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# The InterAmerican Network of Academies of Sciences: An Example of Science-Based Cooperation in the Americas

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SCIENCE and technology (S&T) and their applications pervade almost all aspects of modern existence. We have turned basic scientific knowledge into a treasure trove of technologies to serve human needs.

In most of the Americas, good progress has been made toward meeting a number of the Millennium Development Goals (MDGs), owing in part to the application of science, technology, and medical advances. For example, MDG 1, which is aimed specifically at halving the number of people living with hunger by 2015, is close to being achieved.[1]

At the same time, the twenty-first century presents unprecedented challenges. Global population pressures continue to mount,[2] epidemics such as the Ebola epidemic continue to threaten human wellbeing, climate change is a looming threat,[3] water resources and their management present major problems,[4] there is a dramatic need for new antibiotics,[5] biodiversity loss is accelerating, and adequate

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food production requires innovative technologies.[6] These and a host of other sustainability challenges will confront humankind throughout this century. All of these challenges have solutions in science and its applications, but the choices about which solutions to implement and how best to deploy limited resources to achieve desired outcomes rest with policy makers, most of whom need access to the best scientific advice to carry out their responsibilities.

The idea of accelerating the use of evidence-based decision making is critically important. Global change is accelerating because many resource and sustainability challenges are coupled with increasing population growth. This means that the time to take important actions is growing ever shorter. Major decisions about the climate system, about the species richness of the world, about the efficient use of water resources, and about the food system, to name but a few, will have to be made quickly to avert a poorer future. But the assimilation of science into policy decisions is slow, because the process of repeatability and confirmation by the scientific community takes time. Moreover, the channels of communication between science and policy makers are noisy. Many individuals and institutions claim to speak for science, and policy makers must sort through this welter to find the most credible and trustworthy voices. Finally, policy makers need broad syntheses, whereas most scientists work on narrowly defined problems. The synthesis of a broad picture from an array of specific findings is time consuming. So it is essential for the science community to become more effective in communicating appropriate evidence-based policy options to governments and decision makers.

Most nations have a variety of mechanisms for obtaining scientific and technical advice, but many impediments hinder the quick assimilation of new information by policy makers. The international landscape for science advice is less well developed, owing to the limited role of international governance institutions. Many of these complexities were vividly illustrated in the recent Conference of the Parties conference[7] in Lima, Peru, aimed at achieving agreements on climate cooperation.

A relatively new endeavor in scientific cooperation in the Americas (North America, Central America, South America, and the Caribbean) is based on science academies. The InterAmerican Network of Academies of Sciences (IANAS), a cooperative network, strives to build scientific and technological capacities and strengthen relationships among the countries of the Americas as a tool for societal development. Stronger scientific institutions are essential to the delivery of credible science-based advice to national policy makers on looming challenges and to promoting prosperity and equity in the hemisphere.

## S&T Advice to Policy Makers and the Role of National Science Academies

Every nation has a number of well-developed avenues for S&T advice. These could include informal advice from respected experts. Policy makers often feel most comfortable with people they know and who understand the compromises

and challenges associated with governance. So it is natural to turn to local respected scientific experts for informal advice, especially when quick decisions are required. Every nation also has a cadre of scientific experts within its government. These individuals work for various ministries or agencies, are widely available, and provide a ready source of knowledge and information. At one extreme, the United States government has twelve science departments or agencies, ranging from the Department of Agriculture to the Geological Survey, each employing thousands of scientists. In addition, especially in the post–World War II era, many independent organizations known as think tanks have emerged that seek to provide advice, though sometimes with a political orientation or a particular mission, to governments, usually in specific areas, such as national defense.

Science academies have often served as a useful source of advice. This is perhaps best exemplified by the U.S. National Academy of Sciences (NAS), which was founded as a nongovernmental organization to provide scientific and technical advice when requested by the U.S. government.[8] The U.S. NAS works through expert committees where the experts serve pro bono and provide advice on carefully formulated sets of questions. The expert advice is usually communicated through detailed reports that provide the scientific evidence associated with an issue and that draw conclusions based on analysis of the evidence. The strengths of this system are its independence from outside manipulation and its dependence on a consensus among experts whose knowledge circumscribes the issue in question. In cases where a long-term perspective is needed, the expert-committee system works very well. One weakness of this approach is the time-consuming nature of knowledge synthesis—deliberative, committee-based approaches are not well suited to emergencies.

