CONSULTATIVE GROUP ON INTERNATIONAL AGRICULTURAL RESEARCH

Positioning the CGIAR in the Research *for* Development Continuum

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SCIENCE COUNCIL

CGIAR

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The development of the CGIAR System Priorities for Research has been conducted as a consultative process. The Science Council of the CGIAR adopted three principle criteria for the inclusion of Priority research, namely: (i) the probability of impact, (ii) the international public goods nature of the research, and (iii) the comparative advantage of the CGIAR to undertake the research. To aid the Systemwide discussion and processes of implementation of the Research Priorities, the Science Council firstly elaborated in a paper the definition of International Public Goods (IPGs) and the operational context for CGIAR research. Secondly, in collaboration with the Netherlands Ministry of Foreign Affairs and the University of Wageningen, the Science Council convened a workshop to discuss the positioning of CGIAR research in the Global Research for Development Continuum. The paper on IPGs, and a second paper developed by the Science Council Secretariat (on Partners in Research for Development) served as background papers to the international Workshop and several participants to the Workshop were invited to provide short discussion briefs. The international Workshop was held in The Hague, the Netherlands in May 2006.

This volume collects together the Workshop Report and Summaries, together with the two background discussion papers and selected briefs provided by participants. It is hoped that the collected materials will continue to act as a reference as the CGIAR proceeds to implement the System Priorities for Research.

INTERNATIONAL PUBLIC GOODS AND THE CGIAR NICHE IN THE R FOR D CONTINUUM: OPERATIONALIZING CONCEPTS[1]

Jim Ryan[2]

Introduction

The CGIAR, being an international institution, is expected to have an international reach and relevance. Whilst its donor support is clearly international in scope and publicly sourced, the institution must continually evaluate its centers and their programs to ensure that they cost-effectively respond to the concerns and priorities of the international community. A part of this process is the recent emphasis on assessing to what extent the research agendas of the international agricultural research centers (IARCs) of the CGIAR are designed to capture economies of scale and scope, and lead to outputs that are freely available to all countries and in ways that use by one does not impair use by others. These so called international public good (IPG) characteristics are easy to define but difficult to operationally at the center level. The Chairman of the Science Council (SC) of the CGIAR has recently highlighted the importance of the IPG concept for the IARCs (see Appendix).

The purpose of this paper is to provide some background on IPG concepts as viewed by economists, discuss some issues related to their operationalization, and explore the possible implications of strengthening the focus on them in the CGIAR. It is offered as a work in progress on the part of the SC and is not intended as a definitive document. The Council intends to continue the dialogue on these issues with the centers and other stakeholders in the CGIAR.

Public Goods Concepts

As used by economists, the term public goods only became prominent in the literature some 50 years ago, with the papers by Paul Samuelson on the theory of public expenditure.[3] Since then the concept has been refined and extended. Pure public goods are characterized as being:

- *non-rivalrous* in consumption, which means one person's consumption does not diminish its availability to others;
- *non-excludable*, in that once available, it is not possible to prevent free access to it by all.

Text book examples of pure public goods are sunshine, national defense and lighthouses. It is not possible for the private sector to produce public goods for a profit because of the above characteristics. Hence the public sector must ensure their production lest there be less than the socially desired level of consumption because of the market failing to take account of the

[1] Revised draft of a discussion paper prepared for a brainstorming session between some members of the Science Council of the CGIAR and the Center Deputy Directors' Committee (CDDC) of the Future Harvest Centers of the CGIAR at the CGIAR Annual General Meeting in Morocco, December 3, 2005.

[2] Chairman of the Standing Panel on Impact Assessment and Member of the Science Council of the CGIAR. The author has drawn heavily and liberally on the recent writings of Dana Dalrymple, Per Pinstrup-Andersen, Richard Harwood, Hans Gregersen and others to highlight the issues. Constructive comments were received from Dana Dalrymple, Ken Fischer, Hans Gregersen, Tim Kelley, Per Pinstrup-Andersen and the CDDC, whose inputs are gratefully acknowledged. However he alone is responsible for errors of commission and/or omission, and SPIA and the SC should not be implicated.

[3] See Dalrymple (2005 (a) and (c), 2004) and Harwood et al. (2005) for a more detailed review of the public good literature in an agricultural research context.

externalities involved in non-rivalry and non-excludability. This does not require that the public sector must always be primarily engaged in the production of public goods, as it can choose to contract the supply of public goods from the private sector when this appears more cost-effective.

On the other hand private goods have the properties of being excludable and rivalrous. Production of them is under the control of private firms who can command a price thus excluding those who are not prepared to pay. Consumption by one person also removes that unit from the market and hence makes it unavailable to others.

Technological, policy and institutional changes can alter the properties of goods over time and change them from being public goods to private ones, and sometimes vice versa (Van de Meer and Noordam, forthcoming p. 3). For example changes in intellectual property rights laws in the biological sciences has tended to move more of crop genetic improvement from the public to the private sector, especially in developed countries. With advances in ICT such as encryption, media companies are now able to exclude customers from cable and satellite TV reception, which used to be available free-to-air (provided of course one had a TV set to begin with).

Air used to be thought of as a public good but as pollution has reared its head, even this has come to be considered as somewhat of a hybrid public good, because it's erstwhile non-rivalrous nature has been eroded due to technology and policy. When I drive my car I consume clean air and less is then available to my neighbors, as well as added congestion that I may cause to fellow travelers. Also goods that are excludable at a cost such as national parks and toll roads with entry fees are not pure public goods. Let us turn now to these and other examples of what are termed impure public goods. These are so named because rarely do we now find many text book examples of pure public goods.

Impure public goods

There are four types of goods that are characterized as possessing attributes that distinguish them from each other in an economic sense. Two that we have discussed above are the pure public and private goods. The other two are impure public (or impure private if you prefer) goods, referred to as club or toll goods and common pool goods (Table 1).

While we have referred up to now to "goods", some examples in Table 1 refer not to final consumption goods but rather to resources or inputs to production such as air, water, sunshine and private schools. Hence the impure public goods concept is itself somewhat imprecise and the noun can be a misnomer. Indeed some public goods are really "bads", such as toxic effluent and air pollution. Translating these concepts into terms that have meaning for the CGIAR is a challenge, as the range of expected outputs of the IARCs presented in their Medium Term Plans (MTPs), are at a much more disaggregated scale than the examples usually provided in the economics literature, as illustrated in Table 1.

It would appear that if we are to use public good concepts to delineate the space for the CGIAR, we require a clearer specification of the appropriate outputs or outcomes from the IARCs, by which we can determine which of the four categories in Table 1 they fall into. Additionally, we need the SC and Members of the CGIAR to advise whether only those in the south-east public good quadrant qualify for CGIAR support, or whether those in the common pool and club/toll good quadrants also qualify. Hence we have a double challenge here if we are to be able to

operationalize the concepts of (international) public goods within the CGIAR.[4] Perhaps the least controversial components of the CGIAR from an IPG perspective are the international germplasm banks, with their obvious inter-generational and existence values. Beyond those we have increasing difficulties in articulating what are true IPGs in the CGIAR.

Table 1. Classification of Economic Goods

Consumption	**Access**	
	Exclusive	**Non-Exclusive**
Rival	*Private* (e.g. food, clothing, cars)	*Common pool* (e.g. air, water, soil, landscapes, ocean fisheries)
Non-Rival	*Club/Toll* (e.g. INTELSAT, Suez Canal, Panama Canal, private schools, theatres, professional associations)	*Public* (e.g. sunshine, national defense, lighthouses,)

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Dalrymple (2005 (e)) describes agricultural research as an impure public good and contends that this leads to analytical complexities. At the extreme end of this complexity is the statement (p. 9) that, because agricultural research is usually limited to a sector or commodity, its outputs are by definition excludable to other sectors or commodities, and hence may not be pure public goods. This would seem to ignore the fact that scientific advances such as modern biotechnology involving transgenics and the like are breaking down inter-specific biological barriers. Especially at the basic/strategic end of the spectrum, such boundaries hence would not seem to constrain the public good ambit *per se*. Needless to say his conclusion that the concept of impure public goods in agricultural research is conceptually tractable is unexceptionable, as is his plea for more work on delineating them in an applied sense. Hopefully this paper and the further discussion it generates will be a step in this direction.

