International Agricultural Research: Is the Reformed CGIAR an Adequate Response to the Challenges Ahead?

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International agricultural research, organised since 1971 in the Consultative Group on International Agricultural Research (CGIAR), is a key institutional element for achieving food security and development. In the last two decades, CGIAR experienced increasing shortcomings and unsatisfactory performances, due to a number of external and internal factors which will be discussed in this paper. In answer to the changes and challenges, a renewed CGIAR was adopted last year, with a new institutional model, a common vision, and strategic objectives for all centres, and a development of centralised, cross-centre mega-programs. The next years will indicate whether the reorganised institutional settings and the reorientation of research agendas will be successful. In this context, a number of controversial issues remain.

1 Introduction

The Consultative Group on International Agricultural Research (CGIAR) is a cornerstone of the international agricultural research effort. CGIAR was established in 1971 and was originally based on the four agricultural research centres previously established by the Rockefeller and Ford Foundations: the "Centro Internacional de Mejoramiento de Maíz y Trigo" in Mexico, the "International Rice Research Institute" in the Philippines, the "International Institute of Tropical Agriculture" in Nigeria, and the "Centro Internacional de Agricultura Tropical" in Colombia. When formed, the CGIAR had 20 members (11 industrial countries, six international organizations, and three foundations) and the annual budget was about US$20 million in nominal dollars. At this time, it occupied a unique position in the international agricultural research. Over the last four decades, the CGIAR system has evolved in many ways. It now supports 15 international agricultural research centres. There are 64 CGIAR members today including 21 developing and 26 industrialised countries, four co-sponsors, as well as 13 other international organisations (CGIAR 2011a; cf. Meyer 2008, p. 43).

The research focuses of the CGIAR centres have changed over time. Starting with semi-dwarf varieties of rice and wheat and improved varieties of maize from international agricultural research centres of CGIAR, public breeding programmes in developing countries have released more than 8,000 improved crop varieties over the past 40 years. The contribution of improved crop varieties to yield growth since 1980 has been even larger than in the Green Revolution decade of the 1970s.

A second major task has been developed on improving the management of crops, livestock, and natural resources. In the period 2002–2005 the CGIAR invested about 43 percent of its financial resources in protecting the environment, saving biodiversity, and improving policies, more than twice the 18 percent invested in genetic improvement (Pingali, Kelley 2007, pp. 2388f.). Part of this work has emphasised soil and water management and agro-ecological approaches that employ biological and ecological processes to reduce the use of non-renewable inputs, especially pesticides and mineral fertiliser. Examples include conservation agriculture, green manure cover crops, soil conservation, and pest control using biodiversity and biological control rather than pesticides (World Bank 2007, p. 163).

2 Changes and Problems

Despite high macroeconomic returns on investments and important successes of CGIAR-supported research, since the 1980s the CGIAR system has been criticised time and again for a lack of coordinated action, for neglecting socio-economic factors, especially of smallholder und subsistence agriculture, and for being too much fixed on technology development such as modern biotechnology (Anderson et al. 1988; Lipton, Longhurst 1989; Uphoff 2002; IAASTD 2009a). In recent years, when hunger and poverty reduction became more prominent on the international political agenda, a discussion began on shortcomings and unsatisfac-

tory performance of the CGIAR (CGIAR 2008a, p. 1). A number of external and internal factors can be identified. Major issues are summarised below.

2.1 Changing Landscape of Agricultural Research

The agricultural research landscape has undergone some major changes in the past decades. This changing environment is also for CGIAR of high relevance.

Globalisation and private sector research: During the first 20 years of CGIAR, agricultural research was characterised by public funding. From the 1990s on, agricultural science and technology became increasingly globalised, spurred by massive growth of private sector Research & Development and rapid advances in information and other technologies. In the industrialised countries, investment by the private sector is now higher than total public sector investment. Private investment is largely confined to technologies with intellectual property protection, which can earn significant revenues in the market (IAASTD 2009a, p. 25). Powerful private actors emerged with their own agendas and interests. In contrast, private sector investment in developing countries has remained small, and this is likely to continue.

Development of national agricultural research systems: Besides overall economic growth, the support of the CGIAR system contributed to the building up of national agricultural research systems (NARSs). Today, international cooperation in agricultural research and development goes well beyond CGIAR. In agricultural research for development, the national agricultural systems in Brazil, China, India, and the Republic of South Africa, and some other countries became world leaders in agricultural research and important sources of new technologies and knowledge for other countries and regions. They hold huge potential for increased South-South cooperation. The Brazilian Agricultural Research Corporation, for example, has a budget that is more than three times larger than CGIAR's and has meanwhile launched programmes in Africa.

