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Fostering the Development and Diffusion of Technologies for Climate Change: Lessons from the CGIAR Model

ICTSD Programme on IPRs and Sustainable Development

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Introduction

To address the consequences of climate change, the international community must launch a major global effort of interdisciplinary research in various fields, ranging from fuel-efficient technologies to cut carbon dioxide emissions, to seeds adapted to new climatic conditions.[1]

In negotiations leading to the United Nations Framework Convention on Climate Change (UNFCCC) meeting in Copenhagen, negotiators and other stakeholders, are examining international partnerships in the area of joint research and development (R&D) to draw lessons for fostering the development and diffusion of technologies for climate change mitigation and adaptation. Several proposals have been made to develop such R&D collaboration, ensure a wide dissemination of results, and enhance technology transfer to developing countries. One such proposal that is attracting growing support aims at the establishment of regional technology innovation centres that would promote joint research and development and technology cooperation between developing countries and between developed and developing countries.

It is against this background, that the Consultative Group on International Agricultural Research (CGIAR) is becoming the subject of increased interest on the part of stakeholders actively involved in climate change talks. The CGIAR is a strategic partnership of international agricultural centres that mobilizes scientific research to achieve sustainable food security and reduce poverty in developing countries. It is still little known outside expert circles.

The purpose of this policy brief is to provide an overview of the CGIAR, in particular its organisation and its evolution, taking into consideration the challenges it has faced since its establishment. This brief also discusses a number of questions raised by the CGIAR model that may inform efforts that aim to promote the development and diffusion of climate change mitigation and adaptation technologies.

[1] *Garcia et al. 2008.*

ICTSD
International Centre for Trade and Sustainable Development

Climate Change R&D and Intellectual Property Rights: Trends and Challenges

Currently, a significant portion of R&D relevant to climate change is made by private companies, and this R&D's outcomes are subject to intellectual property rights (IPRs).[2] According to WIPO (World Intellectual Property Organization), 215 000 'clean energy' patents were filed between 2000 and 2008 worldwide.[3] Patenting is particularly important in automobile technologies.[4] There is also a noticeable increase in patent applications in the field of eolic technology[5] and for seeds able to tolerate climate change stresses.[6] Patent litigation is increasing in the wind and solar industries and regarding LED technology, hybrid cars, and biofuels.[7] In the critical area of carbon capture and storage technologies, more than 12 000 patents have been identified related to post-combustion carbon alone.[8] In a scenario dominated by a business approach to a planetary problem, IPRs are likely to play a key role in determining access to technologies and the cost of using them.[9] If highly priced, access to protected technologies may be unaffordable to many developing countries.[10]

Importantly, the appropriation through patents of R&D results is not the rule in the private sector only. Increasingly, public research institutions, including universities, file for patents for their research results. The policy implemented through the 1980 Bayh-Dole Act in the United States has influenced the conduct of public research in many countries, including developing countries.[11] As a result, significant public investment in technologies for the adaptation and mitigation of climate change would not generate publicly available technologies unless a definite approach towards the development of such technologies as public goods was adopted.[12]

While there is a growing appropriation of technologies for adaptation and mitigation of climate change, there is an urgent need to speed up their diffusion through transfer (incorporated or not in equipment) and extensive international cooperation. Technology diffusion creates major benefits: the more a technology is used, the greater the likelihood of further improvement;[13] the wide diffusion of a technology allows the development of economies of scale and reduction in costs; and access to technologies by all countries, including the poor, is essential to face the global challenges posed by climate change.[14]

Climate change mitigation and adaptation hence, require not only a massive effort to develop suitable technologies but mechanisms to make them readily available. Innovation is not enough. Research outcomes should be *available* in sufficient quantities, *acceptable*, in terms of their usability and their appropriateness given cultural and other factors, *effective* to address the emerging conditions, and *accessible* at low or no cost.