Dalrymple (2005 (d)) notes that over time the evolution of IPR has moved science more towards being a private good, even at the basic end of the spectrum, with the advent of the patenting of life forms. However, as he notes there are moves to reverse the trends these changes in policies

[4] So far we have only discussed the public goods concept conceptually, without reference to the international dimensions. This will be introduced later in the paper.

and institutions have generated. For example, the former President of the U.S. National Academies of Sciences, Bruce Alberts, has called for professional scientific journals to be placed on the World Wide Web one year after publication; CABI has recently agreed to place its books both on CDs for developing countries free of charge and on the web six months after initial publication; Google is planning a digitized virtual library of all books ever published; and Microsoft has recently freed up 500 ICT patents earlier than their IPR allowed. Biotechnology firms are also allowing freedom-to-operate provisions to facilitate the use of patented processes by developing countries, where there is minimum likelihood that their commercial markets would be impaired.

Van de Meer and Noordam (forthcoming p. 2) point out that the borders in Table 1 are in fact shaded areas: "In practice, however, most impure public goods have shades of rivalry and excludability characteristics. Many impure public goods are produced by private enterprises. But, because of incomplete rivalry or excludability they are characterized by externalities. Their net marginal benefit to producers can be lower than to society. For many impure public goods, market conditions may render the private provision of various goods unprofitable, despite their social profitability. Consequently, there can be under-provision or no provision at all. In other words, markets may be partly or fully missing." Figure 1 illustrates that, unlike Table 1, there is continuous variation in the nature of economic goods, with scope for linkages among the various producers of them.

The IARCs (and the SC) are currently wrestling with both the identification of these boundaries and how to weigh up choices about the focus on the more obvious "public" outputs, versus other goals of the CGIAR related to impacts on poverty, food and nutrition security and the environment. It is not clear that a focus on IPGs necessarily results in the optimization of the goals of the CGIAR. More will be said about this later.

Scope and scale

Conceptually, public goods can be defined over different scales for expository purposes:

- local -- available[5] only within a district, municipality or state;
- national -- available only within the borders of a country;
- regional -- available to two or more contiguous countries within a geographic or political environment;[6]
- international -- available to two or more countries across geographic, political or continental divides;
- global – available to all countries.

For the CGIAR the most relevant are the regional, international and global scales, as it is an international organization. A key issue for the system is whether the production of regional public goods is a sufficient justification for investment in the IARCs, or whether it is necessary that the products have truly international or global public good characteristics. And if the latter,

[5] "Availability" is a weaker criterion than "used" or "relevant to", which introduce the distinction between knowledge and technology and technological spillovers. These will be discussed later in the paper. Here we are only discussing the conceptual economics literature.

[6] Sandler (2002 p.13) defines a region as a territorial subsystem that may be geological, cultural or political. He says that contiguity is neither necessary nor sufficient for the benefit or cost spillovers from regional public goods. Hence his definition of regional public goods would embrace my regional plus international, with the possible restriction that the latter is intra- and not inter-continental.

how does one determine which products satisfy the criteria? The production of national and local public goods is clearly of less interest to the CGIAR, except in so far as enhancing national capacities through training and institutional strengthening help countries to absorb and benefit from IPGs. Assessment and attribution of the socio-economic impacts of local and national public goods are arguably easier than is the case for IPGs. In an era of increased accountability this aspect has no doubt influenced the priorities of the centers away from IPGs.

Global Public Goods and Overseas Development Assistance

The international donor community has been increasingly willing to support programs that have global public good (GPG) characteristics.[7] Examples include public health, disease vaccines, space satellites for weather monitoring, toxic waste removal, environmental conservation and international security (Kanbur et al. 1999). This has been motivated by both a growing fatigue with the leakages involved from corruption in traditional bilateral forms of aid, and a recognition that market failures lead to costs and lost opportunities for developed, as well as developing countries.[8] Hence concerns about aid effectiveness and enlightened self interest have combined to increase the share of overseas development assistance (ODA) allocated to global programs such as these, from 5 per cent in 1980-82 to 8.8 per cent in 1996-98 (Lele and Gerrard 2003).[9]

Donors have recognized that for developing countries to fully benefit from the production of such GPGs requires ancillary investments in corresponding national public goods (NPGs). As a result, in addition to increased "core" grants to the international institutions involved in producing GPGs, they have increased their support through what are termed "complementary" grants to national programs involved, to facilitate their consumption of GPGs, or to put it another way, the production of the equivalent NPGs. The "complementary" NPG grants were seven per cent of ODA in the 1970s and more than doubled their share to 15 per cent in the late 1990s (Ferroni 2001 pp. 10-12). Most of the growth in GPG grants has occurred in the health and environment areas, with support for knowledge generation and science, including agricultural and livestock research, being sluggish. Kanbur et al. (1999 p. 57) believe the IPG rationale for aid will further strengthen and lead to a continuing increase in its share of the ODA portfolio. Although this may be accompanied by an increasing competition among sectors for the limited funds available (Sandler 2002).

One wonders whether we have here a rationale for the CGIAR to continue to primarily focus on the production of GPGs or IPGs, so that there will be even greater incentives for developing countries to invest (with support from donors) in their own NPGs, to maximize their capture of spillovers from the IPGs. In other words, should the CGIAR be in the R *for* D game, rather than the R *and* D one!

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[7] In the literature on this topic the terms GPG and IPG are used interchangeably. Hence we will not differentiate between them further here.

[8] Another point raised by Dalrymple (personal communication) is that GPGs can be a safer investment because by definition they are useful in more than one country, usually several or more. Bilateral aid investments in one country can suffer or fail completely with a change in government or any one of a number of subtle economic changes or more serious problems such as civil war, the assumption of absolute dictatorship by a once-elected official, natural disaster, etc. Knowledge-based GPGs are both less fragile and more likely to find a safe haven and use somewhere. One is not putting all of one's eggs in one basket.

[9] The term "global programs" does not necessarily imply that they always focus on the production of pure GPGs. The term is sometimes used rather loosely.

The growth in GPG support from ODA has been accompanied by an increased concern about the inadequacy of monitoring and evaluation of the various global programs that have been the focus of the grants provided. The recent World Bank (2003) meta-evaluation of its support for the CGIAR is evidence of this concern. Implicit in this are questions about the appropriate balance between the "core" versus the "complementary" funding, ensuring such grants do not crowd out the private sector and distort markets, and the lack of both *ex ante* and *ex post* impact assessments (Van de Meer and Noordam forthcoming).

The increased profile of global programs in aid funding provides the CGIAR with both an opportunity and a challenge. The opportunity is to capitalize on the growing funding base for so-called GPGs that have provided the major rationale. The challenge is for the CGIAR to ensure that its portfolio indeed consists only of GPGs or IPGs and that it is able to demonstrate that convincingly. The "common pool" approach to ODA funding of GPGs proposed by Kanbur et al. (1999 p. 92) in fact resembles what used to be referred to as "unrestricted core" funding of the CGIAR in its early days.

Operationalizing International Public Goods Concepts in the CGIAR

Science and international agricultural research are generally regarded as having GPG or IPG characteristics by most authors cited so far in this paper. But as indicated earlier, this broad categorization is insufficient when the institutions involved are assessing and determining their research strategies, priorities and programs. There is a need for more clarification of what are legitimate themes, programs, projects, activities, outputs and outcomes and their appropriate scale and scope for the CGIAR, in order to optimize the production of GPGs or IPGs.

In the recent CGIAR system priorities exercise, three criteria were used to select a prospective research agenda from among a wide array of potential candidates using an extensive consultative process involving stakeholders around the world (SC CGIAR 2005 p. 21). The three criteria were:

1. expected impact of the research on the major CGIAR goals (food security, poverty alleviation and sustainable management of natural resources) taking into account the expected probability of success and expected impact if successful;
2. production of international public goods; and
3. alternative sources of supply and CGIAR comparative advantage in the conduct of the research.

