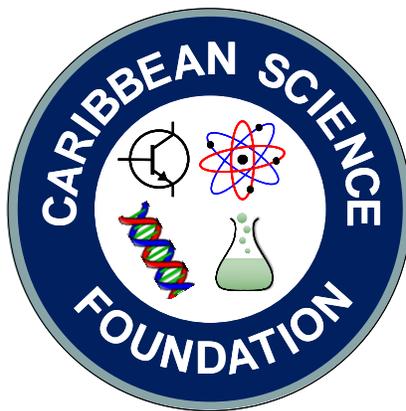


Draft Three-Year (2011-2014) Strategic Plan of the



<http://caribbeanscience.org>

***...stimulating science and technology based
entrepreneurship, assisting with education reform,
and promoting economic development for the
people of the Caribbean...***

Submitted to the Board of Directors of the CSF
by Professor Cardinal Warde
President of the Caribbean Diaspora for Science Technology and Innovation, and
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Revised June 15, 2011



Caribbean Science Foundation

Executive Summary

The Caribbean Science Foundation (CSF) was established as an independent non-profit non-governmental organization in 2010. The primary mission of the CSF is to assist with the diversification of the economies of the Caribbean countries by:

- (1) promoting education reform that places more emphasis on: (a) Science, Technology, Engineering, Math (STEM), (b) business and entrepreneurship fundamentals, and (c) foreign languages and communication skills, and
- (2) stimulating more technology-based entrepreneurship via the funding of science and technology (S&T) projects in new and existing small enterprises on a competitive basis.

The work of the CSF is supported in part by the Caribbean Diaspora for Science, Technology and Innovation (CADSTI) which founded the CSF. CADSTI (see <http://cadsti.org>) has its center of gravity outside the Region, and its primary function is to mine and mobilize the resources in the world-wide Caribbean Diaspora in support of the CSF. The headquarters of the CSF are located in the CARICOM Research Building on the Barbados campus of the University of the West Indies. More information about the CSF and its on-going projects can be found at <http://caribbeanscience.org>.

Preferred projects for development and commercialization include information and communication technologies, energy, biotechnology, food science, water, agriculture and environmental science. Regarding education, the CSF has the broad goal of helping to promote STEM, business and entrepreneurship education, and foreign languages and communication skills in the elementary schools, high schools, universities and other venues using a combination of theoretical, hands-on and total immersion approaches. With its access through CADSTI to a large number of world-wide technology experts in almost all areas of science and engineering, the CSF offers scientific advisory services to corporations, governments, and universities in the Region. The CSF also keeps track of scientific breakthroughs around the globe, especially those that may be relevant to the needs of the Region.

Oversight of the activities of the CSF is the responsibility of the Governing Council which consists of about 22 distinguished leaders from the Caribbean and the Diaspora with broad experience in science and technology, business, education, finance and government. The CSF requires an investment of approximately US\$ 13M to implement its initial 3-year Strategic Plan. Most of the resources (funding, technical expertise, business expertise, and international collaborations) come via CADSTI which is mobilizing the Diaspora and mining these resources for the benefit of the Region. Thus, most of CSF's resources are expected to come from NGOs, corporations and financial institutions outside the Region, and private institutions and banks within the Region.

In ten years, the CSF anticipates that it would have: (1) helped to transform the educational systems in the Region, (2) catalyzed significant change so that science-and-technology-based entrepreneurship is an integral part of Caribbean culture, (3) seeded the growth of about 10 highly-profitable, successful operating companies with about another 25 early-stage companies in the pipeline, and (4) become capable of being self-financing, in part due to returns on equity investments in some of the companies it funded.

For organizations or individuals interested in supporting the work of the Caribbean Science Foundation, please contact Prof. Cardinal Warde (warde@mit.edu or 1-617-699-1281).

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1.0 Background

There continues to be an urgent need for the Caribbean to implement education reform, invest much more resources in industrial research and development, and stimulate entrepreneurship. As far back as 1998, Professor Cardinal Warde has been advocating for the development an entrepreneurial culture and the development of a strong economic pillar based on science and technology [1]. In more recent times we have witnessed major efforts to transform the science and technology landscape in the Region. In 2006, for example, UNESCO jointly with the CARICOM Steering Committee commissioned a report on the status of science and technology in the Caribbean. This report was undertaken by the well known and highly respected Dr. Khotso Mokhele, former CEO and former President of the National Research Foundation of South Africa. In 2007, the Mokhele Report was presented to a number of heads of government in the Region. Then in April of 2008, the then Prime Minister responsible for science and technology in CARICOM convened a high-level meeting of ministers of science and technology, captains of industry and heads of tertiary educational institutes to discuss the Report. Emanating from this meeting was a major recommendation “that an overarching broad-based agency called the Caribbean Science Foundation (CSF) be established as soon as possible to help develop science and technology and build the requisite capacity to harness STI for the Region’s development.” Thus, the CSF has come into existence as a result of a number of initiatives going as far back as 1998.

While all developed countries and most developing countries have some visible Science, Engineering or Technology Foundation and/or Council (see Appendix 1), the Caribbean, in reality, had none that was functioning with the goal of achieving the broader objectives of the CSF. It is also noteworthy that in the past twenty years many developing countries (such as Singapore, Ireland, Israel and Brazil) have made significant technological advances that contributed to their economic development, but technology and economic progress in the Caribbean during this period has been minimal. Consequently, the Region remains economically vulnerable, as most countries rely mainly on tourism as a source of foreign exchange. It is unfortunate that STI has not been fully leveraged as a vital resource to diversify the economy and ultimately become a pillar the economic development strategy of the Region.

To take full advantage of the prospects that STI holds in the economic (and social) development of the Region, it is increasingly clear that unless education reform is enacted, the Region (especially the English speaking Caribbean) will be unable to move forward effectively and expediently towards the ultimate goal of sustainable economic development with STI as one of the economic pillars. The educational challenges of the Region are multifaceted, but there are at least two major problems that need immediate attention: (1) the youth in the Region continue to shy away from science, technology, engineering and math, and (2) the continued use an antiquated 9+ or 11+ exam that inadvertently eliminates the late bloomers remains a barrier to true education reform. Creativity is not measured by these exams, and yet it seems that the will is not there on the part of most governments to discontinue them. The need for education reform is so urgent, that the CSF has no choice but to position itself to help bring about the

much needed change in our educational systems. Warde has contended that beginning as early as age eight, Caribbean schools should start teaching the principles of entrepreneurship, business and accounting skills, typing, computer science, and general science along with a strong mixture of oral and written communication skills, foreign languages and the humanities [1].