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[2] *The United Nations Environment Programme (UNEP), the European Patent Office (EPO), and the International Centre for Trade and Sustainable Development (ICTSD) have conducted a study (the first results of which will be presented in December 2009) analyzing and collating data on patents and the development and transfer of clean energy technologies. See ICTSD 2009. See also Srivinas 2009 and Center for Environmental Public Policy 2009.*

[3] *See New Energy Finance, Ltd. 2009.*

[4] *Intellectual Property Watch* **2007 (reporting the opinion of D. Shabalala, CIEL).**

[5] *See Clavel 2007, p. 179.*

[6] *See ETC Group 2008.*

[7] *See New Energy Finance, Ltd. 2009. A study by Barton (2007) found that, as in other areas, patents related to photovoltaics (PV), wind, and biofuel technologies cover specific improvements or features rather than basic technologies.*

[8] *Barton 2007.*

[9] *Cannady (2009) notes that "developers of solar, wind, biomass, and other energy and environmental technologies have not generally protected their inventions in developing countries". This is likely to change, however, due to the growing global importance of climate change related technologies.*

[10] *Delhi High Level Conference 2009.*

[11] *Sampat 2009.*

[12] *Dickson 2009.*

[13] *On the relationship between diffusion and innovation, see OECD 1992. The expression "green technology accelerator" has been used to refer to a scenario of rapid technology diffusion. See Delhi High Level Conference 2009, para. 7.*

[14] *For a summary of the debate on this subject, see South Centre and CIEL 2008.*

There are strong pressures to let the 'free market' solve the climate change technology challenge.[15] Some of the proposals made to generate or transfer sound technologies for climate change mitigation and adaptation assign a key role to the private sector.[16] High reliance on the private sector may, however, not only imply high costs of access, but may also limit it because technology owners, may be reluctant to transfer advanced technologies, "out of fear of creating new competitors".[17]

Governments may intervene in several ways in order to overcome barriers to the access of environmentally sound technologies arising from IPRs. The 'Agenda 21' (adopted at the 1992 United Nations Conference on Environment and Development) recommended the

> [P]urchase of patents and licences on commercial terms for their transfer to developing countries on non-commercial terms as part of development cooperation for sustainable development, taking into account the need to protect intellectual property rights' (section 34.18(e)(iii)).

The creation of 'patent pools' have also been proposed as a means for developing countries to obtain access to climate change technology, particularly if inventions are available at low or no cost.[18] Patent pools, however, may require payments and the compliance with conditions, such as the grant-back of improvements on patented technologies, which may pose significant burdens on potential recipients.[19] In addition, the possibility of using patents in the pool does not guarantee access to know-how that may be essential to put in practice the protected technology.

The *World Economic and Social Survey* (UN-DESA 2009) notes, however, that these types of approaches may have "focused unduly on protecting the international position of the creators and owners of technology"[20] rather than looking for more effective and comprehensive solutions to the challenges of technology transfer. Those approaches may overlook the urgency of the technological challenge or its links to the idea of a big push onto a new low-emissions growth path, particularly by developing countries. In fact…RD&D [research, development and deployment] spending on some of the key technologies needed to support this transition appears to be moving in the wrong direction. Reversing this trend will be essential for building momentum towards a low-emissions future. Such action will likely have to draw on a variety of mechanisms at the international level and will ultimately require determined leadership that puts collective security before narrow commercial interest.[21]

In view of the dimension and urgency of the technological demands generated by climate change,[22] the commitment of governments and donors to ensure access to needed technologies by developing countries is indispensable. The *World Economic and Social Survey* further notes that, in addition to the urgency and scale of the transfers needed to meet the climate change challenge, there is an ethical dimension, since "the countries most responsible for climate change, or at least their corporations, are set to profit through the transfer of technologies to countries that bear little or no responsibility for the problem".[23]

If climate change is to be addressed effectively, a decisive action by the international community is necessary to make mitigation and adaptation technologies globally available. In the absence of such action, this essentially global problem will not find a global solution, but will be left in the hands of those that possess the capital and technical capabilities to produce new clean technologies.

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[15] *See Bettelheim 2007, p. 60.*

[16] *See, for instance, the Buenos Aires Plan of Action in UNFCCC 1999, sec. I, decision 1/CP.4 (para. 3 (a) and para. 7 (d)).*

[17] *UN-DESA 2009, p. 129. Thus, very few foreign companies have transferred wind power technology to China—which is trying to promote independent domestic companies in this field.*

[18] *See UN-DESA 2009, p. 147.*

[19] *Cannady 2009.*

[20] *UN-DESA 2009, p. 126.*

[21] *UN-DESA, p. 126.*

[22] *Paradoxically, a steady decline in public R&D in the energy sector has been observed (UN-DESA 2009, p. 147).*