Regional research organisations and networks are also playing a much greater role. Many developing countries, including several in Africa, now have national agricultural research institutes with solid capacities (CGIAR 2008a, p. 22). Additionally, the organisational structure of NARSs changed over time, evolving from bureaucratic public service institutions to diversified systems with stronger participation of universities, NGOs, and the private sector (both local and international) (Lele, Ekboir 2004, p. 9). But at the same time, a new dualism emerged. Many smaller, especially poor countries are lagging behind in agricultural research. We see a depletion of national counterparts or a missing of national agricultural research system in many "Least Developed Countries". Therewith, the gap between stronger and weaker nations the CGIAR institutions must cooperate with is widening (CGIAR 2008b).

New technology transfer models: For some decades, CGIAR centres followed a linear concept of transfer of technology: Scienctists were regarded as problem-defining and knowledge-generating agents at the core. Their results, embedded in technologies, messages, and practices, were expected to be transferred by extension agents to farmers, whose role was that of technology adopters. This model was successful for purposes of disseminating improved seed, training farmers in simple practices and input use, and disseminating application prescriptions within the intensive, high external input production systems characterising the relatively homogenous irrigated wheat and rice production systems of South and Southeast Asia (IAASTD 2009b, p. 63). But the model was not suitable for organising knowledge transfer capable of improving heterogeneous agro-ecological and farming conditions. In addition, resource-poor and women farmers were often not well-addressed. In response, new models such as "farming systems research and extension" and "farmer participatory research and extension" were developed. These aim to activate farm level interactions between researchers and farmers in the course of technology design, testing, and adaptation, and to promote farmer-to-farmer communication and training (IAASTD 2009b, p. 65). Including farmers in the research and development process is not only relevant for agro-ecological production system improvements. The "participatory plant breeding" concept involves farmers throughout

the entire breeding process and mainly takes place in farmers' fields (Uphoff 2002; Kotschi 2010).

Civil society engagement in research: New actors from the private sector who are very powerful in financial and ideological terms, such as the "Bill and Melinda Gates Foundation", are becoming major players in financing international agricultural research (CGIAR 2008a, p. 23). Globally acting foundations, e.g. the "Bill and Melinda Gates Foundation", "Kelloggs Foundation", "Syngenta Foundation" have joined CGIAR as donors. They are represented in the CGIAR fund council (CGIAR 2011b). Besides funding research, local and national agricultural NGOs (see *Uphoff in this volume*) have also become increasingly engaged in own or collaborative research projects. Therewith, a new world of actors is evolving.

Changing research agenda in industrialized countries: Until recently, the world's poorest countries were highly dependent on the spillover of agricultural technologies from industrialised countries (especially the United States and the European Union), both individually and through CGIAR. Successful innovation efforts in most developing countries mainly took place at the very end of the innovation process, for example, by selecting and adapting varieties for local conditions using breeding lines and other material developed elsewhere. But the research agenda of industrial countries is shifting. In rich countries, emphasis on enhancing the production of staple food is declining. Instead, environmental and health issues of production and products are gaining importance.[2] This means that the industrialised countries will no longer provide the same level of productivity-enhancing agricultural technologies, suitable for adaptation and adoption in developing countries, as they did in the past.

Intellectual property rights: The rise of modern biotechnology and enhanced regimes of intellectual property rights mean that some technologies that were once freely accessible will be more difficult to access in the future. Biotech companies are mostly located in OECD countries – particularly in the United States – and they emphasise technologies that are applicable at home (Pardey et al. 2006b). If CGIAR centres do not file patent applications for their research, private researchers and companies will do it, preventing free transfer to NARSs and resource-poor farmers (Lele, Ekboir 2004, p. 10). The principle that agricultural research should operate in some kind of "global commons" is challenged by court decisions, legal provisions, and international treaty obligations in favour of "privatisation" of new knowledge.

Imbalance between "emergency aid" and "longer-term research and development": Overall, the balance of assistance shifted away from long-term development to emergency assistance. The value of emergency food aid distributed by the World Food Programme in 2007 was with US$5 billion already larger than the sum of funds for longer-term agricultural research and development: In this year, the "World Bank/International Development Association" committed US$1,771 million to food and agriculture, and the "International Fund for Agricultural Development" provided US$563 million, the annual research expenditure of the CGIAR was US$530 million, and the annual budget of FAO for TA and Standards US$380 million (Lele 2009).