The Chairman of the SC has recently articulated his interpretation of the relevance of IPGs to the CGIAR centers (see the Appendix). He makes the case for an exclusive focus by centers on IPGs and for them to locate themselves in the middle of the research-development continuum. They should resist the temptation to undertake location-specific research because of the high opportunity costs involved. Networks and partnerships should be used in an innovation systems framework along with advocacy to encourage complementary investments at the D end of the spectrum to generate impact.

Dalrymple (2004 p. 6) has no doubt the CGIAR qualifies (as an institution) as a producer of IPGs or GPGs[10]: "Thus it is easy to see how public international agricultural (and associated natural

[10] The role of public agricultural research in international development has been reviewed elsewhere (Dalrymple, 2000).

resource) research fits readily into an International or Global Public Goods framework. According to the GPG classification system developed by Sandler, it would fall in the "Best Shot" category. This group involves a *concerted approach* depending on *focused technical expertise*, which benefits from *economies of scale*, and which is organized for production and delivery in a *"mission-oriented manner*." This is a remarkably apt characterization of the CGIAR System."

Harwood et al. (2005) have recently addressed the IPG issue within the context of integrated natural resource management research (INRM) in the CGIAR. As they point out, the evolution of the IPG concepts in the CGIAR began in the late 1980s with TAC's embrace of the notion of international spillovers; although it was not until 1997 that the term IPGs was explicitly referred to by TAC. Dalrymple (2004) discusses the evolution of international and regional public goods concepts in the CGIAR. Harwood et al. (2005 p. 6) define IPGs in the CGIAR context as follows: *"International public goods are taken to mean research outputs of knowledge and technology generated through strategic and applied research that are applicable internationally to address generic issues and challenges consistent with CGIAR goals*. This would seem to suffice as a working definition with the addition of the following after "…applicable": "and readily accessible.....".

Harwood et al. rightfully distinguish between CGIAR *knowledge* and *technology*. This distinction is important in the quest for clarity in operationalizing IPG concepts within the CGIAR.[11] Technology usually involves embodied intellectual property, which could be protected and made exclusive and hence have elements of a private good, and/or have limited recommendation domains; whereas knowledge is closer to the text book definition of a pure public good. In one paper Dalrymple (2005 (e) p. 6) classifies both as public goods, while in another paper (Dalrymple 2004 p. 9) he limits the public good characterization to scientific knowledge only: "In terms of potential scope of use, Bacon (2000) commented in 1620 that "…the benefits of discoveries may extend to the whole human race." Science, as a form of knowledge, is more likely to inherently be a global public good than is technology, which involves adaptation to particular circumstances and needs. Thus scientific discovery may have a greater degree of "spillover" than technology.[12] Also, science may be more amenable to centralization than technology. But in either case, it is necessary to have adequate adaptive research and development capacity in recipient organizations and nations."

If location-specific public agronomic research only leads to local adoption of productivity-enhancing technology options, one might conclude that this is only a local public good, or at best a NPG. Pinstrup-Andersen (2000) cites the example of information on the optimal planting times for teff in Ethiopia, a crop almost exclusively grown in that country. However, if the results of the research are also published in an accessible professional journal, does this component of the research output also then become a regional public good or an IPG? The *technology* options may not have significance beyond the specific locations where they were developed, but the *knowledge* about their performance may have, and as the knowledge is available non-exclusively and non-rivalrously, presumably it qualifies as an IPG? Are journal editors and referees then the ultimate arbiters of what is a PG or IPG? Is the professional publication containing the research the PG or

[11] Dalrymple (2005 (a)) elaborates on scientific knowledge as a public good and its role in economic growth and development. On the distinction between knowledge and technology he says (p. 39): "…scientific knowledge must normally be transformed into some more tangible form, sometimes referred to as embodied knowledge (processes, products, policies) to be of social benefit. The latter are often grouped under the category of technology."

[12] Even so, as Mokyr (1990) has observed: "modern science has made inventions more universal…by providing insight into the mechanism behind the invention."

IPG, regardless of its geographic or agroecological relevance or spillover potential, or is it the content or knowledge embedded in the publication and its relevance?[13]

The response to this quandary would seem to be that the IPG knowledge test is a necessary but not a sufficient condition to justify CGIAR activity. The production of IPG outputs should be a means to ultimate ends or goals, and not an end in itself. While per se the knowledge might satisfy internationality, non-exclusivity and non-rivalrous criteria, if the potential for impact on the poor, the food insecure and the environment is not also substantial and pervasive internationally, as Harwood et al. (2005 p. 6), Pinstrup-Andersen (the appendix,) and Lele and Gerrard (2003 p. 688) contend, then it is doubtful if it would merit CGIAR priority. Thus, even though location-specific research may pass the knowledge IPG test, it would probably fail the expected pervasive impact test.

Pinstrup-Andersen (2000 p. 3) makes it clear that to qualify as a GPG, international agricultural research must not only be accessible and non-rivalrous but also be "…aimed at the creation of knowledge and technology *relevant* (my emphasis) to many countries i.e. global public goods". Relevance here means that it can be used by others to actually improve agriculture. He indicates knowledge is a public good even when the initial acquirers have to pay for it. Eventually it spreads to non-payers because the knowledge is not used up by the original buyers (non-rival). This is the essence of the spillover concept, to be discussed later.

Pinstrup-Andersen and Mengistu (2005 p. 12) broaden the public good concept further by including poverty and market failure considerations: "*But even when the research output is not of a public goods nature, the private sector may not be able to capture a sufficiently large share of the social gains to cover research costs because farmers are poor and no credit is available to help them pay for improved technology. Without effective credit programs or public research funding, large potential social benefits are foregone and poor farmers do not escape poverty*." They are referring to publicly-funded national rather than international agricultural research here. Pinstrup-Andersen (2000) also maintains where spillovers of benefits occur to more than one other country, there will be underinvestment by national governments and hence a further market failure. This provides an additional rationale for public international agricultural research such as the CGIAR. A further benefit of a multi-country test is that it can reduce the risks of any one country reducing the overall impacts due to circumstances beyond the control of centers.

The above issues are relevant for the CGIAR, as poverty alleviation and more recently the Millennium Development Goals have become the overriding goals of the system in recent years.[14] There are potentially large trade-offs in the pursuit of an IPG agenda when the bulk of the world's poor reside in a few large countries like China and India.[15] A number of IARCs have been

[13] A related issue discussed with the CDDC in the context of the preparation of MTPs, is whether research project outputs such as numerical counts of books or journal articles are the appropriate performance monitoring indicators, or whether it is rather the content of these publications. The emerging consensus was the latter. Of course this begs the question of how one assesses content from an IPG perspective.

[14] Sandler (2002 p.11) maintains that the heightened interest in what he terms transnational public goods in fact is due in part to the endorsement by the international community of the Millennium Development Goals.

[15] Other trade-offs are also evident, such as between the achievement of high benefit-cost ratios on research investments and ensuring that most of the benefits and few of the costs accrue to the poor, rather then the more affluent. Simple consumer and producer surplus analyses of the type that typically accompany the use of economic surplus approaches in benefit-cost estimates do not explicitly address the poverty issue at the level of disaggregation required. For example Randolph et al. (2005) found that foot and mouth disease control in Zimbabwe has adequate benefit-cost ratios but that most of the benefits accrue to the commercial sector rather

in the horn of this dilemma for some time: CIP in the case of sweet potatoes in China and ICRISAT with pigeonpeas in India. The two countries produce the bulk of the world production of these commodities, which are important for the large numbers of poor in both.