The history of the Caribbean, with the after effects of slavery and long colonial ties may offer some insights into why today the Region has so far not developed or embraced an entrepreneurial culture. A cultural paradigm shift is needed in the Region, and it is coming. The CSF is just one of the mechanisms that will help to accelerate the dawn of this new culture.

It was the Caribbean Diaspora for Science Technology and Innovation (CADSTI) under the leadership of Professor Cardinal Warde of the Massachusetts Institute of Technology that undertook the responsibility for the establishment of the CSF. The relationship between CADSTI and the CSF is captured in Fig. 1. As shown, this is CADSTI’s first project, and CADSTI’s role is to mobilize resources in the Diaspora in support of the goals and the work of the CSF. These resources include but are not limited to: funds, technical and business expertise, research collaborations between universities in the Diaspora and universities in the region, location of venture capital, identification of overseas markets, etc.

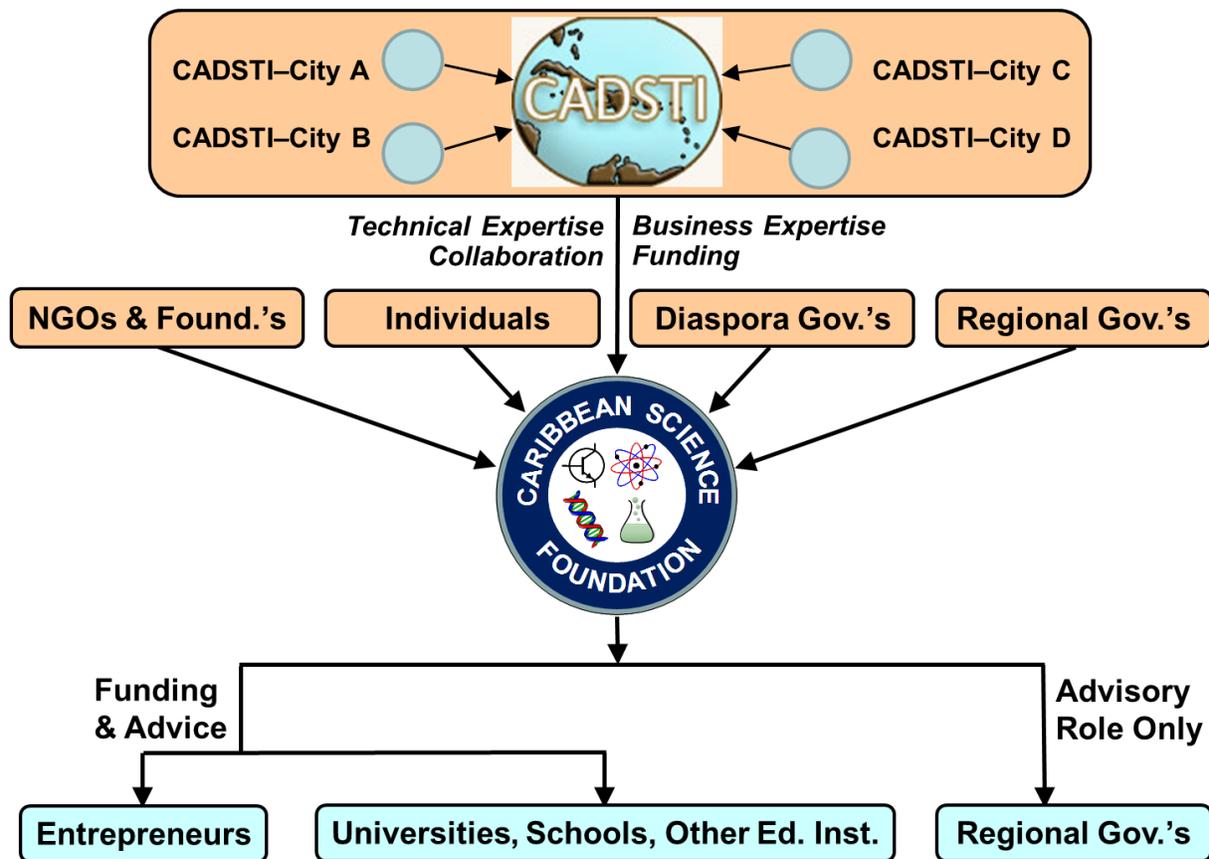


Fig. 1. Relationship between CADSTI and the CSF

The CSF was officially launched by CADSTI on September 21, 2010 in Port of Spain, Trinidad, and CADSTI is totally committed to supporting CSF for as long as CSF needs its assistance. The headquarters of the CSF are located in CARICOM Research Building, Cave Hill, St. Michael, Barbados, across the street from the Barbados campus of the University of the West Indies. However, as part of its ten-year plan, the CSF has the goal of relocating to space that is owned and controlled by the CSF.



Fig. 2 CARICOM Research Building: Home of the Caribbean Science Foundation

The members of the CADSTI Steering Committee who were charged with the responsibility of establishing the Caribbean Science Foundation are listed below. These individuals, along with others, serve on the Scientific Advisory Board of the CSF:

- Dr. Basil Burke - UWI Consulting, Jamaica, and San Francisco, CA, USA
- Prof. John-Paul Clarke - Georgia Institute of Technology, Atlanta, Georgia USA
- Dr. Ken Harewood – formerly North Carolina Central University
- Prof. Baldwin Mootoo - UWI, St. Augustine, Trinidad)-Treasurer
- Senator-Prof. Harold Ramkissoon - UWI, St. Augustine, Trinidad (Secretary and Ambassador)
- Mr. Ravi Ramkissoon - Oracle Corp, Redwood Shores, CA
- Dr. Brian Tom - Cambridge University, Cambridge, England
- Prof. Maya Trotz – Univ. of South Florida, Tampa, FL, USA (Chair Youth Affairs Committee)
- Prof. Cardinal Warde - MIT, Cambridge, MA, USA (President of CADSTI and Committee Chair)

Perhaps Israel is the best example of a country that most effectively engages its Diaspora to develop Science and Technology projects at home, and thereby help to stimulate technology-based economic development. In setting up the CSF, CADSTI learned from the model and the best practices of the Office of the Chief Scientist of Israel [2], as well as the models used by the United States National Science Foundation [3] and the United States Small Business Innovation Research Program [4].

The vision and mission, organizational structure, major roles and responsibilities, activities, areas of focus, performance assessment, and funding and sustainability mechanisms of the CSF are outlined below.

2.0 Mission of the CSF

CADSTI is keenly aware that, to help diversify the economies of the Region for long-term sustainable economic development, Caribbean countries must harness science, technology and innovation while simultaneously implementing education reform. The CSF has been established to provide dedicated attention and support to these needs.