[23] *UN-DESA 2009, p. 123.*

A variety of proposals have been made to foster climate change related R&D and ensure broad access to its results. These proposals include the establishment of specialized international funds, such as a 'multilateral technology fund',[24] and the setting up of "regional R&D networks of existing indigenous research institutions in developing countries for climate change technology development and commercialization that permit sharing of resources and cost for innovation infrastructure and expensive equipment".[25]

At the Delhi High Level Conference on "Climate Change: Technology Development and Transfer", held on 23rd October 2009, a proposal was made to create a network of international research institutes inspired by the Consultative Group on International Agricultural Research (CGIAR). In accordance with the Chair's summary of the Conference:

> The second lesson we will take away from here is what President Nasheed called a Green Power Revolution, learning from the lessons of the Green Revolution in which India led the way, with international cooperation, in the 1960s and 1970s, to address what was then the most formidable threat faced by developing countries, the threat of famine and food insecurity. Several speakers alluded to the CGIAR network as a model for addressing the challenge of climate change as well as energy poverty. As you are aware, the Green Revolution relied on an elaborate mosaic of interlocking institutions for research, education, credit, marketing, inputs provision, and most importantly, extension—getting the knowledge into the hands of those who needed it. Within 10 years we had transferred knowledge from a few hundred scientists to millions of farmers, the vast majority of whom were illiterate. The CGIAR network provided international support and cooperation in research and education (paragraph 9).[26]
>
> A CGIAR type of global network could provide international support for research and cooperation and ensure that they become centers of excellence (paragraph 10).

The World Bank's *World Development Report 2010: Development and Climate Change* has also raised the question of using the CGIAR as a model for addressing climate change,[27] while a report by the Clean Energy Group and the Meridian Institute has suggested that the CGIAR's "Challenge Programs"[28] may provide a good model for technology sharing and cooperative research to foster open and distributed innovation.[29]

Interestingly, the CGIAR has been taken as a possible model in other areas, notably health research. The Commission on Health Research for Development considered, in 1990, "…the CGIAR…mechanisms as highly relevant to the needs of the health field. The functions of maintaining a global overview across many specific health problems backed by independent technical assessments and the capacity to mobilize resources in support of larger research efforts are sorely missing. Provided there is ample developing country representation in the decision-making process, analogues to the CGIAR…could be extremely constructive for the health field…."[30] The World Bank's 1993 World Development Report: Investing in Health and the 2001 Commission on Macroeconomics and Health made similar recommendations.[31]

The Birth of the CGIAR

The CGIAR was born in 1971 as a result of the joint initiative of a number of international and bilateral agencies, supported by the Ford and Rockefeller Foundations. The CGIAR emerged as a loose network of international agricultural research centres that, although independently managed, worked together to create and disseminate improved plant varieties

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[24] *UN-DESA 2009, p. 147. Cannady (2009) proposes the creation of an international fund to match developing-country commitments to targeted climate change related R&D undertaken at developing-country universities and other research institutions. See also Barton and Maskus' (2005) proposal for the negotiation of a binding agreement to enhance access to basic science and technology by developing countries at reasonable cost.*

[25] *Cannady 2009.*

[26] *Delhi High Level Conference 2009.*

[27] *World Bank 2009, p. 306.*

[28] *See Clean Energy Group and Meridian Institute 2009.*

[29] *See Clean Energy Group and Meridian Institute 2009.*

[30] *See Commission on Health Research for Development 1990.*

[31] *See Commission on Macroeconomics and Health 2001 and World Bank 1993. See also Commission on Intellectual Property Rights, Innovation and Public Health 2006, p. 187.*

with the goal of alleviating hunger and poverty.[32] The CGIAR is closely associated with what has been termed the "Green Revolution". Various factors decisively contributed to the establishment of the CGIAR:

a) During the 1960s there was significant public and scientific concern about a 'Malthusian' threat of a world food crisis, that is, the risk "that rapidly rising population in developing countries would soon outstrip the world's capacity to provide food."[33] There was a strong sense of urgency to address the widespread problem of hunger in developing countries.