It is essential that nations be able to access and assimilate global advances in science, technology, and medicine to build a prosperous future.[9] So most nations see S&T investment as an essential means of delivering higher living standards to their peoples. In this regard, science academies can be national assets because they often include among their members the scientific leadership of a nation, making them credible sources of advice to government. Moreover, it is not uncommon for leading scientists to have served in important government posts such as ministries of science and education, so they have access to high levels of government and are frequent sources of informal advice. The leadership of science academies can and often does advocate for policies that promote educational and human resource investment and national support for scientific research.

## The Origins, Governance, and Programs of the InterAmerican Network of Academies of Sciences

European science academies in many cases date from the early Renaissance while the academies of the Americas are relatively young (Table 1). Despite this,

## Table 1: The InterAmerican Network of Sciences (IANAS) Member Academies

| North America | Founded | Members |
|---|---|---|
| Mexican Academy of Sciences | 1959 | 2,499 |
| Royal Society of Canada | 1882 | 2,018 |
| U.S. National Academy of Sciences | 1863 | 2,100 |
| **Central America and the Caribbean** | | |
| Academy of Medical, Physical, and Natural Sciences of Guatemala | 1945 | 68 |
| Academy of Sciences of Cuba | 1861 | 2,018 |
| Academy of Sciences of the Dominican Republic | 1974 | 168 |
| National Academy of Sciences of Costa Rica | 1992 | 43 |
| National Academy of Sciences of Honduras | 2013 | 29 |
| Nicaraguan Academy of Sciences | 2006 | 30 |
| Panamanian Association for the Advancement of Science | 1985 | 124 |
| **South America** | | |
| Academy of Physical, Mathematical and Natural Sciences of Venezuela | 1917 | 50 |
| Academy of Sciences of Ecuador | 2013 | 31 |
| Brazilian Academy of Sciences | 1916 | 506 |
| Chilean Academy of Sciences | 1964 | 80 |
| Colombian Academy of Exact, Physical and Natural Sciences | 1929 | 185 |
| National Academy of Exact, Physical and Natural Sciences of Argentina | 1874 | 34 |
| National Academy of Sciences of Bolivia | 1960 | 47 |
| National Academy of Sciences of Peru | 1938 | 124 |
| National Academy of Sciences of Uruguay | 2009 | 26 |
| **Regional Members** | | |
| Caribbean Academy of Sciences | 1988 | 223 |
| Latin American Academy of Sciences | 1982 | 152 |
| **Observers** | | |
| National Academy of Sciences of Cordoba, Argentina | 1869 | 40 |

Sources: The data were compiled from "By Region," the InterAcademy Panel, the global network of science academies, *http://www.interacademies.net/Default.aspx?id=11023&RegionID=11044,* and *The WfS Census Report* (InterAcademy Network of Sciences, 2014).

most academies of the Americas are modeled on the European tradition. A few countries in the Americas lack academies altogether, owing to small populations or other factors. So, for example, there are twenty-eight Caribbean countries, but about half are territories of major powers (e.g., Puerto Rico is a U.S. territory, Martinique is a French territory, and the British Virgin Islands are a British territory). Of the independent Caribbean nations, only Cuba and the Dominican Republic have national academies, but the Caribbean Academy of Sciences elects scientists to membership from throughout the Caribbean countries (including Central American and South American countries bordering the Caribbean), and it maintains active chapters in Antigua, Barbados, Guadeloupe, Guyana, Jamaica, and Trinidad and Tobago. Mainland countries without academies include Belize, El Salvador, Guyana, Paraguay, and Suriname. But the great majority of the countries of the Americas have academies, and these are interconnected through shared values and shared histories.

IANAS was founded in 2004 at an international meeting of the science academies of the Americas held in Santiago, Chile. The stimulus to create an American network of science academies came from several sources. An important source was the IAP, the global network of science academies, which had earlier helped establish the Network of African Science Academies (NASAC) and saw regional networks as an important mechanism for pursuing its goal of academy capacity building. IAP continues to be an important source of core financial support, and IANAS is nested within the organizational structure of IAP. Other stimuli came from the Organization of American States and the Inter-American Development Bank, which saw an American network of academies as a useful adjunct to their shared goals of economic development and hemispheric cooperation.