The existence of large and relatively strong national research programs in both countries has been regarded as sufficient reason to question the priority accorded to these two commodities in the system. This relates to the comparative advantage test in criterion (3) above used by the CGIAR to determine priorities, and highlights the need for more transparent and explicit weights, or a hierarchy on all three criteria. Indeed implicit weights are currently being assigned, although in an opaque and subjective fashion. If expected impacts on the poor from a research program are large enough for example, can or should this offset a lack of internationality, high risk and the presence of alternative suppliers? Or should the IPG test in criterion (2) be applied in a dichotomous manner as a first and necessary condition, regardless of the magnitude of the others? Even if this is agreed at the CGIAR system level, is there a way to clearly discriminate amongst alternatives in an IPG context at the level of individual IARC programs, projects and activities, as contained in their Medium Term Plans?[16]

Where the indirect impacts of research on consumers, especially those in other countries, dominate those on producers, there is a question as to whether these provide an IPG rationale, in addition to any IPG attributes the research outputs that led to these impacts might themselves have.[17] In other words, is it the likely geographic scope of the impacts rather than the research outputs that matter from an IPG perspective? Here again there could be trade-offs in terms of the internationality of the impacts versus the research outputs, which may require weights to be assigned. For example, if CGIAR policy research on forest conservation in Brazil were successful, such that as a result CO_2 sequestration benefits were global in scope, could we not classify that research as an IPG, even if the application of the knowledge/policy results were only in one country? Similarly, if IRRI research with China is hugely successful to the extent that world prices of rice fell by some measurable amount, wouldn't that research be considered an IPG by virtue of all the rice buyers in Asia and elsewhere who benefit? Hence, in considering the IPG nature of the research, maybe we need to look beyond the direct application of the knowledge/technology and look at their potential impacts, both *ex ante* and *ex post*.

In the recent system priorities exercise, the CGIAR SC has endeavored to formulate a more demand-led agenda by engaging in a long and extensive consultative process with a wide range of both CGIAR and non-CGIAR stakeholders. In spite of that, because farmers and the poor in developing countries did not play a direct role, there is a principal agency problem, as stakeholders and the CGIAR are in essence endeavoring to reflect a derived demand for international agricultural research that will be most relevant to the ultimate intended beneficiaries. Hence one has what Dalrymple (2005 (b) p. 17) refers to as a "demand-informed"

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than to the communal sector, where most of the cattle are kept. As a result, lower income households only enjoy one-third of the total income gains achieved.

[16] Identifying IPG attributes is a non-trivial exercise, not only for the CGIAR, but for other international agencies. Van de Meer and Noordam (200 p.24) conclude that even the World Bank needs to train staff to be able to identify and assess market failure and hence where grants may be appropriate. Their review of the Bank's global grants program indicates many examples where it was not obvious what market failures were being addressed.

[17] I am grateful to Tim Kelley for raising the issues in this paragraph.

but "supply-led" approach to priority setting, which he sees as appropriate at a CGIAR system level.

There is a potential paradox here though. If the CGIAR centers are to focus exclusively on IPGs, then how is "demand" to be determined? How can non-excludable and non-rivalrous attributes be assured from bottom-up, demand-led approaches? Again, is there a potential dichotomy between "demanded attributes" such as a researchable problem of immense value to large numbers of poor in one or two countries, and the resulting "supplied outputs" having IPG attributes? The formation of global, regional and sub-regional organizations such as GFAR, FARA and APAARI, ASARECA etc., offers the promise of a desirable intersection of "demand-led" and "supply-led" perspectives, with the CGIAR starting with the "demands" of these organizations in arriving at its IPG/poverty niche.

Harwood et al. (2005 pp. 8-17) indicate that integrated natural resource management (INRM) research can, when appropriately designed, generate at least five types of IPGs:

1. Tools and methods for research or development that have applicability beyond one nation's borders.
2. Global and regional approaches for INRM research coordination and facilitation services that involve more than one country.
3. Development at both field and landscape levels of management and institution-building principles and methods that have applicability in more than one country for suggesting the appropriateness of technologies and policies.
4. Contributions to technology development for INRM-based production systems that can be effectively used, with modest adjustments for site-specific conditions, in more than one country context.
5. Scientific understanding of the nature of ecosystem problems, their driving factors, and their consequences/interactions with poverty and productivity; understanding the principles of managing ecosystems (across spatial and temporal scales) i.e. lessons for technology, institutions, and policy interventions.

It seems that for Harwood et al. the answer to Pinstrup-Andersen's question in the appendix of how many countries it takes to qualify as an IPG, is two or more. Again, the size and extent of potential impacts cannot be ignored also. It would seem to this author that items 1, 2 and 5 above are more clearly of an IPG nature than are 3 and 4. Dalrymple (2004) maintains that NRM research appears to have more public good attributes in an *a priori* sense than genetic improvement research, once the widening IPR regime moved the latter into the private good arena in most countries. He points out that recent experience suggests that NRM research may be largely a NPG rather than an IPG, due to its location-specificity, with resultant modest benefit-cost ratios. Harwood et al. raise doubts about this inference, but the jury is still out.[18]

[18] The Standing Panel on Impact Assessment of the Science Council recently commissioned a series of case studies of the impact of NRM research in the IARCs that are addressing these issues. It is expected that a book with syntheses of the case study experiences will be published by CABI in 2006. The draft manuscript has been peer reviewed and is currently under revision. A summary report of the series of studies was prepared for the AGM in Morocco in December, 2005.

As indicated earlier, Pinstrup-Andersen (see Appendix) prefers the IARCs to position themselves midway along the R & D continuum, the elements of which are arrayed in the first column of Table 2. The other three columns contain three requirements for CGIAR involvement in the six elements. The IPG characteristics and the comparative advantage of the CGIAR relate to criteria (2) and (3) used by the SC in the recent priorities exercise, as listed earlier. Criterion (1) is captured implicitly in the impact element in column 1. In the last column headed complementary advantage we add a new dimension to the criteria, which recognizes the need for the CGIAR to operate as a component of innovation systems, as Pinstrup-Andersen (see Appendix) indicates. The complementary advantage concept will be elaborated later, as it entails more than the expression of the respective comparative advantages of each component of innovation systems, as mentioned by Pinstrup-Andersen and Mengistu (2005 p. 27).[19]

Table 2. The R & D Process and CGIAR Priority Assessment Criteria

R & D Element	Requirements for CGIAR Involvement/Delivery		
	IPG Characteristics	Comparative Advantage	Complementary Advantage
Activities	Not important	Necessary	Necessary
Outputs	Necessary	Necessary	Necessary
Outcomes	Desirable	Necessary?	Not appropriate?
Influences/Adoption	Desirable	Necessary?	Not appropriate?
Responses	Desirable	Necessary?	Not appropriate?
Impact	Desirable?	Necessary?	Not appropriate?

Taking the perspective of an IARC, for discussion purposes we pose in the body of Table 2 one view of what these criteria might mean in an operational sense for each element in the R & D process. For research activities it would seem that whether the activities were in one or many international locations should not matter, as long as the outputs have the usual IPG characteristics. Recall the dwarfing genes or rice and wheat were derived from individual countries and if we said at that time the research activities associated with their collection, characterization, conservation and use were as a result associated with national rather than international public goods, we might have missed out on the green revolution, arguably the most impressive example of IPGs. [20]

[19] "The generation of the knowledge and technology may well be undertaken in innovation systems that include researchers from the CGIAR, the national agricultural research system (NARS), the private sector, as well as NGOs and farmer associations. What is important, however, is that each of these groups of actors focuses on their comparative advantage. In the case of the CGIAR, that means the generation of international public goods rather than attempting to substitute for NARS by producing national public goods. It also implies that the CGIAR centers should not enter into development activities but focus on their comparative advantage in research."

[20] In a discussion of this issue at the fourth meeting of the Science Council in Penang in June 2005, consensus seemed to emerge that the specific location of the activity and result does not, in itself, determine the nature (local, national or international) of the research output. More relevant are the objectives of the research and particularly the scope of the problem and the ultimate expected research or recommendation domain where the results of the research will be relevant. This must be defined ex-ante. The research plan is the key. The outputs need to be "robust", or expected to be broadly applicable (adjustable with further applied or adaptive research) across a relatively wide agroecological domain.