b) Successful experiences with the development of and diffusion of high-yielding varieties, initially in Mexico, India, and Pakistan, created the perception that targeted research could be undertaken to significantly increase food production in developing countries, given the available scientific and technological tools. In particular, work by Norman Borlaug on semi-dwarf, high-yield, disease-resistant wheat varieties created the basis for a revolutionary transformation of agriculture, by putting improved varieties and other agricultural technologies within the reach of small farmers in those countries.

c) With the support of the Ford and Rockefeller Foundations, the constitution of the CGIAR built on four international research centres specialized in particular crops: the International Rice Research Institute (IRRI) in Philippines (rice), the Centro Internacional de Mejoramiento de Maiz y Trigo (CIMMYT) in Mexico (wheat and maize), the International Institute of Tropical Agriculture (IITA) (crops for low, humid tropics) and the Centro Internacional de Agricultura Tropical (CIAT) (tropical crops).

d) The heads of FAO, UNDP, the World Bank, and of British, Canadian, Swedish, and U.S. aid organizations were personally involved in the process leading to the creation of the CGIAR. The Asian Development Bank, the Inter-American Development Bank, and Japan's Ministry of Foreign Affairs also participated. The Ford and Rockefeller Foundations had a decisive role in this process. The World Bank offered technical advice and financial assistance and provided the secretariat to the new institution.

e) An independent Technical Advisory Committee (TAC), composed of scientists and research administrators, was created in order to define priorities and assess CGIAR's activities. TAC—replaced in 2004 by the 'Science Council'—was effective in defining the overall CGIAR research strategies. It subjected the different Centres to periodic and thorough evaluations, conducted by external teams of scientists and other experts. Despite the Centres' independence, the extent to which they contributed to the CGIAR general mission was permanently scrutinized by a centralized unit.

f) While the main focus of the CGIAR Centres has been biological research in various fields, social science played a significant role in determining their objectives and modes of operation. Gender, malnutrition, poverty, international norm setting,[34] *inter alia*, became issues of system-wide relevance. In particular, the International Food Policy Research Institute (IFPRI), which was associated with the CGIAR in 1980, provided economic analysis for the system's operation.[35]

CGIAR: A Network for Oriented Research

The CGIAR is a strategic partnership with 64 Members that include 21 developing and 26 developed countries, 4 co-sponsors as well as 13 other international organisations. Most of the funding is provided by development assistance agencies of developed countries. The World Bank covers the Secretariat costs in Washington D.C. The CGIAR operates a centre-driven coalition of 15 research Centres.[36] The Centres are *international* legal entities

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[32] *As mentioned below, the CGIAR later adopted a more holistic view of agriculture and expanded its activities to other areas of biodiversity.*

[33] *Baum 1988.*

[34] *The CGIAR has been actively involved, through the International Plant Genetic Resources Institute (IPGRI), recently renamed as Bioversity, in the design and implementation of international agreements and rules in the area of plant genetic resources for food and agriculture.*

[35] *The Centres' staffs have included economists since nearly the beginning of the CGIAR. See Dalrymple 2006,* **pp. 347-79.**

[36] *The number of Centres reached 17 in the 1990's, later reduced to 15 as a result of mergers.*

established on the basis of specific agreements with the host countries. They are the following:

- Africa Rice Center
- Bioversity International[37]
- CIAT - Centro Internacional de Agricultura Tropical
- CIFOR - Center for International Forestry Research
- CIMMYT - Centro Internacional de Mejoramiento de Maiz y Trigo
- CIP - Centro Internacional de la Papa
- ICARDA - International Center for Agricultural Research in the Dry Areas
- ICRISAT - International Crops Research Institute for the Semi-Arid Tropics
- IFPRI - International Food Policy Research
- InstituteIITA - International Institute of Tropical AgricultureILRI - International Livestock Research Institute
- IRRI - International Rice Research Institute
- IWMI - International Water Management Institute
- World Agroforestry Centre (ICRAF)
- World Fish Center

The CGIAR was conceived as "a loose federation of independent centres" and not as "an organization at all, but an arrangement for consultation".[38] Each Centre is managed by its own board, has an independent budget, and can seek funding for its own activities. While the core operations of the Centres has been supported by 'unrestricted' funding (that is, not linked to specific tasks or projects), the relative weight of 'restricted' (that is, targeted) funding grew over time, possibly to the detriment of activities of global interest as opposed to those of national or regional relevance.[39] Since contributions to the CGIAR are entirely voluntary, the level of funding is one of the constant challenges faced by CGIAR's management and the Centres themselves. The system, however, has been successful in securing funding for the Centre's activities, subject to the limitations found in all types of public research activities.[40]