The interest in networks as instruments to enhance S&T development is part of the larger globalization trend of the past twenty-five years.[10] The power of IANAS rests in the fact that there are academies in almost every major country of the Americas that are able to disseminate and implement the work of IANAS locally and nationally. This accelerates the transmission of ideas, best practices, and S&T policy innovations throughout the hemisphere to support sustainable development.

IANAS is governed by the triennial IANAS General Assembly (GA), which brings together all twenty member academies to play an equal role in the governance of IANAS. At the GA, members elect two co-chairs and an executive committee that conduct IANAS business between GAs. The Mexican Academy of Sciences (Academia Mexicana de Ciencias) hosts a secretariat that administers the financial resources and work of IANAS. IAP has granted IANAS about US$100,000 per year for the core operating budget and the IANAS member academies have contributed about US$2.50 for every IAP dollar to support the work of IANAS. IANAS has also benefited from various grants to support specific programs,

including support from the United Nations Educational, Scientific and Cultural Organization for some of its work on water resources.

*IANAS Capacity-Building Program*

The core IANAS program aims to build the capabilities of academies to advise policy makers while also working to strengthen scientific communities in the Americas. There have been a number of tangible results from this effort. First, three countries have founded new academies, including Nicaragua, Uruguay, and Ecuador, all three of which have become active in their own countries and in the programs of IANAS.

The Nicaraguan Academy of Sciences has hosted meetings of IANAS programs, the most recent being a major workshop to identify scientific questions associated with the proposed transoceanic canal through Nicaragua. The Canal Workshop was held in Managua in November 2014, supported financially by the Nicaraguan Academy, IANAS, and the Regional Office for Latin America and the Caribbean of the International Council for Science. Despite the initiation of construction of the canal in December 2014, an environmental impact report will not be completed until summer 2015. The workshop, which included twelve distinguished scientists and engineers from Latin America, the Caribbean, Europe, and the United States, was intended to provide independent input for the impact-assessment process. The workshop garnered considerable press attention in Nicaragua and beyond, and it led to an article on the environmental and economic challenges associated with the canal that was recently published in *Environmental Science and Technology*.[11]

The new academy in Uruguay is also off to a strong start by building links to its government and participating in the IANAS programs on water, energy, science education, and women for science. The Academy of Sciences of Ecuador (ACE) began with six founding members in 2013 and inducted its first class of elected members in February 2015. The ceremony to establish the academy included prominent representatives of the Ecuadorian government and international guests. The founders of ACE sought the advice of IANAS as they worked to obtain legal status for the new organization, and despite its very recent establishment, ACE has sent representatives to IANAS program meetings over the last two years.

Several inactive academies have also become active owing largely to the assistance and advice of IANAS, which has likewise provided support when existing academies have been in political jeopardy. In one case where an academy appeared to be under political attack, IANAS sent a delegation to visit with government representatives. This visit resulted in a substantial improvement in the relations between the government and the academy. In another case, where the academy remains threatened, IANAS has held meetings in the country to demonstrate the support for and value of the local academy.

It is also important to note that IANAS statutes allow membership of science associations when an active academy does not exist. Thus, in Panama the IANAS

member is the Panamanian Association for the Advancement of Science (APANAC), an active and very effective participant in IANAS activities. At present, APANAC's president is also Panama's science minister, and he has worked to facilitate a joint APANAC–IANAS-NASAC meeting on water challenges in Africa and the Americas held in October 2014. The president of Panama spoke at an evening event in conjunction with the meeting.

As alluded to earlier, IANAS has launched several cooperative programs aimed at addressing the hemisphere's human and natural resource challenges. These programs are part of the capacity-building program in that all of the academies work together on each program as a means of disseminating best practices and developing effective approaches to the provision of science advice.

IANAS has organized several workshops to address specific issues in the hemisphere. In addition to the cases cited already, IANAS has conducted a workshop on the "Science Funding Landscape" held in Guatemala, a workshop on "Non-Communicable Diseases" held in Brazil, and a workshop on "Challenges and Opportunities in Communicating Science to the Public" held in Argentina. This last workshop included leading science journalists from many countries of the Americas, and it facilitated a constructive dialogue on science communication between journalists and the academies. Many of the journalists have remained engaged with IANAS as a result.