Harwood et al. (2005 pp. 17-19) maintain that the research itself must be conducted and oriented internationally to qualify as an IPG. They have compiled a useful list of lessons learned in conducting INRM research, in response to the challenge to produce generalizable results and replicable methods that could form the basis for IPGs. The World Bank (2003 p. 63) concluded that much NRM research is inherently site-specific and therefore does not generally produce global public goods: "*Several external reviews indicate that there is some apprehension and misunderstanding within* Center*s as to how the local-global research link needs to be made. This is most clearly captured in the 1998 report of the CIFOR review panel.*[21] *Although not explicitly highlighted in other reviews, the CGIAR leadership faces significant challenges in financing, priority setting, and scientific criteria for approval when applying the global public goods criterion while at the same time seeking in-depth research in specific, carefully chosen sites, which emphasizes the importance of strong scientific review capacity within the System, albeit in a smallholder development context*."

Kanbur et al. (1999 p. 81) are of the view that it is not necessary for research activities to be conducted multinationally to qualify as IPGs: "*For the direct production of international public goods like fundamental scientific or economic research, rich and poor countries both need to be involved in defining the direction of research, but implementation of the basic research can take place in the developed country or through institutions set up and financed by the donors.*" The World Bank (2003) indicates that sometimes developing countries themselves "produce" the global public good (such as conservation of biodiversity or the containment of communicable diseases), which both they and the global community enjoy. It goes on to state that hence investment is needed in developing countries to research and produce some global public goods, and assessment criteria of core and complementary activities need to account for spillovers from the local to global level. Hence the World Bank accepts that locally produced research outputs under some circumstances can generate global public goods; presumably so can IARC location-specific research?

The *outputs* of the IARCs should have the IPG characteristics described earlier (Tables 1 and 2). However sometimes the initial outputs and outcomes occur in or for one country, but this should not be the *intention* at the outset. Others should be able to access and benefit from the research. Here we recall the discussion about the example of the rates and dates agronomic research on teff in Ethiopia. Does professional publication of what otherwise might be regarded as a local public good, or a NPG, transform the knowledge into an IPG, regardless of whether the research results have spillovers elsewhere that lead to adoption and productivity effects?

Gardner and Lesser (2003 p. 695) have a more liberal interpretation of the appropriate roles for international agricultural research. For example, where markets are limited for new crop seeds and the private sector hence has little incentive to be involved, they contend the public sector has a role as a supplier of last resort, even in the absence of a GPG rationale. A number of the IARCs

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21. "The Panel found that some CIFOR researchers are frustrated with the IPG [International Public Goods] criterion because they view it as being associated with shallowness of research at the specific site level. The Panel wishes to point out that this is (or should be) a false assumption. The IPG nature of CIFOR's work should not make it incompatible with in-depth research on particular sites. In fact, significant generalizations based upon a profound understanding of the nature of crucial variables at multiple sites, is what CIFOR projects should, and in most cases do, seek to achieve. A misunderstanding of this basic concept will, axiomatically, lead to research that is neither cost-effective nor IPG related. The need for cost-effectiveness of CIFOR research must not deter in-depth research. When expensive senior staff cannot engage in time-consuming field activities, they should recruit and supervise students in the field and develop mutually beneficial links with other appropriate, lower cost and locality focused partners who can carry out the in-depth field work in the overall IPG context of the research" (TAC Secretariat and CGIAR Secretariat 1998d).

are currently involved in developing and promoting seed systems for their mandate crops intended for smallholders in developing countries where the public and private sectors are failing. Their rationale is that without their involvement at this end of the R & D spectrum in individual countries, the investments they have made in genetic improvement leading to improved cultivars, would not have impact. As Pinstrup-Andersen (see Appendix) indicates however, the risk is that centers can crowd out other suppliers by becoming directly involved in such development activities and can also incur a large opportunity cost in terms of foregone IPG research. It is here advocacy might conceivably be a preferred alternative strategy.

It is notable that a contrary view to Gardner and Lesser has been put by Govindaraj and Sarna (2003 p. 702) with respect to global health, nutrition and population programs: "…*global programs cannot be a substitute for failures of programs at the national level, since global programs are unlikely to succeed if they are not effectively linked with national priorities and if necessary complementary national-level investments to support the global programs are not made*." Again the implication here is that appropriate advocacy to fill gaps at national level may be more effective than direct involvement of global institutions.

When we turn to *outcomes, influences/ adoption* and *responses* in Table 2, it is not clear that we can require that IPG characteristics apply to the IARCs. Whilst this is obviously desirable for institutions with international mandates, because the centers have less control over these elements, it is the contention that we cannot and should not require these to have pervasive internationality in an ex post spillover sense. Also, the concepts of non-rivalry and non-exclusivity have less relevance for these elements than they do for outputs.

Similarly, in an *ex ante* impact assessment context, maybe we should be aiming for a portfolio with maximum potential international *impact* spillovers, as a reflection of the IPG nature of the CGIAR. However, in an *ex post* impact assessment context, we should not be overly concerned if the final impacts are not of a pervasive international character. Serendipity and the unpredictable effects of changing economic, climatic and political environments, mean that while international spillovers are planned, they may not eventuate. One can still get a large B/C ratio and large reductions in poverty on the CGIAR investments from one large country like an India or a China. Again it is ultimately a question of the weights one prefers on the various criteria in Table 2.

Perhaps the lesson is that it is more important that the expected impact pathways for each project are well specified *ex ante*, with clear linkages between activities-outputs-outcomes-influence/adoption-responses-impact, accompanied by a quantitative *ex ante* impact assessment. Maybe there is justification for action research by IARCs on these pathways themselves in order to better position their research for adoption and impact, as an alternative to becoming directly involved in delivery mechanisms themselves, as Pinstrup-Andersen (see Appendix) proposes.

The dilemma faced by IARCs in actively seeking to generate impacts versus conducting IPG research is exemplified in the recent discussion in the SC of the evaluation and impact assessment of the Alternatives to Slash and Burn (ASB) Program, coordinated by the World Agroforestry Center. The following extract from the minutes of SC 4 illustrates this (pp. 7-8):

> "*The Panel Chair felt this issue exemplified a more fundamental dilemma faced by the CGIAR at the system-level—how far down the R → D continuum* Centers *should go, particularly in cases when suitable enabling conditions on the delivery and uptake side do not exist or are not fully adequate. Is the CGIAR only focused on producing IPGs, and not on their application? Although*

Challenge Programs (CPs) were designed to deal explicitly with this issue of engaging with development partners early on in the process, CPs are in a somewhat 'still-born' stage of development within the CGIAR. The Rainforest CP that would have explicitly addressed this constraint faced by the ASB program has been put on hold. While this is true, it was not altogether clear why the ASB itself could not have moved in this direction if it felt it was the major constraint to impact. According to the Panel Chair, the ASB as currently embodied, is strongly orientated towards producing IPGs. The Panel felt that any recommendation concerning the future of the ASB should wait for the outcome of the on-going priority setting and implementation process. …"

While acknowledging that the ASB has been successful in generating knowledge and influencing current thinking, the SC noted there was a conspicuous lack of documented impact from technology and policy innovations (or, Action R&D). The Panel Chair agreed that the former is where ASB was having its largest impact and that a shift away from a 'technology fix' focus to one enhancing understanding and developing a more complete perspective on and analysis of the problem (e.g. the ASB matrix) was more relevant. Nevertheless, he felt that at the benchmark sites there were many examples of success as a quick browse through the Website shows. The Panel, however, wanted to avoid an analysis which "looked only under the lamppost" for achievements, and rather asked the broader question—where were the significant IPG outputs of ASB. Thus, knowledge about how factors shaping land use at forest-agriculture interfaces in the humid tropics and about options for changing those land use patterns trumped technology innovation per se."