The existence of the CGIAR has permitted the Centres to share resources and coordinate policies at the system level, and thereby generate economies of scale and of scope that enhance the Centres' capacity to perform their missions. The Centres rely on more than 8000 scientists and staff, with activities in over 100 countries.[41] Although at its inception the CGIAR research focused on the diffusion of the 'Green Revolution' (essentially through increases in the productivity of foodgrains), as economic and social changes took place in developing countries, its work expanded into areas of natural resources management, problems of the poor (including enhancing the micronutrient content of food staples), and analysis of policy and institutional issues.[42] Currently, the CGIAR mission is:

"to achieve sustainable food security and reduce poverty in developing countries through scientific research and research-related activities in the fields of agriculture, forestry, fisheries, policy, and environment". The priorities of CGIAR research are defined as follows:[43]

- Reducing hunger and malnutrition by producing more and better food through genetic improvement;
- Sustaining agriculture biodiversity both *in situ* and *ex situ;*
- Promoting opportunities for economic development and through agricultural diversification and high-value commodities and products;

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[37] *Formerly International Plant Genetic Resources Institute (IPGRI).*

[38] *Baum 1988, p. 10.*

[39] *Dalrymple (2006) contends that this may have contributed to the CGIAR's shift from a "science-driven" to a "donors-driven" model, leading to underemphasis of global public goods.*

[40] *Total CGIAR revenues in 2008 were $553 million, double the revenues obtained in 1994 (See CGIAR 2009a). However, in constant terms, total funding "increased by only $21 million (in 2007 dollar terms) from 1995 to 2007, a rise of less than half a percent in 12 years. Furthermore, 36 percent of funding in 2007 was unrestricted as compared with 63 percent in 1995 and 100 percent in 1972. In addition, a lack of coordination among investors results in sub-optimal resource use" (CGIAR Change Steering Team 2008, p. 2).*

[41] *See Who we are (Web page), http://www.cgiar.org/who/*

[42] *See CGIAR Science Council 2008, which reviews and assesses the large body of evidence on the impacts of agricultural research by the CGIAR and its partners in South Asia, p. xi.*

[43] *See Who we are (Web page), http://www.cgiar.org/who/*

[44] *See Who we are (Web page), http://www.cgiar.org/who/*

- Ensuring sustainable management and conservation of water, land, and forests; and
- Improving policies and facilitating institutional innovation.[44]

The CGIAR system produces a number of global public goods,[45] such as the maintenance of the world largest collection of germplasm of various crops. However, the extent to which the Centres operate globally varies significantly. Although most of them operate with a global reach, "there is a tendency to emphasize one or two regions, particularly Africa".[46]

In addition, the expansion of IPRs in different areas of biodiversity, and the growing role of the private sector in agricultural research, required the adaptation of the Centres' *modus operandi* to a new reality. In accordance with the Science Council, "the Centres have found, increasingly and particularly in the molecular biology area, that they need to be able to use proprietary technologies; the need for and the implementation of humanitarian licences have become much debated; biotech crops, with varying levels of statutory protection but still under the control of an increasingly consolidated international plant breeding industry, are now being grown widely in a number of developing countries; and, the System has had its first experiences of third party IP in its own biotech crops".[47]

Despite the proposal of a system-wide IPRs policy elaborated in 2000[48] and the establishment of a Central Advisory Service for Intellectual Property (CAS-IP), the task of defining a common approach to IPRs has posed a complex challenge to the CGIAR Centres. The Genetics Resources Policy Committee (GRPC) recently elaborated a new proposal on the subject. In accordance with this proposal, the Centres might only seek or assert intellectual property rights in exceptional cases, such as when it is indispensable to ensure further development of a research result, or to get access to technologies under the control of private companies that are needed to fulfill the CGIAR mission.[49]

A distinct feature of CGIAR's operation is the constant effort made to identify and evaluate the impact of the Centres' activities. According to an independent review conducted in 2008 of CGIAR's governance, scientific work, and partnerships, "its research has produced high returns since its inception, with overall benefits far exceeding costs…. Even under the most conservative assumptions, they far outweigh total research expenditures of $7.1 billion since 1960 (expressed in 1990 dollars)".[50] The impact of policy-oriented research has also been positively evaluated in 2007–2008 by the CGIAR's Standing Panel on Impact Assessment.[51]