"Mushrooming" of aid agencies, "verticalisation", and fragmentation of development aid: The number of official development agencies has mushroomed in the last three decades and the development aid architecture today is far more complex than ever before. Official development assistance is provided from over 126 bilateral agencies in member countries of the Development Assistance Committee (DAC) of the OECD. In addition, outside the DAC, there are at least 23 other countries giving aid. These are mostly well-off countries, but an increasing number of large middle-income countries as well, such as China, India, Brazil, and Turkey, which are active in their neighbourhoods and in selected countries where they have strategic interests (see also *Fan, Breisinger in this volume*). The picture gets even more complicated with at least 263 multilateral aid agencies, ranging from large well-known bodies to small and highly focused organisations (Kharas 2009).

The main aid instruments – project aid and technical support – utilised until the 1980s have now been supplemented with a variety of new instruments such as budget support, debt relief, Sector Wide Programmes, multi-donor Trust Funds, pooled funding, capacity building, and other de-

vices. Associated with the greater number of donors and manifold of instruments, aid budgets get more fragmented. The number of new aid activity commitments registered with the DAC increased almost five-fold in one decade, from 17,000 in 1996 to 81,000 in 2006. At the same time the average size of each activity halved, declining from US$3.2 million to US$1.6 million (Kharas 2009). Simultaneously, more development assistance through multilateral channels as well as bilateral assistance was restricted, that means "earmarked" for specific themes or sectors. In addition to this "verticalisation" of donor funding, a phenomenon called "bilateralisation" of multilateral aid, i.e. the bilateral funding in multilateral assistance, came up in the 1990s. All this opened new possibilities in agenda setting by donor countries and agencies (Lele 2009).

2.2 Changes within the CGIAR

The changing environment is also reflected inside the CGIAR system which has undergone continuous evaluations and adjustments. Nonetheless, major inefficiencies remained before the current reform.

Enhanced mission: Over the course of the last four decades, the mandates have increased significantly, growing from a narrow focus on improved productivity to 15 centres with a much expanded agenda, from the traditional focus on crop genetic improvement to complex issues like natural resource management and conservation issues critical to sustainable development (CGIAR 2008b). The shift in priorities has also reflected changes in donor priorities.

Inadequate financing: The resources made available to the CGIAR have not kept pace with broadening tasks and portfolios. While in nominal terms funding has increased, in constant US$ it has stagnated. Between 1995 and 2007, total funding increased by only US$21 million (in 2007 dollar terms), a rise of less than 0.5 percent over 12 years (CGIAR 2009b). Further, the share between unrestricted funds and earmarked contributions has changed dramatically, with a proliferation of smaller, targeted grants (CGIAR 2008a, p. 53). In 1972, 100 percent of funding was unrestricted. In 2009, 66 percent of the funding were restricted contributions (CGIAR 2009b). Important consequences of this shift are higher administrative costs for centres and insufficient recovery of indirect costs. In addition, a lack of coordination among donors resulted in sub-optimal use of financial resources (CGIAR 2008b).

Increased complexity and overlaps in mandates: CGIAR evolved over time into an increasingly complex system, characterised by complicated governance structures. The result is a loss of efficiency due to overlaps in mandates, cumbersome monitoring and review procedures, an inability to harmonise funding and resource allocation, and a lack of authority to enforce decisions. No mutually agreed understanding of the obligations of donors and centres existed (CGIAR 2008b).

Impacts of research: There is an ongoing debate about the impacts of different research areas, and therewith on the appropriate weighing of research programmes:

- The first position highlights the impacts of crop genetic research. A meta-analysis of economic ex-post impact assessments over the system's lifetime (until 2001) came to the result that research benefits heavily outweigh costs, with a wide spread of results depending from the studies included (Raitzer 2003). A very high proportion of benefits was associated with just a few of CGIAR's programmes, however. Roughly half (47 %) of total benefits were attributed to breeding of modern rice varieties, and almost a third (31 %) to spring wheat breeding. Biocontrol research that led to reduced crop damage from the cassava mealybug, which can cause crop losses of up to 80 %, accounted for most of the remaining total benefits (15 %) (CGIAR 2008a, p. 28). But this result derives from the fact that only a small subset of impacts has been assessed in the studies (Raitzer 2003, p. xvi). A recent review of evidence on the impacts of CGIAR research published since 2000 confirms that crop genetic improvement research stands out as having had the most profoundly documented positive impacts. For other research areas within the CGIAR, substantial evidence is seen for large beneficial impacts although often locally and nationally rather than internationally. The "right time, right place" nature

of successful policy research and the relatively limited geographic scale of much natural resource management research often limits the overall scale of impacts of these programmes vis-à-vis genetic improvement research. The conclusion is that the CGIAR's portfolio of research allocations has become overly balanced toward natural resource management and policy research over time (Renkow, Byerlee 2010).