These discussions again raise the question: is the CGIAR an R *for* D or an R *and* D organization? The ASB Panel (Science Council, CGIAR 2005 (a) p. 77) suggests that there may well be a different answer for NRM than for genetic improvement: "…the Panel questions whether the CGIAR model of distinguishing the creation of global public goods from their implementation at scale is as likely to work as well for the NRM component of the CGIAR's work as it did for the earlier commodity efforts."

Comparative advantage is not necessarily fixed and immutable over time in the way that natural monopolies are. It can be acquired or lost by exogenous changes in policy and technologies. Witness the advent of biotechnology, PBR and patenting and their effects on the comparative advantage of the CG centers in plant breeding vis-à-vis the private sector, as referred to earlier in this paper. Comparative advantage is also an elusive concept to operationalize in R & D in a convincing manner, unlike in international trade, where the concept originated. As shown in Table 2, it is moot whether the CG has to have a comparative advantage beyond activities and outputs. As the CG is increasingly accountable for generating and documenting outcomes, influences, responses and impacts, maybe it is inescapable that it must also be able to demonstrate that it can achieve these more effectively than others.

Complementary advantage implies that the particular role(s) of the CGIAR centers be such that they maximize the synergies and multiplicative effects from interactions with other actors/partners/suppliers in the R & D continuum, consistent with their mandates and comparative advantages. The roles could range from:

1. a primary research function, where the CGIAR center assumes leadership of agreed priority basic/strategic research endeavors, such as for example molecular characterization of international foodgrain germplasm;

2. a secondary research role at a more strategic/applied level on agreed priorities, for example incorporation of drought tolerance genes in staple cereals;
3. a catalytic role, where the center stimulates additional investments by others in order to capture various comparative advantages of partners and stakeholders on agreed priorities, for example as in the Harvest Plus Challenge Program (CP) or the Alternatives to Slash and Burn Systemwide Program;
4. a facilitative or enabling function, where the activities of partners and stakeholders are made easier by the center, for example the various networks hosted at the centers such as CLAN and CONDESAN; and
5. an advocacy role, such as in the Vision 2020 initiative of IFPRI, where there is a need for ancillary policies or investments, sometimes in other sectors involved in delivery systems for example, in order that the CGIAR's investments have desired impacts.

All these roles are appropriate in an innovation systems context; especially the last three where the aim is to enhance spillovers in an IPG context. In constructing impact pathways in MTPs, all these elements are appropriate to consider and describe, as appropriate to the program or project. If accompanied by *ex ante* impact assessments as discussed above, one would have most of the information required for effective monitoring and evaluation.

The INRM paradigm as described recently in Campbell et al. (2005) *Navigating Amidst Complexity* seems to emphasize roles (3) and (4) for the CGIAR centers. The aim is to improve the quality of partnerships among multiple stakeholders at various scales and levels in the R & D process, by improved knowledge management and learning in an innovation systems framework. It is moot whether these represent sufficient rationales for CGIAR involvement without (1) or (2) also. In other words, are these roles alternatives or complements? The risk is that INRM's apparent predominant emphasis on catalytic and facilitative processes, with such potentially high transactions costs, can create incentive systems that encourage a great deal of interaction but at the expense of action and impact. Additionally, the ability to attribute impacts among partners can become even more elusive. There is also a need to differentiate the value of horizontal from vertical interactions/partnerships. The optimal mix will depend on the particular research priorities and prospects.[22]

Anderson (1998) calls for more resources to be devoted by the IARCs to fostering cooperation among and with NARS partners involved in agricultural research. He cites the need for things like novel networking and partnership arrangements in areas such as NRM and social sciences: "*If IARCs efforts in such things were "more formally recognized as legitimate research-related activities, the overall functioning of the global system might be further improved, NARS partners more empowered, and* interactive synergies *(my emphasis) increased*." (p. 1158).

These interactive synergies are the objectives in suggesting earlier in this paper that IARCs exploit their complementary advantage, not only their comparative advantage. Ferroni (2001 pp. 17-19) also calls for international organizations to help build partnerships and networks, including public-private partnerships among developed and developing countries. In such a role he sees the CGIAR as helping to build trust to make equitable partnerships effective. However it

[22] It is possible that these roles can be a prelude to better identification of the subsidiarity advantages of provision of IPGs or regional public goods by other institutions like SROs instead of globally mandated IARCs. Subsidiarity is a characteristic that is seen to be desirable in supporting institutions that deliver IPGs or GPGs (Kanbur et al. 1999)

is inescapable that public-private partnerships will be always faced with intellectual property rights (IPR) issues. It should be the role of the centers to endeavor to widen rather than narrow the purview of any IPR arrangements they enter into with the private sector, in order to maximize the opportunities for the production of IPGs. The Central Advisory Service for Intellectual Property has been set up in the CGIAR System Office to facilitate the exchange of knowledge and experiences of IP issues among the centers.

Barrett (2002 pp 5-6) links existence values associated with NRM research that generates both environmental benefits as well as productivity gains, as GPGs. He recognizes that much NRM research is location-specific and requires local-to-global connectivity (hierarchical connectivity) to be a GPG, as ecoregional programs endeavored to do. When capacity building is added to such research, he maintains this also helps ensure a continuing global reach and relevance. Kelley (personal communication) suggests that relevance could be further decomposed into "potential relevance" (assuming that partner capacity is unlimited) and "realized relevance" (information that can actually be applied under existing partner capacity). Thus, countries targeted should have sufficient capacity to absorb the "solution" generated by the IPG – be it a technology, innovation, understanding (e.g. analysis, explanations) or information (datasets). This suggests for example that if seed markets are the major limiting factor in a country or region, producing improved lines may not constitute a 'relevant' IPG.

Pinstrup-Andersen and Mengistu (2005 p. 29) conclude that multi-stakeholder approaches to publicly funded research within an innovation systems context is an ongoing trend, as is the development of regional frameworks to enable better regional cooperation among different national research institutions. They see the challenge being to create new knowledge that would benefit poor farmers, while also integrating within the new more globalized agricultural research environment.

This author believes there are potential moral hazards associated with emerging perspectives associated with INRM and information learning and change (ILAC). Their preoccupation with horizontal and vertical partnerships and interactions at multiple scales, or hierarchical connectivity, can overemphasize processes and activities with high transactions costs, at the expense of value-added or impacts (i.e. complementary roles (3) and (4) instead of (1) and (2)). Proponents imply these processes will enhance impacts *per se*, but the jury is still out on this issue. Others appeal to IPG concepts to rationalize such a process-oriented focus. Hopefully both are true.

What this discussion suggests is that when it comes to having a complementary advantage, the IARCs should definitely have such in the activities or roles that they engage in and in the production of the outputs they are responsible for. As many if not most of the outcomes, influences/adoption, responses and impacts in an innovation systems framework will be difficult to attribute to the various partners individually, it may not be appropriate to hold the IARCs separately accountable for their particular parts of them. But like all aspects of Table 2, this is a topic for much more discussion.

Spillovers, Impacts and Poverty

Spillovers are generally of two types. The first may be described as technological and the other is economic. Technological spillovers occur when new technology options developed in and for one location or institution are found or planned to be relevant to others, with or without further

research. Their size and extent can be influenced by the choices of research priorities, approaches and types and the prevailing IPR environments. Economic spillovers relate to economic effects transmitted across boundaries or markets as a result of production, price and trade effects from adoption of productivity-enhancing innovations. Generally both types are generated by agricultural research, be it national or international.

Alston (2002) finds that studies typically reflect that about half or more of the research benefits in any state or nation may be attributable to spill-ins from other places. Also spillouts to other places might be of a similar magnitude to their own benefits from research conducted by a state or nation. "*When the research is directed at multiple locations such as ……CGIAR research benefiting many nations, - the* "spillover" *aspect becomes quantitatively even more important*." (p. 338).

Some technological spillovers may be due to serendipity, but the intent should be more than this. Anticipating the research or recommendation domains, utilizing research sites that take in the range of possible settings within those domains in order to optimize relevance and robustness, and planning delivery in varying agroecological and economic environments, would seem to be indicators of intent to do IPG research with maximum spillovers. It has been demonstrated that genetic improvement research and related germplasm conservation and management have such IPG characteristics, as illustrated by the green revolution. However with the new IPR regimes, this is less true now than it was. As we indicated elsewhere, the jury is still out on the extent to which NRM research has IPG characteristics.