The CGIAR's Organisation

The Chair of the CGIAR, usually a Vice President of the World Bank, is nominated by the World Bank's President and endorsed by CGIAR members. As mentioned, the World Bank facilitates the services of a professional secretariat to the CGIAR. The Director of the CGIAR, acts as Chief Executive Officer and heads the CGIAR Secretariat.[52] In addition, a 'virtual' System Office was created to integrate services provided to

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[45] *The concept of 'global public goods' was first used by TAC in 1997 and defined (CGIAR ICT-KM Program 2005) as "data, information, and value-added information and services based on data and information that are:*

- *Searchable and located in repositories (electronic)*
- *Globally available*
- *Open and easily accessible to all*
- *Demonstrably sustainable*
- *Contributing substantially to the CGIAR mission".*

See also Le Goulven and Louafi 2008, p. 20.

[46] *Dalrymple 2006.*

[47] *CGIAR Science Council 2006, p. 1.*

[48] *See GRPC 2002.*

[49] *See the proposal by the CGIAR Genetics Resources Policy Committee for a "Policy of the Alliance of CGIAR Centres on Intellectual Assets" in GRPC 2009.*

[50] *Based on the development of a counterfactual scenario of world food production without CGIAR contributions, it was found that "world food production would be 4-5% lower, and developing countries would produce 7-8% less" and "world grain prices would be 18-21% higher". See CGIAR 2009b.*

[51] *See Briefs of impact assessment studies (Web page), http://impact.cgiar.org/eims_search/briefs.asp#Impact%20Assessment%20of%20Policy-Oriented%20Research%20in%20the%20CGIAR:%20Evidence%20and%20Insights%20from%20Case%20Studies.*

[52] *See Who we are: Structure & governance: Executive Council (Web page). http://www.cgiar.org/who/structure/executive/index.html.*

the Centres by the CGIAR Secretariat and other office units,[53] including strategic planning and development, monitoring and evaluation, communication and resource mobilization, and management.

Annual General Meetings (AGMs) provided CGIAR members and stakeholders a forum for discussion about needs to be addressed, strategies, and programmes. The Genetic Resources Policy Committee and the Private Sector Committee were established to deal with particular issues and ensure the participation of civil society and other stakeholders in CGIAR debates and activities.

The CGIAR's organization and programming approach has changed over time in order to adapt to changing realities and perceived needs. Two significant changes were undertaken in the last ten years. In 2001, a 21-member Executive Council[54] was established in order to act on behalf of the CGIAR on matters delegated to it by the Group, facilitate decision-making, provide oversight during the implementation of the Group's decisions, and ensure continuity between the AGMs. In addition, the Alliance Executive (AE) of the CGIAR Centers provides support and perspective on system-wide issues and on technical and management concerns of the Centres,[55] while the Alliance Board (AB) makes recommendations to the individual Boards about policies, methodologies, and practices.[56] In addition, a set of 'Challenge Programs' was established. A 'Challenge Program' is "a time-bound, independently-governed program of high-impact research that targets the CGIAR goals in relation to complex issues of overwhelming global and/or regional significance, and requires partnerships among a wide range of institutions in order to deliver its products".[57] While for some CGIAR members these programs should have reinforced the CGIAR's role as producer of public goods (by allowing, *inter alia*, broader cooperation with different partners), the new CGIAR vision and strategy, as adopted in 2000, rather gave preference to a *regional* focus in research in order to complement and supplement the national approach.[58]

In December 2008, the CGIAR decided to significantly change its governance structure in order to establish a results-oriented research agenda, clarify accountability across the system, and streamline governance and programs for greater efficiency.[59] The AGMs will be replaced by a biennial Global Conference on Agricultural Research for Development, which is intended to provide a consultation forum for stakeholders to provide input into the formulation of the CGIAR strategy. Under the new organizational model, a "more programmatic approach than in the past" will be taken through 'mega-programs' that would "bring CGIAR scientists and partners together to address critical issues and deliver international public goods that advance global development objectives".[60] A 'Consortium of the CGIAR Centers' and a 'CGIAR Fund' will be established.