The CSF is an independent, semi-autonomous non-profit agency whose mission is to: (1) assist with the diversification of the economies of the Caribbean Region, (2) create a Caribbean society that is globally competitive, and (3) help to raise the standard of living of Caribbean people. The CSF intends to achieve these objectives by promoting the rapid, aggressive and systematic development of science, technology and innovation and utilizing them to assist with the sustainable economic development of the Region. Specifically, the CSF aims to help:

- (a) **Stimulate technology-based entrepreneurship** - by identifying and funding science and technology projects in new and existing enterprises that are relevant to the economic development needs of the Region.
- (b) **Accelerate education reform that supports technology-based entrepreneurship** - by promoting and funding programs that focus on: (i) science, technology, engineering and math, (ii) business and entrepreneurship education, and (iii) foreign languages and communication skills in schools, universities and other educational venues.
- (c) **Provide scientific and engineering advisory services to Caribbean industries and Caribbean Governments** - by working with CADSTI to leverage the technology, business and marketing expertise that resides in the Diaspora.

The CSF has several key features that distinguish it from existing Caribbean scientific bodies including:

- a. It is a semi-autonomous overarching entity
- b. It is financed primarily by the Diaspora, although the Region's private sector, and the Region's STI community and governments play key roles and make substantial contributions
- c. It ensures sustainable, dynamic leadership of STI in the Region
- d. It is developmental, action oriented and accountable
- e. It is capable of being self-financing within 10 years

The CSF employs a lean, agile and accountable administrative and operational structure that is responsive to regional economic and educational needs and realities. The administrative budget is kept small and benchmarked to international standards, so that the bulk of its operating funds are available to support STI projects.

3.0 Governance and Organizational Structure

As shown in Fig. 3, oversight of the CSF is provided by the CADSTI Governing Council that comprises forward-looking, action-oriented individuals with broad experience in business, science and technology, education, finance and government.

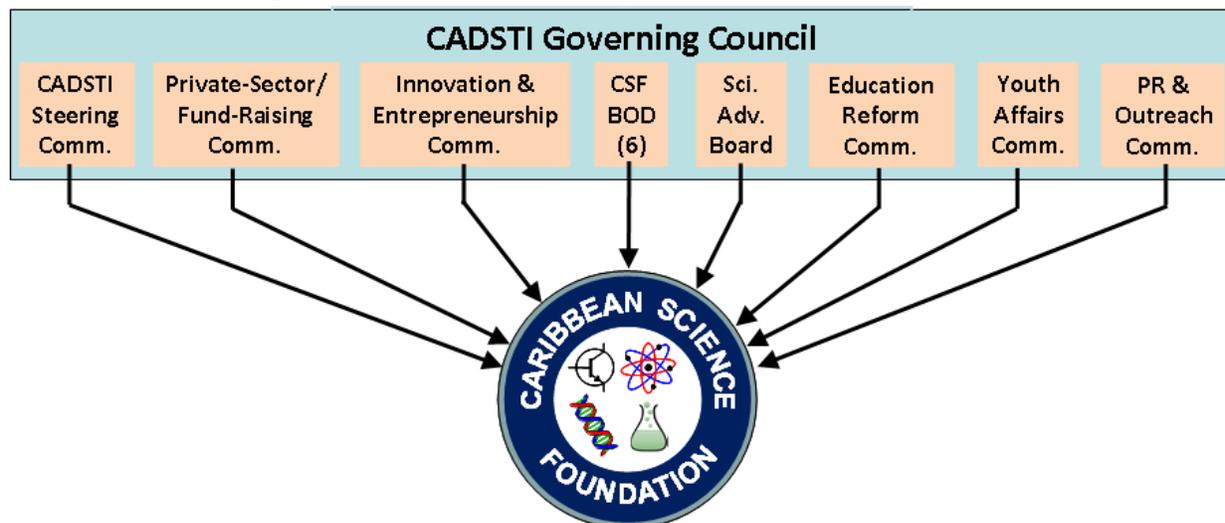


Fig. 3. Committees that together constitute the Governing Council of the CSF

At present there are eight committees that together constitute the Governing Council.

- The **CADSTI Steering Committee** has as its main responsibility, engagement with the Diaspora.
- The **CSF Board of Directors** has the direct responsibility for the governance of the CSF.
- The **Scientific Advisory Board** serves as an advisory body to the CSF Executive Director.
- The **Private-Sector/Fund-Raising Committee** is primarily concerned with funding for the CSF.
- The **Education Reform Committee** provides guidance and oversight to CADSTI and the CSF on educational programs and initiatives in the Diaspora and the Region.
- The **Innovation and Entrepreneurship Committee** acts as an advisory body to the Innovation and Small Business Directorate of the CSF
- The **Public-Relations/Outreach Committee** provides guidance and oversight to CADSTI and the CSF in its service and engagement with the communities in the Diaspora and the Region.
- The **Youth Affairs Committee** is responsible for making sure that CADSTI and the CSF address the needs of and engages the youth in the Region in science and technology initiatives.

The Governing Council comprises the individuals shown below:

- Mr. Nicholas Brathwaite - Partner & CTO, Riverwood Capital (Chair of the Board)
- Senator, the Hon. Franka Alexis-Bernardine - Minister of Education of Grenada
- Dr. Orson Bourne - Business Development Officer for (SIMS), National Research Council, Canada
- Dr. Basil Burke - UWI Consulting
- Prof. John-Paul Clarke - Georgia Institute of Technology, Atlanta, Georgia USA
- Dr. Sheena Francis- UTech, Jamaica (Young Scientists Representative)
- Dr. Ken Harewood – formerly North Carolina Central University
- Mr. Dodridge Miller – CEO, Sagicor Insurance
- Prof. Baldwin Mootoo - UWI, Trinidad & Tobago
- Prof. Suresh Narine – Trent University, Peterborough, Ontario, Canada
- Mr. Hollick Rajkumar - Managing Director, HRC Associates, Trinidad & Tobago
- Senator-Professor Harold Ramkissoon – UWI, Trinidad & Tobago
- Mr. Ravi Ramkissoon - Oracle Corp, Redwood Shores, CA
- Mr. Robert Riley, CEO – BP, London
- Dr. Dinah Sah, Vice President of Research, Alnylam Pharmaceuticals, Cambridge, MA, USA
- Dr. Brian Tom - Cambridge University, Cambridge, England
- Prof. Maya Trotz –Univ. of South Florida, Tampa, FL, USA (Chair Youth Affairs Committee)
- Dr. Arnoldo Ventura – Former Science Adviser to the Prime Minister of Jamaica
- Mr. Richard Vieira - Group Head, Technology Investment Banking, BMO Capital Markets
- Professor Cardinal Warde – MIT (President of CADSTI)
- Mr. Richard Williams – RFW Associates, London
- Mr. Gervase Warner - CEO, Neal & Massy
- Chair of the Caribbean Council for Science and Technology (Dr. Lennox Chandler)

Members of the Governing Council serve terms no longer than 3 years initially, although reappointments are considered on a case-by-case basis. Biographies and photos of the Members of the Governing Council may be found at <http://cadsti.org>.

