisions.

A recent example was the controversy around the environmental and social impact assessment (EIA) underpinning construction of the Nicaragua canal, intended to provide a new passage for shipping, notably mega tankers, from the Caribbean to the Pacific Ocean. The Nicaraguan government used the EIA, conducted by a British consulting company and filling 14 volumes, to support a decision to proceed with construction.

It then emerged that the consultancy had invited a panel of environmental scientists and project experts to review the assessment. The panel had concluded that the study was rife with significant flaws. Panel members expressed frustration about insufficient data collection and the pedestrian quality of ERM's analysis, and castigated ERM for 'indefensible', 'implausible', 'wrong' and 'unrealistic' scientific conclusions. As a result, various science academies had joined forces to organise an international workshop aimed at examining the major scientific and technical questions associated with the canal.

Given these trends, scientific diplomacy should encompass joint efforts by academies and individual scientists to ensure that major police decisions were based on sound science and sound evidence.

CONCLUDING DISCUSSION

Dr Jason Blackstock said that, following the day's discussions, participants needed to reflect again on three basic questions. The first was whether the concept of science diplomacy was useful for scholarly enquiry, the activities of a range of national and international institutions, and thinking about this interface.

The second was what capacities most needed to be built. The training of individuals was one aspect, but building institutional capacity was another. 'Do we have the right ecosystem of institutions, or are there gaps in that landscape?'

The third question related to the South African context. Participants had begun with global conversations, and worked their way down to local conversations which remained related in different ways to international affairs and the global order. Participants needed to reflect on this transition from science diplomacy to a discussion of knowledge systems and government systems.

Two useful examples had been mentioned. Pugwash represented a traditional model of science diplomacy at a time when Albert Einstein could write directly to President Roosevelt and assume that his proposals would be placed in the hands of key government decision-makers. This represented a mode of thinking about turning knowledge into action prevalent in the 1950s, 1960s and 1970s, around issues such as nuclear arms and nuclear treaties.

The IPCC represented a later model of science diplomacy in which scientists synthesised their knowledge in order to inform the UN climate negotiations, on the assumption that governments would then make the decisions. However, action would not ultimately be taken by governments but by cities, corporations and individuals.

The actors dealing with energy systems, ecosystem management and city planning were not sitting at the UN climate change convention table, but in local, provincial, and national communities. At that point, the conversation expanded from the natural sciences and engineering to incorporate the humanities.

All knowledge ended up being local in its application, and this related back to whether science diplomacy was the most appropriate concept for dealing with this dimension. Governments around the world were launching science diplomacy strategies, agendas and programmes. The question was whether this was the best way of dealing with these issues.

Secondly, whatever concept was used, capacity gaps clearly existed, and participants should consider where they were located and how they should be addressed. Responses to these questions would shape the agenda going forward for developing education and training, capacity-building, and deeper scholarship and intellectual thought.

Prof David Hornsby suggested that the notion of science diplomacy was a valuable rallying point, but too complex for a fully fledged theory of political science. The issue was whether one could make it work as a jumping off point for engaging with this range of vital issues.

Prof James Ogude of the Centre for the Advancement of Scholarship said it was important to determine whether the notion of science diplomacy aided or limited a meaningful discussion of this dimension in the African context.

Dr Isayvani Naicker said the challenge ultimately was to make a difference in the workplace. At present, scientists and government officials were playing major science diplomacy roles with no formal training. Another pressing need was to prepare young graduates for entering this field.

The practical dimension had to be considered. Scholars could create complex typologies, but the issue was how to translate this knowledge in ways that assisted people who actually undertook science diplomacy in practice. This included the interdepartmental dimension. ‘We face these challenges all the time.’

Prof Peter Vale, director of JIAS, suggested that diplomacy was an outdated notion that could play an arresting role, and create a particular pathway. An alternative term could be international science and social change, with the notion of social change providing the teleological dimensions of science at work to change people’s lives. Presentations about the impending effects of climate

change underscored the need to create something akin to science without borders, which would bring science and society together on a new level.

Responding, **Dr Blackstock** said it was clear that science diplomacy needed to be embedded in a broader programme. However, the EU, Japan, and numerous other countries were spending large mounts on research grants linked to science diplomacy, which spoke to the conversation about its relevance. The workshop had been invaluable from the UCL perspective. UCL actually offered training programmes in science diplomacy, including a master's degree in public administration. The workshop would assist it in thinking about examples, and what it needed to be teaching.

Prof Hornsby said the workshop had provided the first opportunity for a conversation in South Africa across government, science academies and academic institutions. It had been extremely valuable, and the conversation would continue.

In conclusion, **Prof Vale** said the workshop had expanded boundaries of understanding, and provided a leading example of scholars and practitioners getting together to explore paradigms and push them in the direction of social change.

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