The new governance structure—which will become operational in 2010—will entail significant changes for Centres' operations. The new 'Consortium of the CGIAR Centers' is a *new legal entity* intended to unite the Centres.[61] The CGIAR Fund is a new "multidonor, multiyear funding mechanism set up to provide

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[53] *These units are: Central Advisory Service on Intellectual Property, Alliance Office, Gender & Diversity Program, Media Unit, Science Council Secretariat, Internal Audit, and Human Resources Unit.*

[54] *The Chair of the CGIAR also chairs the Executive Council.*

[55] *The AE main functions include to:*

- *inform members of important internal and external developments affecting the System and especially the Centres;*
- *discuss issues of common interest put forward by any part of the CGIAR System or its Members, and decide on a common position;*
- *implement activities of collective interest to the System and Centres through appropriate mechanisms for planning, sharing costs, and achieving results;*
- *ensure linkages with the Science Council and other components of the CGIAR System on matters of joint interest; and*
- *undertake certain public awareness activities for the System, and prepare a collective position of the Alliance Executive for discussions with representatives of any part of the CGIAR System, as well as for presentations at CGIAR meetings (http://www.cgiar.org/who/structure/committees/center/directors.html).*

[56] *The* **main functions of the AB** *are to:*

- *demonstrate initiative in responding to CGIAR opportunities and challenges that are common to Centres;*
- *contribute to the development of CGIAR policy;*
- *provide oversight of Centres' adherence to CGIAR policies;*
- *encourage and develop effective leadership by Centre boards; and*
- *provide oversight of coordination between and among Centres.*

[57] *See Research & impact: Challenge programs (Web page), http://www.cgiar.org/impact/challenge/. The Programs approved so far are: Water and Food, HarvestPlus (interdisciplinary, research to breed nutrient dense staple foods), Generation (use of molecular biology to create a new generation of plants), the Sub-Saharan Africa Challenge Program (SSA CP), Climate Change, Agriculture and Food Security (CCAFS).*

[58] *See CGIAR Technical Advisory Committee 2001.*

[59] *See Change management (Web page), http://www.cgiar.org/changemanagement/*

[60] *See Change management (Web page), http://www.cgiar.org/changemanagement/*

[61] *See Change management (Web page), http://www.cgiar.org/changemanagement/*

strategic financing to support priority agricultural research areas.... [It] will finance Mega Programs under the SRF [Strategy and Results Framework] for implementation by the Centers and their partner institutions implementing the Programs. It is intended to facilitate harmonization of donor support by providing a single entry point for financing through three designated funding 'windows'".[62]

Can the CGIAR Model be Applied in the Area of Climate Change?

The focus of the Centres' research, the significant spillovers of their activities, their strong interaction with national agricultural research institutions, and their autonomy to pursue their specific missions, have been crucial for the Centres' successful performance in the almost 40 years of the CGIAR's existence.

However, changing circumstances, including the broadening of the Centres' mandates, the reduction in unrestricted funding, and the growing role of the private sector in agricultural research, have required significant adjustments in the policies and organization of the CGIAR.[63]

While the CGIAR´s experience may provide useful lessons, the possibility of establishing a similar network of institutions for the coordinated development and broad diffusion, as public goods, of climate change adaptation and mitigation technologies, poses a large number of political, strategic, and managerial challenges.

Science is normally more amenable to cooperative work and dissemination as a public good than is technology, which generally requires adaptation to particular needs and circumstances. In an international scenario dominated by the private development and appropriation of technologies, developed countries should make a major concession at the UN Climate Change Convention (COP-15) in Copenhagen to ensure sufficient funding to develop clean technologies and make them globally accessible. If this (certainly ambitious) objective were achieved, a set of research institutions of excellence would be a useful mechanism to undertake a common program of activities. Existing national institutions may welcome additional international funding, but governments may be reluctant to lose control over them.[64] Given the vast array of fields where research is needed to generate adaptation and mitigation technologies, defining a set of priorities would require scientific competence and political commitment. A mechanism of monitoring and evaluation should also be put in place. As the CGIAR experience shows, such a mechanism would be essential to define priorities, to ensure an efficient utilization of resources, and to achieve the concrete results that are urgently needed.