Ken Fischer (personal communication) sees the role of IPG research to provide the knowledge to enable the planning of a technology to be relevant in a new location. Inherent in this knowledge is an adequate understanding of the processes that drive the outcomes in one or more locations, such that the outcome can be predicted (or a hypothesis tested) in a new (spillover) location. In other words, IPG research not only helps to develop the technology options, but also adequate knowledge about the technology options is acquired in the process to add to the "robustness" of their application. To Fischer, merely testing performance variables in new international environments does not automatically qualify them as IPGs. There has to be more value-added than that. To illustrate again with the teff example: If rates and dates experiments were conducted in two or more countries without developing an understanding about the cultivars' adaptation to the prevailing environments, there would be little knowledge gained for extrapolation to other environments. Research that understands why rate x and date y are optimum in environment z in location w, allows global testing of hypotheses about teff planting in n locations.

A major aim of international agricultural research (IAR) is to try and optimize both technological and economic spillovers in order to have maximum impact on the goals of the CGIAR, especially on poverty. Pinstrup-Andersen and Mengistu (2005 p. 3) indicate this justifies sharing of research costs across countries. As discussed earlier, this is not necessarily congruent with only being engaged in IPG research, which emphasizes accessibility and non-rivalry. Indeed the generation of economic spillovers from IAR implies potential winners, losers and free-riders, and hence some rivalry in an economic welfare sense.

IPG concepts may have some relevance for the underlying knowledge it is hoped to generate from IAR, but not necessarily in terms of the pursuit of the ultimate goals of CGIAR research. There may be a dichotomy here. As Kanbur et al. (1999) and Alston (2002 p. 337, 339) point out, using ODA for the production of IPGs may not be the most effective way to target the poor, and

vice versa. Dalrymple (2005 (c)) discusses recent literature on enlarging the theory of public goods to include going beyond market failure to give more weight to their contributions to enhancing people's well being and stimulating global economic growth (i.e. impact). He also notes that: "The type of research deemed best for poverty alleviation may not maximize international spillovers of technology and knowledge." (p. 443). Van de Meer and Noordam (forthcoming pp. 6-7) state that simply justifying grants for IPGs on the grounds of additionality due to market failures only may not suffice. They prefer that there is also a benefit-cost assessment of the economic impacts of the grant schemes. Alston (2002 p. 338) goes further to stress that such *ex ante* impact assessments should explicitly consider expected international spillover potentials. He acknowledges however that this is a challenging task. Gardner and Lesser (2003 p. 696) conclude that on balance expected rate of return analysis is a preferred guide to assessment of donor investments in the CGIAR, rather than GPG criteria. They also view poverty aims as downstream NPGs and not GPGs.

Dalrymple (2004 pp. 15-17) raises the issue of the number of countries required to qualify as an IPG and the potential impact trade-offs between a focus on large numbers of small countries, versus a few large ones: "*On one hand, small nations may in general have greater need for international or global research than larger nations who are able to carry out a wider range of research activities within their borders. On the other hand, the larger nations may make wider use of international or global research, raising its public goods value. Hence determining the social value of a GPG is not merely a matter of counting countries. A technology that is widely adopted in a large country such as China or India may, because of their comparable populations, have considerably more overall social value than a technology that is adopted in a larger number of smaller countries.*" (pp. 15-16).

Again this raises the question of whether the internationality of the research efforts is necessarily the best indicator of IPG characteristics or of impact potential. Furthermore, if the focus becomes on substituting large numbers of relatively weak NARS in small countries with IARC activities, the risks are that the resultant IARC research agendas may be much more applied and adaptive in nature, not conducive to the optimal production of IPGs. The IPGs foregone may have large potential payoffs to the larger countries with stronger NARS. As indicated earlier in the case of India with pigeonpeas and China with sweet potatoes, if these countries also have large numbers of poor dependent on these crops, then the goals of the CGIAR may be better addressed by a focus on these. We agree with Dalrymple that such key strategic issues require more discussion and thought, as there are no easy answers.

Conclusions

Public good concepts are intuitively appealing in helping to define the niche for the CGIAR as an institution in the R for D continuum. Arguably they provide a much clearer rationale in their more realistic impure mode than in the pure form of the economics literature. The devil is in the detail of trying to operationalize them for priority setting and research planning at the level of individual IARCs and programs within the CGIAR. Gardner and Lesser (2003 p. 696) put it succinctly: "*Although the idea of CGIAR output being a global public good can be a rhetorically useful term of art (sic), as an analytical category it provides no simply applicable key to identifying optimal spending on international agricultural research or the choice of alternative projects.*" However they go on to say that: "*The GPG concept…is helpful in understanding why CGIAR research is likely to be more productively focused on upstream than downstream research outputs.*" The fact that the IPR regime is

constantly changing also means that what is regarded as an IPG today may not be so tomorrow and requires a continuous watching brief by the CGIAR.

With the growing imperatives on the IARCs to measure and document their impacts, especially on the poor, the scope for ensuring this while at the same time engaging only in the production of IPGs, may become more limited. To help ameliorate this, there is a need for a stronger focus on the complementary advantages of CGIAR centers and their research, so that their IPG outputs have a better chance of leading to local gains in terms of poverty alleviation. However, potential trade-offs between pursuing measurable and more immediate poverty impacts and engaging in the production of IPGs with generally longer time horizons before identifiable impacts, appear inevitable and require more recognition, elaboration and discussion.

Maximizing technological and economic spillovers are legitimate goals for the CGIAR. Indeed their existence provides a major rationale for the system. However these are not the only IPG attributes of relevance and they are difficult to articulate and measure, especially in an *ex ante* planning context. Proxies such as the internationality of the problems the research is intended to address are sometimes used. However even these indicators have limitations. For example in establishing priorities, how does one weigh up a problem affecting 30 small countries and 50 million poor versus a problem affecting 100 million poor in only two? *Ex ante* impact assessment can help, but may reveal even more potential trade-offs.

There is a risk that the pursuit of an IPG-driven research agenda by the CGIAR will be excessively supply-driven, with implications for the ability of the IARCs to form requisite partnerships and collaborative relationships. Unless all CGIAR stakeholders commit to the gap-filling or unmet needs approach to setting an IPG agenda for the IARCs, such interactive synergies might be more difficult to negotiate. The imperative for the centers also to have a demand-driven agenda derived from the developing countries, may also limit their degrees of freedom in pursuing a more supply-driven IPG program.

It would seem that where research activities are conducted is of little importance in terms of satisfying IPG requirements. It should not matter if it is conducted in one or many countries. What is important is that the *expected* outputs are *intended* to be relevant to as many countries as possible with the *intention* of maximizing international impacts via spillovers. Whether or not those impacts actually turn out to be international and pervasive is of less importance than that they were originally planned to be.

Ex ante intentions are more important than *ex post* realizations from the point of view of accountability. Many factors beyond the control of the IARCs can intervene to thwart the best of ex ante intentions. Impact pathway analysis is therefore a critical element in research planning, in order both to convince donors that projected impacts are plausible, and that the outputs will as far as possible have IPG attributes. At the same time, ex post assessment of the actual impact pathways and of measured and documented impacts in relation to the planned ones, provides valuable information for future planning of IPG research outputs and the identification of constraints that could be the subject of further research and/or developmental investments.

The pursuit of deliberate, interactive synergies with appropriate partners is a legitimate part of the *modus operandi* of the IARCs. There are different roles that the centers could play and are playing in this context. It is a question of the appropriate balance among them as they are often complements, not substitutes. The identification of what we term a center's complementary

advantages should become an explicit criterion in assessing its activities and outputs, as an addition to the current three criteria used by the SC.