In another example of capacity building, IANAS implemented a program to provide support for short-term scientific visits to U.S. laboratories by twenty-eight early-to-midcareer scientists from throughout Latin America and the Caribbean. This program was supported on a onetime basis by the U.S. Department of State through a grant to the U.S. NAS. The demand for participation was high, and the selection process was very competitive. National academies advertised the opportunity in their respective countries and then selected five finalists from among their applicants to forward to a final selection committee composed of representatives of many IANAS countries. Owing to the onetime funding source, the program was implemented for only a single year, but it has been used as a model for a similar program in Brazil. Exchange programs are vitally important in creating the kinds of international scientific collaborations that will accelerate scientific progress and cooperation.

*IANAS Natural Resource Programs*

In its initial decade of existence, IANAS focused on two key natural resource issues. The first concerns the challenges of water resource management in the Americas. The IANAS Water Program has a number of substantial accomplishments to its credit. It has conducted multiple training workshops for water managers in the Americas and in 2012 it published a major assessment of hemispheric water resources in both English and Spanish.[12] Very recently, a sequel volume entitled *Urban Water Challenges in the Americas*[13] was also published in both Spanish

and English. Both books are available as free PDFs. The first book has received approximately 46,000 downloads in the three years since its initial publication. This book has chapters evaluating water resource issues for most countries in the hemisphere and serves as a valuable resource for decision makers and water professionals.

The work of the water program is carried out by so-called focal points, each of whom is a subject-matter expert appointed by his or her local academy. The focal points meet face-to-face approximately once a year, and by e-mail and Skype more frequently, to set priorities for their joint work. They are also responsible for leading the writing teams for the country assessments featured in the book projects.

The IANAS Secretariat provides financial support (largely travel support for focal point meetings) and assists with editorial and publication decisions. This model of joint collaboration across all academies has been very successful, helping accelerate the transfer of ideas and knowledge back to local academies and scientific communities and, through them, to policy makers. Examples of the acceleration of knowledge transfer are provided by the two books mentioned earlier, wherein the approaches of different countries are presented as a source of fresh ideas on water issues. A second example can be found in the Indálaga website, a resource for sharing inquiry-based science education (IBSE) materials in Spanish. Finally, no substitute exists for the stimulation associated with the face-to-face exchange of ideas, and this is an important feature of the focal point meetings. The collaborative model has also facilitated the growth of informal networks of water experts across the Americas, because the focal points have engaged a wider segment of their national communities in preparing the country assessments, thereby widening the circle of participation. So, for instance, the recent volume on urban water challenges has 120 authors drawn from almost all counties of the Americas.

The second natural resource program is focused on energy challenges. The Energy Program was established following the publication of the InterAcademy Council (IAC) report on the global energy transition[14] with the initial goal of disseminating the report's recommendations to the academies and, through them, to national audiences in the Americas. The Energy Program also works through focal points appointed by each academy, and like in the Water Program, they typically meet once a year. The Energy Program is just completing a report assessing the requirements of populations whose energy needs are underserved in the Americas.

Other program priorities include

- energy and water and the role of women,
- the intersection of energy and water resource challenges,
- biofuels for energy security and the climate, and
- building capacity for achieving an equitable and sustainable energy future.

*IANAS Human Resource Programs*

The 2004 IAC report *Inventing a Better Future* makes the strong argument that human resources in S&T are key to national economic and social advancement. Accordingly, the third pillar of IANAS's work consists of human resource development in S&T, implemented through a Program on Science Education and a Program on Women for Science.

The challenges for science education are similar everywhere in the hemisphere. Children and young adults get turned off science by poor curricula, inadequately trained teachers, and an excessive focus on memorizing facts as opposed to learning through discovery. All academies of the Americas are strongly committed to finding ways to improve science education, and many academies have active programs to improve science education within their own countries. The ultimate goal is to foster both a more scientifically literate public and a larger cadre of scientific professionals in each country. A major achievement is the Science in Your School program of the Mexican Academy of Sciences, now being extended to neighboring countries in Central America. This program engages academy members in providing training to teachers, thereby magnifying its impact by "training the trainers." A second noteworthy achievement is the Indágala website mentioned before, which provides Spanish-language IBSE materials. And once again, the joint collaboration of experts from many countries accelerates the transfer of new ideas and methods.