3.1 Organizational Structure

The organizational structure of the CSF is illustrated in Fig. 4. The CSF will carry out its functions via four directorates. The Education Reform Directorate, the Innovation and Small Business Directorate, and the Technology Directorate will be formed first. Later, the Science Directorate, which will fund research in the basic and social sciences, will be added. Each Directorate will have an Advisory Committee that assists the leader of the Directorate with the vision, the strategy and the implementation of its programs.

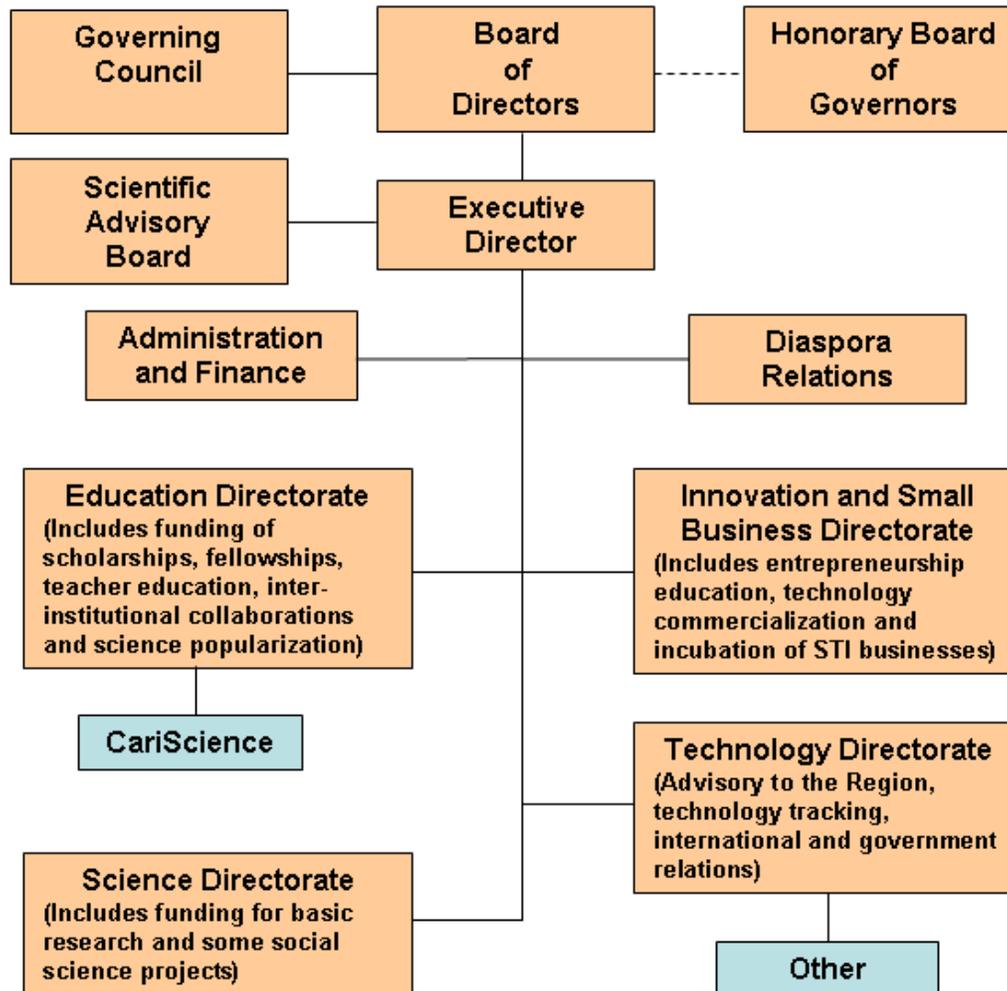


Fig. 4. CSF Organization Chart when fully functional. The Science Directorate is to be formed after CSF's third year of operation and the activities which are shaded will thereafter migrate to the Directorates shown.

The Innovation and Small Business Directorate has the primary goal of providing seed capital to small companies (on a competitive basis) to develop relevant science and technology projects. Proposals are solicited from entrepreneurs, universities and other science-related business entities and evaluated by science, technology and business experts. The final approval of each project is made by the Research Committee chaired by the Executive Director of the CSF. Preferred projects have wide-ranging applications in diverse industries such as information and communication technologies, biotechnology, food science, energy, and agriculture. This Directorate will also assist individual inventors during the pre-seed stage. For example, the CSF will set up or help support existing incubators that provide infrastructure, business guidance and administrative assistance to enable novice entrepreneurs with innovative concepts to conduct feasibility studies that could lead to further support for the establishment of their companies.

The Education Directorate has the broad goal of helping to stimulate technology-based entrepreneurship by promoting STI, as well as business and entrepreneurship education, and foreign languages and communication skills in the elementary, high schools, universities and

other educational venues. Thus, CSF's education reform initiatives include the development of curricula with a special focus on STI, entrepreneurship, and hands-on learning. Additionally, this Directorate will offer scholarships and fellowships, provide funding for science popularization programs on TV and at museums, and facilitate research collaborations and student and faculty exchanges between universities in the Region and leading universities in the Diaspora. CADSTI is expected to offer considerable assistance in setting up the collaborations with the Diaspora.

The Science Directorate will fund research in the basic and social sciences. The CSF recognizes that while applied science and technology will have a near term impact on the economic development of the Caribbean region, the longer-term impact of pure science and the social sciences should not be neglected.

The Technology Directorate will assume the responsibility for: (1) the scientific advisory role of the CSF, (2) working with CADSTI (which maintains a database of S&T professionals and companies in the Diaspora) to identify and engage S&T professionals and companies in the Diaspora for the benefit of the Region, (3) promoting collaboration and interaction between Caribbean industries and industries in the Diaspora, (4) promoting and facilitating a free exchange of information on scientific research among the research centers of excellence within the Caribbean, (5) setting up and facilitating networking groups of technology academicians, entrepreneurs and students in the region, and (6) coordinating most of CSF's outreach activities in the Region (including publishing an electronic biennial newsletter). As the CSF matures, the Technology Directorate will be further responsible for establishing educational and scientific research collaborations with countries in the Spanish, French and Dutch-speaking Caribbean.