- A second position takes a more inclusive view. The independent review of the CGIAR system in 2008 states that recent studies on the impact of natural resource management research, including pest management, show substantial benefits. Some benefits occurred at a considerable scale and are of international significance. It is admitted that much of the research impact for natural resource management is on a smaller geographic scale than that for crop genetic improvement, often because adoption depends on local collective action, extension services, or assignment of property rights (CGIAR 2008a, p. 28). Additionally, a deficiency is seen in the focus on productivity benefits while ignoring environmental benefits – presumably due to the methodological difficulties to quantify them in macroeconomic numbers. Finally, the tendency to compartmentalise impact assessment neglects the collective contribution to strategic goals and that natural resource management is essential to realise higher yield potentials through crop genetic improvements in the field (CGIAR 2008a, p. 31).
- A third position criticises that CGIAR is weak in its agronomic research and in systems development research capacities. Relatively little attention has been given to agronomic practices, integrated pest management technologies, and innovations like Conservation Agriculture and the System of Rice Intensification, and social research – compared to germplasm enhancement and crop improvement research. The negligible socio-cultural research conducted within the CGIAR over the past three decades is cited as a particularly serious deficit (Cernea, Kassam 2006).

Short-falls in partnership: At all levels – global, regional, national, and local – there are many alternative sources of supply for the goods and services that CGIAR once provided alone. The relationship between CGIAR and NARSs has changed considerably over the last four decades. In some regions (for example Asia) and some countries of Sub-Saharan Africa (for example Kenya, Nigeria, and the Republic of South Africa), the centres have changed from mentors to collaborators or partners with NARS (CGIAR 2008a, pp. 63, 68). Despite an increasing number of concrete active partnerships between NGOs and single centres, the formal relationship between CGIAR and NGOs since 1995 has been characterised more by difficulties than productive collaboration (CGIAR 2008a, p. 71). Overall, the changing landscape of agricultural research makes new and changed partnerships necessary.

3 A Renewed CGIAR

In answer to these changes and challenges, the CGIAR adopted a new alignment and organisation last year, after two years of consultation (see CGIAR 2010). The main elements of the "new business model" are:

- New institutional model,
- Common vision and strategic objectives,
- Portfolio of mega programs with legally binding funding and performance agreements.

Table 1 shows a comparison between the founding principles and the new ones.

Table 1: Recasting the founding principles of CGIAR

Founding principles (situation in the past)	*Principles of the new CGIAR*
Donor sovereignty	Donor harmonization
Center autonomy	Significantly reduced with greater system coherence
Decision-making by consensus	Replaced by new decision rules and performance contracts
Independent scientific and technical advice	Integrated independent science, partnership, and development outcome advice

Source: CGIAR 2008b, p. 7

The *new institutional model* of CGIAR aims to clearly delineate the responsibilities and accountability of those who conduct research and those who fund it. On the one hand, the Consortium of the CGIAR centres unites the international agricultural research centres supported by CGIAR and provides a single contact point for donors. On the other hand, CGIAR donors join together in the CGIAR Funders Forum, and the Fund Council, with the aim of harmonising their contributions to agricultural research for development (CGIAR 2010). The two-pillar management structure will be held together by four bridging mechanisms. The most fundamental is the "Strategy and Results Framework" (SRF), which guides the development of a results-oriented research agenda (see mega programs below) in line with the new vision and strategic objectives. In April 2011 the Fund Council and Funders Forum have adopted the SRF (CGIAR 2011c).