Like the natural resource programs, the Program on Science Education works through focal points appointed by each academy who meet annually to establish priorities and share information. The most recent focal point meeting was in Lima, Peru, in October 2014, where the priorities were science and mathematics teacher training and IBSE. Many countries in the Americas have started government programs on IBSE thanks to the initial impetus provided by IANAS projects. Presently, the focus is on promoting STEM (science, technology, engineering, and mathematics) education at all levels.

To extend the science education effort to a wider audience, IANAS participated in and helped support a broad-based science education symposium as part of the Congreso Iberoamericano de Ciencia, Tecnología, Innovación y Educación in Buenos Aires in November 2014. In addition, a book of best practices providing a menu of experiences and ideas to improve teacher training is in preparation.

The IANAS Women for Science Program (WfS) seeks to advance opportunities for women in science by enhancing the status of women in academies. Some accomplishments of the WfS program are included below:

- A book, *Mujeres Científicas en las Americas* (*Women Scientists of the Americas*), of brief biographies of prominent women scientists from fifteen of the American countries is available in both Spanish and English.

- A second book telling the stories of inspiring young women scientists in the Americas is in the final stages of production.
- A census of the status of women in the academies of the Americas will be published in mid-2015.
- A prize for scientific achievement was presented to a young woman scientist from Venezuela in 2012.
- Some academies have started awarding a yearly prize for young women scientists (e.g., the Chilean Academy).

A current challenge is to collaborate at the intersections of different IANAS programs. So, for example, WfS has collaborated with the energy and water programs to address the role of women in the energy and water economies. The energy and water programs are cooperating on areas where energy and water resources are tightly coupled, and the Science Education Program has worked with the energy and water programs on teaching modules that emphasize education about the scientific dimensions of these resources.

**IANAS's Continuing Impact**

In total, more than two hundred scientists, engineers, medical professionals, and academicians from throughout the hemisphere have devoted substantial time and effort to making the work of IANAS successful. These individuals come from a wide diversity of countries, but all share a passion for science and a passion for advancing their own countries through science. They work without compensation, and through their efforts and enthusiasm, they validate the notion that a collaborative network stretching from Chile to Canada can produce benefits for society.

Financial sustainability is also a challenge. IANAS has no permanent government sponsor, although it has received several grants from various governments and from private foundations. IANAS is also very fortunate that the staff costs associated with its operation have been generously provided by the Mexican Academy of Sciences, and before that by the Brazilian Academy of Sciences. This has paid for a professional staff that ensures an effective organization.

Nongovernmental organizations like IANAS have considerable potential, but they are dependent on external resources to support their work. Moreover, the goal of providing independent advice requires that potential funding sources meet stringent tests to avoid conflicts of interest. Yet the quest for additional support is essential to delivering full value to the countries of the Americas, and IANAS will need to find ways to grow well beyond its present scale to meet the Americas' twenty-first-century needs.

As noted earlier, IAP provides core support that goes a long way toward making IANAS a viable organization. But that support is not guaranteed, and IANAS

must seek to augment it from other sources. The strategy adopted by the IANAS leadership has been to try to make the organization as valuable as possible to the communities it serves in the expectation that over the long term this will attract additional financial support.

The network approach is powerful because the academies represent nodes in each country through which ideas and solutions to problems, both old and new, can be quickly disseminated. Because each academy is a node in the network, and because each academy has the potential of influencing policy makers in its own country, IANAS can help enhance and accelerate the adoption of evidence-based policy in national decision-making. The collaborative nature of the focal point system also helps quickly spread best practices and new ideas, because it involves cooperation across many countries.

The IANAS endeavor represents an effort to accelerate the adoption of evidence-based policy in the American hemisphere, and the initiative can point to many successes in its first decade. For example, IANAS has released several substantial publications that address critical issues, including unique volumes on water challenges covering the entire hemisphere, that are available for free in both Spanish and English. In addition, special volumes advancing the status of women in science and on climate change have been produced in Spanish and English, and are also available for free. Judging from downloads, these volumes have resonated with a large audience. Another measure of success is the significant financial and in-kind support provided by the academies that make up IANAS. Further, more than two hundred individual scientists from throughout the hemisphere are engaged in IANAS work, and they provide their time and expertise on a pro bono basis. While many challenges remain, IANAS has established a record of credibility and independence that should stand it in good stead in the future. **SD**

**Endnotes**

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