The Board of Directors, selected from the Governing Council, is the voting body that sets the policy and plans for the CSF, and it meets at least four times year. The Board of Directors selects the Executive Director of CSF, and the leaders of the Directorates upon the recommendation of the Executive Director. The current members of the Board of Directors are:

- Mr. Nicholas Brathwaite (Co-Chair)
- Prof. Cardinal Warde (Co-Chair)
- Prof. Harold Ramkissoon
- Dr. Sheena Francis
- Dr. Arnaldo Ventura
- Dr. Basil Burke

The Executive Director is directly responsible for fund raising, implementation of CSF policy and plan, and progress towards CSF's goals, overseeing the CSF staff and management, and day-to-day operations. The Executive Director prepares a new strategic plan every 3 years for approval by the Board of Directors. Ideally, the Executive Director is a renowned scientist with an international reputation and fund-raising experience, and a proven leader with a sound track record in R&D management. He or she must be:

- A skillful relationship builder with connections in academia, government and industry
- A superb communicator and influencer, with excellent presentation skills
- A proficient fund raiser with demonstrated fund-raising experience
- An accomplished high-level and motivational administrator
- Strongly appreciative of the potential impact of STI on the Caribbean society and economy
- Self-reliant, resourceful and creative
- Willing and able to travel extensively in conduct of the affairs of the CSF
- A champion of STI with an appreciation of its impact on Caribbean social and economic development.

The appointment of an Interim Executive Director was necessary until resources permit the hiring of a full-time Executive Director. Dr. Cardinal Warde has agreed to serve as the Interim Executive Director for the near term. An ad is being circulated for the position of an Associate Executive Director who could be groomed into the position of Executive Director. One of the first activities of the Interim Executive Director is the translation of this 3-year strategic plan into an internal operations plan.

The Executive Director is ably assisted by the Strategic Advisory Board. Members of the Steering Committee of CADSTI serve on the Scientific Advisory Board to the CSF along with other world-renowned scientists. The following individuals constitute the Scientific Advisory Board:

- Dr. Orson Bourne
- Dr. Basil Burke
- Prof. John-Paul Clarke
- Dr. Ken Harewood
- Prof. Baldwin Mootoo
- Prof. Suresh Narine
- Senator-Professor Harold Ramkissoon
- Mr. Ravi Ramkissoon
- Dr. Dinah Sah
- Dr. Brian Tom
- Prof. Maya Trotz
- Dr. Arnoldo Ventura
- Professor Cardinal Warde

The members of the Private-Sector/Fund-Raising are:

- Mr. Hollick Rajkumar – (chair)
- Mr. Nicholas Brathwaite
- Dr. Basil Burke
- Mr. Dodridge Miller
- Senator-Professor Harold Ramkissoon
- Mr. Robert Riley
- Dr. Arnoldo Ventura

- Mr. Richard Vieira
- Professor Cardinal Warde
- Mr. Richard Williams
- Mr. Gervase Warner

The Honorary Board of Governors comprises the following influential individuals who also assist with the fund-raising activities:

- CARICOM Secretary-General
- Prime Minister responsible for S&T in the CARICOM Quasi Cabinet
- President of Caribbean Association of Industry and Commerce
- President of the Caribbean Academy of Sciences
- President of CARISCIENCE
- Hon. P. J. Patterson, former Prime Minister of Jamaica
- Mr. Bowen Wells, former UK MP
- Mr. Chris Rowlands, former director of 3i Investments - Managing Partner for Asia
- Sir Harold W. Kroto, 1996 Nobel Laureate, Chemistry
- Dr. DeLisle Worrell, Governor of the Central Bank of Barbados

Others will be added in the coming months.

4.0 Major Roles, Responsibilities and Activities

The major roles and responsibilities of the CSF are: (1) assistance with the development and funding of relevant science and technology projects within small and medium-size businesses, (2) assistance with education reform in the Region, and (3) providing scientific and business advisory services as well as networking connections with the Diaspora. The areas of focus of the science and technology projects include:

- Energy, Water and Materials
- Transportation
- Agriculture and Food Science
- Medicine and Health Care
- Biotechnology
- Manufacturing
- Information and Communication Technologies
- Environmental Science and Engineering
- Crime Prevention

4.1 Support of Technology Entrepreneurial Projects

The CSF procures funds to support new science and technology projects by liaising with similar international organizations, donor agencies and non-government organizations (NGOs), and the Diaspora. Both the Innovation and Small Business Directorate and the Technology Directorate are involved in this endeavor. As part of its mission, the CSF keeps close track of ongoing

research around the world, maintains constant contact with the external research community for novel discoveries, and identifies those science and technology projects that leverage our natural resources, including marine resources. The CSF also promotes active mining of the Internet for research results and methods that can be leveraged and used for the development of new products.

Under the Innovation and Small Business Directorate, the CSF solicits and critically reviews applications for funding to support new science and technology projects. Proposals are solicited from entrepreneurs, universities and other science-related business entities and evaluated by technology and business experts. This Directorate will also consider for funding, companies that start outside the Region and that are ready to either relocate within the Region or to set up branches or spin-offs within the Region.

The final approval of each project is made by the Research Committee chaired by the Executive Director of the CSF. An approved R&D project is one with technological novelty, economic justification, and that has the potential to result in a new product, process or a significant improvement to an existing product or process. By providing seed funding to existing small businesses, the CSF sends a positive signal which can mobilize and attract additional private-sector funds for the growth of new and existing companies. On the other hand, concurrent government or private-sector matching investments increase the chances of CSF funding.

Preferred projects have wide-ranging applications in diverse industries such as information and communication technologies, biotechnology, food science, energy and agriculture. The overall goal is to identify and help develop (with funds and technical resources) new projects and industries that are relevant to the economic development needs of the Region, and that would be carried out by new and existing companies.

The Innovation and Small Business Directorate also assists individual inventors during the pre-seed stage. Support includes assistance with: evaluating the technological and economic potential of the inventor's concepts and proposals, patent preparation, prototype construction, business plan preparation, establishing contact with appropriate industry representatives, and attracting investors. Further, the CSF will set up or help support existing incubators that provide infrastructure, business guidance and administrative assistance to enable novice entrepreneurs with innovative concepts to conduct initial proof-of-concept experiments that could lead to further support for the establishment of their companies. Such incubators support the earliest stages of technological entrepreneurship that are not yet ready for private investment (such as venture capital funding), thereby preventing commercially viable technological ideas from going to waste due to lack of resources.

The CSF also: (1) funds new technologies that are to be developed in a cooperative venture between the Caribbean company and leading academic scientific research institutions in the fields that are of highest priority, (2) accepts proposals to bridge the gap between basic and applied research - a problem that characterizes many high-tech industries, (3) connects companies in the Region with angel, venture capital and corporate capital in the Diaspora, and

(4) helps to find overseas business partners for Caribbean companies for the purposes of collaboration on technology development projects from basic research to manufacturing.