The *common vision* is "to reduce poverty and hunger, improve human health and nutrition, and enhance ecosystem resilience through high-quality international agricultural research, partnership, and leadership" (CGIAR 2009a). The *strategic objectives* are:

- "Food for People: Create and accelerate sustainable increases in the productivity and production of healthy food by and for the poor.
- Environment for People: Conserve, enhance and sustainably use natural resources and biodiversity to improve the livelihoods of the poor in response to climate change and other factors.
- Policies for People: Promote policy and institutional change that will stimulate agricultural growth and equity to benefit the poor, especially rural women and other disadvantaged groups." (CGIAR 2009a, p. 4)

In the shift to a more programmatic approach, the "CGIAR Research Programs" or so called *mega programs* play a key role. They represent contractual relationships – both within the CGIAR and between the lead centre and research partners outside – and put greater emphasis on results on the ground. The Consortium Board takes the lead in selecting and defining mega programs, which are then submitted to the Fund Council for approval and funding. Fundamental to developing the SRF and its mega programs is their alignment with the perspectives and priorities of end users, as expressed through biennial "Global Conferences on Agricultural Research for Development" (GCARD) and other contacts (CGIAR 2010). The 1st GCARD took place in 2010 and produced a road map "Transforming Agricultural Research for Development Systems for Global Impact" (GCARD 2011).

4 Perspectives and Remaining Questions

A first success of revitalising CGIAR is a remarkable increase of funding. The CGIAR funding was raised from US$426 million in 2006 to US$606 million in 2009 (last available figures) (CGIAR 2009b). The changed institutional structure is too new to assess its performance. Fifteen mega programs were proposed by CGIAR centres in cooperation with their partners, from which four are adopted, one is under provisional approval, and ten are at various stages of progress (Consortium 2011). Therewith, the reorganisation of the research agendas is still under way.

Independent from an overall success of the CGIAR reform, the following questions will probably also accompany the international agricultural research system in the next years.

- *Plant genetic improvement versus agro-ecological production system research:* Macroeconomic benefits of crop genetic improvements are the most often assessed and best documented research area. They represent the most important success stories of CGIAR in the past. Modern varieties have the chance of high spillovers also in the future. But yield gaps are very high in many developing countries and therefore the potential for intensification, in contrast to favourable areas in OECD countries (Neumann et al. 2010). The realisation of improved yield potentials, achieved by breeding, depends on parallel advances in the production management. Sustainable intensification via agro-ecological approaches (see *Kassam et al. in this volume*) holds high unexploited potentials for higher productivity and for reduced environmental degradation, independent from breeding successes. Concerning climate change

adaptation, the adequate mix of crop resilience through breeding and resilience of agricultural production systems through agro-ecological approaches is discussed controversially. Overall, the debate about the best balance between crop genetic improvements and management improvement of production systems with agro-ecological approaches will continue.

- *International research versus local production system development:* The evaluation of CGIAR revealed that a clear conflict between generating international public goods and working on the applied research and capacity building of partners in turning outputs into outcomes and impacts existed in some centres (CGIAR 2008a, p. 30). The new CGIAR Consortium and the mega programs now aim at a centralised programming, to move away from fragmented and restricted projects. But nonetheless, it was learned in different contexts that "one size fits all" strategies do not work. The new results-oriented research agendas have to show how well they can address the international, regional, national, and local interconnections, with no simple or single solution in sight.
- *Scientific excellence versus networking:* The reformed CGIAR aims to create an exciting research environment, which attracts, develops, und supports the best scientists (CGIAR 2008b, p. 6). But CGIAR also has to tackle other tasks. Given the site-specificity of much agro-ecological research and the lack of critical mass to do good work in this area in many NARSs, more attention needs to be given to the facilitative model, in which the CGIAR serves more as a broker between NARSs and international research institutions and among NARSs. The task of CGIAR should be to develop methodologies, tools, data, information, and results that have broader spillovers (World Bank 2004, p. 101). The necessary networking to deliver the support, coordination, and exchange for local production system developments may conflict with aiming at scientific excellence.
- *Top-down transfer model versus participatory research*: The linear technology transfer concept is challenged by new participatory approaches. One objective of the new CGIAR is to be more open for partnerships. The heterogeneity of potential partners makes this a challenging task. The new mechanisms have to prove that they are capable to include the demands of poor, smallholder and subsistence farmers, consumers, and other users of natural resources which are largely unrepresented at the international level.

The overriding challenge for the renewed CGIAR is to make an essential contribution to reduce hunger, malnutrition, and poverty by harnessing greater productivity and ecosystem services with less fossil energy and environmental impacts.

Notes

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2) See Pardey et al. 2006b, detailed in Pardey et al. 2006a.

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