In designing a possible international network of research institutions to work on climate change related technologies, the following issues should be considered:

- selection of participating institutions or establishment of new ones;
- funding mechanism and plans;
- governance of collaborating institutions and capacity to engage in joint research;
- mechanisms to determine research priorities, distribute tasks, monitor progress, and evaluate the achievement of the defined objectives;
- conditions for cooperation with and use of technologies held by the private sector;
- establishment of common policies on diffusion of research outputs and use of the IPRs system; and
- participation of developing countries' institutions in research and means for facilitating access by developing countries to all relevant research results.

Conclusion

The dimension of the challenges generated by climate change seems to justify the efforts required to put into place an international system of applied research that produces global public goods. The CGIAR may serve as a model for that purpose, but the history, area of work, focus, and organisation of the system suggest

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62 *See CGIAR Executive Council 2009.*

63 *In accordance with the CGIAR Change Steering Team, "[S]ince its inception in 1971, the CGIAR System has evolved into an increasingly complex entity, characterized by complicated governance structures. The result is a loss of efficiency due to overlaps in mandates, cumbersome monitoring and review procedures, an inability to harmonize funding and resource allocation, and a lack of authority to enforce decisions. There is no mutually agreed 'compact' outlining the obligations of donors and Centers" (CGIAR Change Steering Team 2008, p.1).*

64 *As noted above, the CGIAR Centres are international entities that are not subject, hence, to the jurisdiction of the national government of the country where each Centre was established.*

that replicating it in other areas may not be an easy task, given, in particular, the current trend towards the appropriation of research results under IPRs in the various industries that may generate adaptation and mitigation technologies. A significant degree of organisational capacity, funding, and political support will be necessary to ensure that an initiative of that type can materialise in a way that effectively responds to those challenges. Building it will also require dealing with the boundaries between knowledge and action in ways that enhance the impact of the scientific and technological results that are produced.[65]

KEY CONCLUSIONS AND RECOMMENDATIONS

1. Recent years have witnessed a growing trend toward the appropriation of climate change technologies by intellectual property rights (IPRs). If this trend is to continue, IPRs are likely to play a key role in determining access to these technologies. If highly priced, access to protected technologies may be unaffordable to many developing countries.

2. Adaptation and mitigation to climate change require not only a massive effort to develop suitable technologies but mechanisms to make them readily available on an affordable basis through technology transfer and extensive international cooperation. Innovation is not enough.

3. In the context of international partnerships in the area of joint R&D collaboration, the Consultative Group on International Agricultural Research (CGIAR) offers a model which is attracting increasing interest on the part of stakeholders actively involved in climate change talks.

4. Born in 1971, the CGIAR is a strategic partnership with 64 Members that include 21 developing and 26 developed countries, four co-sponsors, as well as 13 other international organizations. The CGIAR operates a centre-driven coalition of 15 research centres. Currently, its mission is "to achieve sustainable food security and reduce poverty in developing countries through scientific research and research-related activities in the fields of agriculture, forestry, fisheries, policy, and environment".[66]

5. The CGIAR system has proven to be a successful international partnership producing a number of global public goods such as the maintenance of the world largest collection of germplasm of various crops. However, changing circumstances, including the reduction in unrestricted funding, and the growing role of the private sector in agricultural research, have required significant adjustments in the policies and organisation of the CGIAR.

6. In particular, the expansion of IPRs in different areas of biodiversity and agriculture has raised many challenges. Defining a common approach to IPRs by the CGIAR Centres has proven problematic. According to a new proposal in this area, the Centres might only exceptionally seek or assert IPRs, such as when it is indispensable to ensure further development of a research result, or to get access to technologies under the control of private companies that are needed to fulfill the CGIAR mission.

7. Based on the CGIAR experience, efforts to design a possible international network of research institutions to work on climate change mitigation and adaptation technologies should consider the following issues:

   - selection of participating institutions or establishment of new ones;
   - funding mechanism and plans;
   - governance of collaborating institutions and capacity to engage in joint research;
   - mechanisms to determine research priorities, distribute tasks, monitor progress, and evaluate the achievement of the defined objectives;
   - conditions for cooperation with and use of technologies held by the private sector;
   - establishment of common policies on diffusion of research outputs and use of the IPRs system; and
   - participation of developing countries' institutions in research and means for facilitating access by developing countries to all relevant research results.

[65] *See Cash et al. 2003.*

[66] *http://www.cgiar.org/who/*

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