Firms can qualify for up to two phases of funding. Phase I funds are for exploratory research and to show feasibility of the concept or innovation. Firms successful at the Phase I level may be invited to apply for Phase II funding which is intended to bring the product or service closer to the marketing or manufacturing phase such that it is more attractive to other sources of financing such as angel, venture capital or corporate partner investment. The process would be similar to that used by the United States SBIR program [4].

CSF projects are funded on a risk-sharing basis. That is, the Foundation partially funds R&D expenses associated with an approved project for an equity stake in the company or a royalty stream. Royalties are due only if commercial revenues are generated as a direct result of the project. If the project fails, the CSF claims no repayments.

4.2 Assistance with Education Reform

The Education Reform Directorate of the CSF has the broad goal of helping to stimulate technology-based entrepreneurship by promoting science and technology as well as business and entrepreneurship education in schools, universities and other educational venues. An Education Reform Advisory Committee consisting of innovative and forward-looking leaders in the Region will be formed to help develop strategy and provide guidance and assistance to the leader of this Directorate. Recognizing the importance of education to the development of science and technology initiatives, this Directorate will:

- Promote science and technology studies in the schools and universities through new activities that may include special lectures, hands-on learning, and extracurricular opportunities
- Develop new curricula (with a special focus on STI and entrepreneurship) for the schools in the Region
- Set up and/or help to sponsor science competitions and science fairs, and otherwise engaging and encouraging the youth (primarily high school students and undergraduates) to participate in science and technology projects and activities.
- Provide scholarships and fellowships:
 - For students
 - For the professional development activities and the continuing education of teachers
 - For the exchange of scientists, engineers and other R & D personnel between academic institutions in the Region and those in the Diaspora.
- Help to establish, facilitate and fund collaborative research projects between the universities in the Region and leading universities in the Diaspora (CADSTI is expected to offer considerable assistance in setting up the collaborations with the Diaspora).
- Fund knowledge acquisition and science popularization programs such as public science education programs on TV and at museums.

4.3 Advisory Role

In its advisory role, the CSF, through its Technology Directorate, will:

- Serve as a scientific advisory body to the Governments of the Region
- Assist the Governments of the Region with the harmonization of regulations (especially safety) and the setting of industry standards especially in rapidly evolving areas such as biotechnology, nanotechnology and genetic engineering.
- Work with the Governments of the Region to sign agreements and create funds together with other governments and NGOs to actively support and encourage industrial R&D cooperation between Caribbean industries and industries overseas.
- Help the Governments of the Region to identify national needs as well as suitable technologies that match those needs.
- Assist in identifying and removing impediments, while helping to build the infrastructure for mutually beneficial economic and technological development.

4.4 Outreach and Networking Activities

CSF Country Representatives: The CSF will appoint CSF Country Representatives in almost every Caribbean territory. The primary responsibilities of the CSF Country Representatives are to help:

- Disseminate information from and about the CSF and its activities to the populace
- Mobilize the youth in the country, and carry out activities related to Science, Technology and Innovation
- Organize CSF sponsored events in the country
- Make linkages for the CSF to the political, educational and business communities in the country
- With fund-raising in the country
- Report on the science, technology and innovation initiatives in the country to the CSF Board on a periodic basis

Networking Groups: The CSF will set up and facilitate a number of networking groups such as:

- (1) The Young Academic Science Professionals (YASP)
- (2) The Caribbean Entrepreneurs Network (CEN)
- (3) The Caribbean Science Students (CSS), and
- (4) The Education Reform Network (ERN)

The potential of our scientists within the Caribbean Region is undoubtedly significant. However, as yet, harnessing the depth of this potential regionally has proven challenging. To help overcome these challenges, Professor Sheena Francis, University of Technology, Jamaica, will chair the above-mentioned Young Academic Science Professionals Networking Group. This is a community of academic professional scientists with a diverse range of experiences spanning scientific disciplines. The group's central objective is to improve the level of academic research and funding within the Caribbean. This will be achieved by providing:

- (a) Avenues for networking between Caribbean scientists and their peers from other regions
- (b) Information on funding opportunities available to researchers from the Caribbean
- (c) Information on job opportunities present throughout the Region

- (d) A forum for trouble shooting and the sharing of research protocols, and
- (e) Access to regional scientific mentors.

Youth Affairs: The Youth Affairs Committee (under the Education Directorate) is led by Professor Maya Trotz and will set up and or help sponsor science competitions and science fairs, and otherwise engage and encourage the youth (primarily high school students and undergraduates) to participate in science and technology projects and activities.

Science Popularization: The CSF will work closely with organizations such as NIHERST to fund and help spread science popularization programs from Trinidad and Tobago across the Region.

Relationships with Industry Associations: The CSF will work with Caribbean industry associations (such as the Caribbean Association of Industry and Commerce) to promote the development of advanced technologies and to create fruitful international partnerships through industrial cooperation and joint ventures.

Long-term Relationship with CADSTI: CADSTI will maintain a database of scientists and companies in the Diaspora and the Region that have an interest in helping the Region. This database will be searchable by technology, application, keyword or alphabetically. Collaboration with the National Institute of Higher Education, Research, Science and Technology (NIHERST) on this project will be sought. CSF intends to use this database to identify experts for the evaluation of its proposals, as well as to create advisory panels as needed or as requested by the governments and industries of the Region.

CADSTI intends to set up centers in all the major cities in North America, Europe and elsewhere outside the Caribbean. The goals of these centers are to:

- Mobilize the Diaspora in and around these cities to help support the activities of the CSF.
- Disseminate information from and about CADSTI and the CSF
- Help organize CADSTI and CSF sponsored events
- Make linkages and set up collaborations for the CSF with the political, educational and business communities in their country
- Report on the science, technology and innovation, political and business initiatives in the Diaspora to the CSF Board on a periodic basis.

Electronic News Letter: CSF will publish a biennial electronic newsletter, "*Caribbean Technologies*," which will be e-mailed to all interested parties around the globe as well as posted and accessible on the CSF's web site.

5.0 Financing and Sustainability Plans

5.1 Financing Plan

The CSF cannot undertake and fulfill its mission and goals without the requisite funds. Consequently, acquiring funding for its mission is a most critical task. Effective leadership by the Executive Director and the Finance Committee will be required to ensure that the organization remains financially viable at all times. Failure to secure adequate funding and/or mismanagement of funds can potentially result in the demise of the CSF.

As shown in Table 1, The CSF will require an initial investment of approximately US\$ 13M over the next three years from a wide variety of sources. These initial resources will support a small administrative staff, provide funding for about 15 to 20 research and development projects in small companies, a few educational and outreach programs, and the development of a sample education reform syllabus for elementary schools and high schools.

Table 1. Three-Year budget

Expense	Year 1	Year 2	Year 3
Salaries	\$ -	\$ 200,000	\$ 500,000
Employee Benefits	-	40,000	100,000
Part-time Help	20,000	30,000	50,000
Seed Capital Fund	1,500,000	3,000,000	6,000,000
Educational Activities	50,000	250,000	500,000
Outreach Activities	10,000	50,000	100,000
Country Rep. Programs	15,000	25,000	40,000
Advertising	15,000	25,000	30,000
Conferences	100,000	125,000	130,000
Publications	5,000	10,000	20,000
Travel	15,000	25,000	40,000
Office Expense	5,000	20,000	35,000
Rent	-	25,000	40,000
Utilities	-	5,000	15,000
Other OVHD Expenses	35,250	124,500	240,000
TOTAL	\$ 1,770,250	\$ 3,954,500	\$ 7,840,000
GRAND TOTAL			\$ 13,564,750

The potential sources of funds include: international agencies/organizations, the Diaspora, the Caribbean private sector, member countries, individuals, dividends or profits from invested endowment/trust funds, and equity holdings in CSF-invested companies. Each member country in the Region will be asked to make a financial contribution to the CSF, irrespective of amount, to signal their commitment to its mission and goals. Specific NGOs that are targeted include UNESCO, OAS, EU-ACP, DFID (UK Dept. for Intl. Development), CSIR (Canada) and the IDB. The anticipated funding breakdown goal by percentage is shown in Table 2.

Table 2. Funding Breakdown Goal by Percentage

Donor	Year 1	Year 2	Year 3	Year 10
International Agencies/Organizations	50%	50%	50%	30%
Member Countries	5 %	5 %	5 %	5%
Caribbean Private Sector	10%	10%	10%	8%
Dividends from CSF-invested companies	-	-	-	25%
Diaspora Organizations	10%	10%	10%	8%
Banks & Credit Unions	2%	2%	2%	2%
CAIC	1%	1%	1%	1%
Individuals	2%	2%	2%	2%
Private Foundations/Philanthropies	10%	10%	10%	9%
Diaspora Governments	10%	10%	10%	10%

5.2 Sustainability Plan

The sustainability model is illustrated in 5. In this model, CSF projects are funded on a risk-sharing basis. That is, the CSF in some cases partially funds R&D expenses associated with an approved project for an equity stake in the company or a royalty stream. Royalties are due only if commercial revenues are generated as a direct result of the project. If the project fails, the CSF claims no repayments. In this sustainability model, returns on investment are ploughed back into the CSF to fund more new companies.

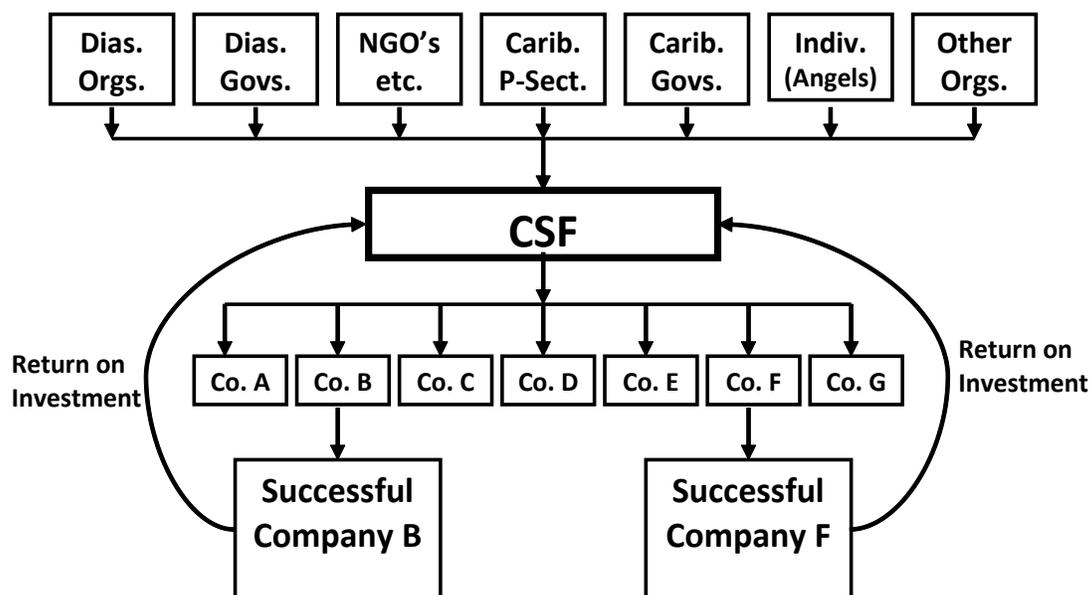


Fig. 5. Sources of funds and the sustainability model

The longer-term, 10-year, financing goals are: (1) to be in a position where the CSF could be self-financing, and (2) to have seeded the growth of about 10 highly-profitable operating companies with about another 25 early-stage ones in the pipeline.

5.3 Use of Funds

Table 1 also illustrates the use of funds. The assumptions are that the CSF is led by an unpaid Interim Director during the first year, and that the Government of Barbados provides rent-free space and utilities during the first year. Modest funds for an Associate Executive Director's salary become available during the second year, as well as salary for one or two support staff and a part-time employee. The bulk of the funds raised go towards the seed capital fund which is managed by the Innovation and Small Business Directorate. After the first three years, a small fraction of the seed capital fund will be managed by the Science Directorate to fund some basic scientific research as well as some social science projects.

The budget for educational activities will be managed primarily by the Education Directorate. This budget item includes funds for student scholarships, teacher training, faculty exchange programs, establishing joint research projects between universities in the Region and universities in the Diaspora, and some funding for the projects of CARISCIENCE.

The outreach activities that will be partially funded include: CSF's advisory services to businesses and governments of the Region, the activities of the professional networking groups, the projects of the CSF representatives in the various countries, and the international relationships with foreign governments, donor agencies and businesses.

6.0 Key Milestones

Year 1:

- Raise \$1.8M for funding projects and operations
- Pilot entrepreneurship training and assistance initiatives in a few countries
- Fund 3 new projects
- Have a sample education reform syllabus completed for elementary schools

Year 2

- Raise \$4.0M for funding projects and operations
- Expand entrepreneurship training and assistance initiatives to 6 countries
- Fund 7 new projects
- Have a sample education reform syllabus completed for high schools

Year 3

- Raise \$7.8M for funding projects and operations
- Expand entrepreneurship training and assistance initiatives to 6 countries
- Fund 10 new projects

7.0 Accountability and Performance Measures

The CSF accountability system and performance measures will be guided by the CSF's strategic plan. The Executive Director will prepare an annual report for submission to the Board of

Directors (including financials) which will show CSF's annual and cumulative progress towards accomplishing its mission, goals and objectives. These reporting mechanisms will provide donors and investors, and the people of the Region with vital information about the return on their investments into the CSF.

Examples of performance measures by which CSF progress will be assessed include both management and administrative measures such as:

- Amount of funds/resources distributed
- Reach of funds distributed
- Efficiency and effectiveness of funding processes
- Selection criteria used to award funds
- Profile of entities receiving funds/support (businesses, schools, individuals)
- Purpose for which funds were used (STI and education)
- In-kind versus dollar/financial support
- Role and function of advisory and other governing bodies
- Facilitators/what worked well
- Challenges/what did not work well
- Unanticipated/unintended factors and events

Process and products that include the results and outcomes produced by the activities of CSF will also be measured. These include:

1 STI Ventures/Enterprises

- Number created by science and technology discipline/sector
- Revenue generated
- Jobs created
- Diffusion of innovation/spin-offs
- Time to organizational viability

2. Cultural Changes

Here we want to assess the extent to which CSF is helping the Region to make progress towards a culture where science and technology, business and entrepreneurship are increasingly valued and promoted in formal and informal educational settings.

- science and technology curricula adoption
- enhanced teaching and learning environments
- teacher training in science and technology
- student test performance
- choice and pursuit of science and technology careers
- science and technology training programs
- science popularization informal/everyday settings

3. Diversification of the Economic Base

- policy and programs that facilitate the creation of STI
- availability of funding for science and technology enterprises/ventures

Reporting Requirements and Accountability System

With the creation of the CSF, steps will be taken to refine the accountability system and performance measures and to establish the mechanisms by which information on the measures are collected, analyzed and used for program development and documenting the CSF's progress. To establish this system, the CSF will draw on professionals with the requisite expertise in the areas of accountability, performance measures, research and evaluation from both the economic and educational perspectives.

8.0 Risks and Contingency Plans

Perhaps the most uncertain item at this time is finding the right Associate Executive Director for the CSF. This job will be an unpaid position for most of the first year of operation, and this situation is currently limiting the applicant pool.

In the event that the fund-raising milestones are not met, CSF would have to make the hard choices of cutting staff and funding fewer projects. This would also mean that the current fund-raising mechanisms were not working, and so the Board of Directors and the Executive Director would be called upon to modify the fund-raising strategy. One option would be to cut the Phase II awards in half and/or reduce the number of Phase II awards.

9.0 Expected Outcomes

In the ten-year time frame we hope to begin to see significant positive changes in the entrepreneurial culture in the Region, and to be in a financial position where the CSF could be self-financing. The Region should expect the CSF to have seeded the growth of about 10 highly-profitable operating companies, with another 25 early-stage companies in the pipeline. The education reform initiatives would have been completed, and most countries in the Region would be working with new curricula that emphasize STI, business and entrepreneurship, foreign languages and communication skills in the elementary and high schools.

10.0 Acknowledgments

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11.0 References

1. Warde, Cardinal, “Communications and Information Technologies: Opportunities for Economic Development in the Caribbean” Proceedings of the 10th annual meeting of the Caribbean Academy of Sciences, pp 187-195, 1998. Also available at <http://cadsti.org/documents.php> or at <http://web.mit.edu/caribbean/www/oldsite/cdf/>
2. See for example, “The Office of the Chief Scientist - An Overview” at <http://www.moit.gov.il/NR/rdonlyres/CD3AF19B-2619-415B-B2F4-B747101C5202/0/TheIntellectualCapital3550.pdf>
3. General information about the US National Science Foundation can be found at <http://nsf.gov/about/>
4. General information about the US SBIR program can be found at <http://www.sbir.gov/about/index.htm>

12.0 Appendix I - Other S&T Foundations and/or Councils

ARGENTINA

ANPCYT: Agencia Nacional de Promocion Cientifica y Tecnologica
CONICET: Consejo Nacional de Investigaciones Cientificas y Tecnicas

AUSTRALIA

AAS: Australian Academy of Science
ATSE: Australian Academy of Technological Sciences and Engineering
Australian Research Council: Foundation for Research, Science and Technology
CSIRO: Commonwealth Scientific and Industrial Research Organization
DEST: Department of Education, Science and Training
ITR: Department of Industry, Tourism and Resources

BRAZIL

ABC: Academia Brasileira de Ciencias
CNPQ: National Council of Scientific Research
FINEP: Financiadora de Estudos e Projetos

CANADA

NRC: National Research Council
NSERC: Natural Sciences and Engineering Research Council
SSHRC: Social Sciences and Humanities Research Council

CHILE

CONICYT: National Council of Science and Technology
FONDECYT: Fondo Nacional de Desarrollo Cientifico y Tecnologico
FONDEF: Fondo de Fomento al Desarrollo Cientifico y Tecnologico

CHINA

CAS: Chinese Academy of Sciences
CERN: China Education and Research Network (Universities)
NSFC: National Natural Science Foundation of China

COLOMBIA

COLCIENCIAS: Consejo Nacional de Ciencia y Tecnologia

FRANCE

CNES: National Center of Space Studies
CNRS: Centre National de la Recherche Scientifique
IFREMER: French Institute of Research on Sea Use
INRA: National Institute of Agricultural Research
INRIA: Institut National de Recherche en Informatique et en Automatique
INSERM: National Institute of Health & Medical Research
MOR: Ministry of Research and Technology

GERMANY

BMBF: Federal Ministry for Education, Science, Research, and Technology
DAAD: German Academic Exchange Service
DFG: German Research Association

JAPAN

NSF/Tokyo: National Science Foundation--Tokyo Office site

KOREA

KOSEF: Korea Science and Engineering Foundation
KUSCO: Korea-U.S. Science Cooperation Organization
KRF: Korea Research Foundation

MEXICO

CONACYT: Consejo Nacional de Ciencia y Tecnologia
FUMEC: The United States-Mexico Foundation for Science

SOUTH AFRICA

CSIR: Council for Scientific and Industrial Research
HSRC: Human Sciences Research Council
NRF: National Research Foundation
SAAG: South African Association for Geotechnology
SASBMB: South African Society of Biochemistry and Molecular Biology
SASC: South African Science Councils

SPAIN

CSIC: Higher Council for Scientific Research
MCYT: Ministry of Science and Technology

TAIWAN

NSC: National Science Council

UNITED KINGDOM

BBRSC: Biotechnology and Biological Sciences Research Council
EPSRC: Engineering and Physical Sciences Research Council
ESRC: Economic and Social Research Council
MRC: Medical Research Council
NERC: Natural Environment Research Council
OST: Office of Science and Technology--Related Sites
RCUK: The Research Councils of the United Kingdom

UNITED STATES

NSF: National Science Foundation