A major strategic issue emerges from this consideration of IPGs and the CGIAR. It is that there may not necessarily be a perfect congruence between the humanitarian goals of the CGIAR and the IPG imperative. The former are by nature of a shorter term character, such as the Millennium Development Goals, whereas the latter tend to be much longer term. The two goals conceivably converge as the planning horizon lengthens. The planning horizons of donor agencies vary, but importantly most have higher discount rates on longer-term than on shorter-term future benefits. Convergence hence can be an elusive objective. This has implications for both agenda setting for the centers and the ability to attract future funding, as Dalrymple (2004) and Alston (2002) allude to.

An increasing share of ODA budgets is apparently allocated to IPGs via various global programs according to Lele and Gerrard (2003) and the World Bank (2001 pp. 116-120). The trend may continue, but it is accompanied by increased competition for the limited funds available due to the higher profile that GPGs now have in the international community, which extends to many other sectors than agriculture.

The increased interest in funding GPGs is in contrast to support for the CGIAR, where restricted and special project funding has significantly increased as a share of the total in the last 15 years, limiting its pursuit of IPGs, where unrestricted funding is more advantageous. To follow more of an IPG-driven agenda, regardless of whether developed or developing countries are the major beneficiaries, rather than a purely humanitarian one, hence might allow the CGIAR to harness additional resources, both from ODA and perhaps national and international science and technology budgets. The CGIAR should consider these issues as it continues the reform processes within the system.

Needless to say the System has a way to go in operationalizing the IPG imperative articulated recently by the Chairman of the SC. It is going to require a continuous dialogue between the centers and the SC, with a suitable dose of learning by doing.

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Appendix

Note from Chairman of the Science Council in CGIAR Newsletter

From the Science Council Chair

Answers to three interrelated questions are of critical importance for the future priorities and activities of the Future Harvest centers. The questions are: What is an "international public good"? Should the Future Harvest centers prioritize the creation of such goods? And, where on the research-development continuum should the CGIAR supported activities be? I will address each of the three in turn.

Public goods have two characteristics. First, the use of the good by one individual does not detract from that of another and second, it is impossible to exclude anybody from using the good. A public good is international, if it is of use across country borders. But across how many borders? That is a matter of judgment. I like to use the word "several", meaning more than a few. Imprecise? For sure. The SC will lead discussions to further refine the concept.

My answer to the second question is YES. Why? For two reasons. First, research that produces private rather than public goods, i.e. goods that can be protected with exclusive property rights, are likely to be produced by the private sector. Second, research results of use to many countries may not generate enough benefits to any one country to warrant national research. Adding the benefits that several countries can obtain justifies international research. Identifying those areas of research that would remove the largest number of people from poverty but that would not be undertaken by the private sector or publicly funded national systems, is the most important part of setting priorities within the CGIAR.

But what do we do in countries where the publicly funded agricultural research system is absent or in very poor shape? We help strengthen national or regional systems. Capacity strengthening is a legitimate activity of the CGIAR. So is advocacy to get national governments and development assistance agencies to do it. Doing the research for them is usually not. It reduces the incentive for the national government to allocate funds to a national system and it tends to crowd out national researchers, while spending CGIAR money that would be better spent generating research results of use to several countries. Most CGIAR research would best be done in collaboration with national researchers in selected developing countries. It should be useful to the country where it is done, but also to several others. Research planning should identify the pathway from the desired research output through outcome and impact. The pathways should be plausible, not guaranteed.

This brings me to the third question. In my opinion, the Future Harvest centers should prioritize research for development, maintaining close collaboration with advanced research institutions for more basic research and with national and international institutions for adaptation of knowledge and technology from international research as well as delivery systems. Facilitating interaction and delivery through networks has been effective in a number of cases. Placing the CGIAR in the middle of the continuum will, I believe, contribute to the maximization of impact per dollar spent, particularly if we operate within an innovation systems approach, in which each institution is capitalizing on its comparative advantage. But what if there is no delivery system? Then the research results from CGIAR research will rot on the shelf. Rather than giving in to the temptation to develop delivery systems for particular communities or countries, a temptation that is particularly strong if donors are ready with money, I believe the Future Harvest centers should engage in advocacy with national governments and development assistance agencies to have such delivery systems developed,

either through publicly funded national institutions, or international agencies such as FAO, IFAD, World Bank, the regional banks, NGOs, or private consultancy firms. For delivery systems to be effective, investments are likely to be needed in rural infrastructure such as roads, markets, credit institutions, extension, and water management infrastructure. To maximize impact, investments in primary education and health care may be needed. We in the CGIAR should do a much better job putting pressure on the appropriate institutions to get these jobs done, rather than pretending that we have to do it all.

Having been a center director, I know how difficult it is to say no to a donor, even if the available funds are earmarked for activities outside the mandate of the CGIAR. In the short run, it may appear more important to expand revenues than maximizing impact. So, why not get involved in technical assistance to help with location-specific development activities? The main reason is that it is likely to reduce funding available for research either directly by donors or centers channeling money from research with international impact to development activities with local or national impact or indirectly by failing to apply full costing approaches. Both would result in less IPGs and more location-specific activities better done by others. Centers that wish to do location-specific development activities would probably do the least damage to the mission of the CGIAR if they create financially independent, wholly owned consulting arms through which research results could be made available. But then, why not enter into agreements with private consulting firms instead?

Per Pinstrup-Andersen
October, 2005

PARTNERS IN RESEARCH FOR DEVELOPMENT
Background paper for a workshop on Positioning the CGIAR in the Global Research for Development Continuum, to be held in The Hague, 19th May 2006[23]

Science Council Secretariat

The new System Priorities for CGIAR Research, aimed at producing key contributions to the MDGs and the long term targets of improving food security, poverty alleviation and environmental sustainability, seek to renew the focus of the System, its Centers and Programs on international public goods research. Ryan (2006) has elaborated the definition of IPGs in relation to the research goals of the CGIAR. The SC has identified the requirement to distinguish between research for development and the conduct of development activities *per se*, for which the CGIAR has little or no comparative advantage. This paper is provided (as a companion paper to that of Ryan) to help identify the placement of CGIAR research within the array of complementary activities and partners required to implement the goals of the System Priorities.

1. Conventional and evolving views of the Research for Development Continuum

The phrase "the research for development continuum" has been used in the past to describe a process based on a time-line and 'adoption lag' analysis. The research lag time is that between starting to investigate new technology and arriving at one or more options. Basic and strategic research generally have longer research lags than more applied or adaptive research. In the case of agricultural research for development, this has led several investors to opt to fund activities with more immediate impacts (although sometimes at much more local scales). The World Bank meta-evaluation of the CGIAR suggested that "conventionally, the CGIAR has been viewed as conducting strategic research in the research and development continuum [and] has also had to conduct applied and adaptive research when developing countries lacked their own capacity to do so."[24] The report identifies that the value of the concept of an agricultural research and development continuum is that it provides a "framework for considering the role of different actors in research and the kinds of research they conduct."[25] A recent SC report also considers the importance of understanding the appropriate time to involve different actors in the research for development continuum such as involving farmers earlier in research and adoption processes in order to reduce potential development lags.[26]

The quandary at the heart of this discussion is, in the case of finite resources, to choose between the relative uncertainties of longer term research on major underlying problems of developing country agriculture and the political (and even ethical need for development donors) to demonstrate shorter term impact (and value for money spent). The 1st External Review of the Systemwide Program Alternatives to Slash and Burn (ASB) (Science Council, 2006) raised the issue of the role of that program in the research to development continuum, not least in the Panel's major conclusion that: *The Program's greatest shortcoming is that it has been unable to secure*

[23] Written by Peter Gardiner and Robert Chapman – Science Council Secretariat. This paper has been developed with the constructive inputs and suggestions of Beatriz Avalos-Sartorio, Chris Barrett, Ruben Echeverría, Ken Fischer, Tim Kelley and Jim Ryan. It has been lightly revised, taking into account selected inputs to the Workshop in May 2006.
[24] World Bank 2004 p.51
[25] World Bank 2004, p50.
[26] Science Council of the CGIAR (2005) "Science for Agricultural Development".

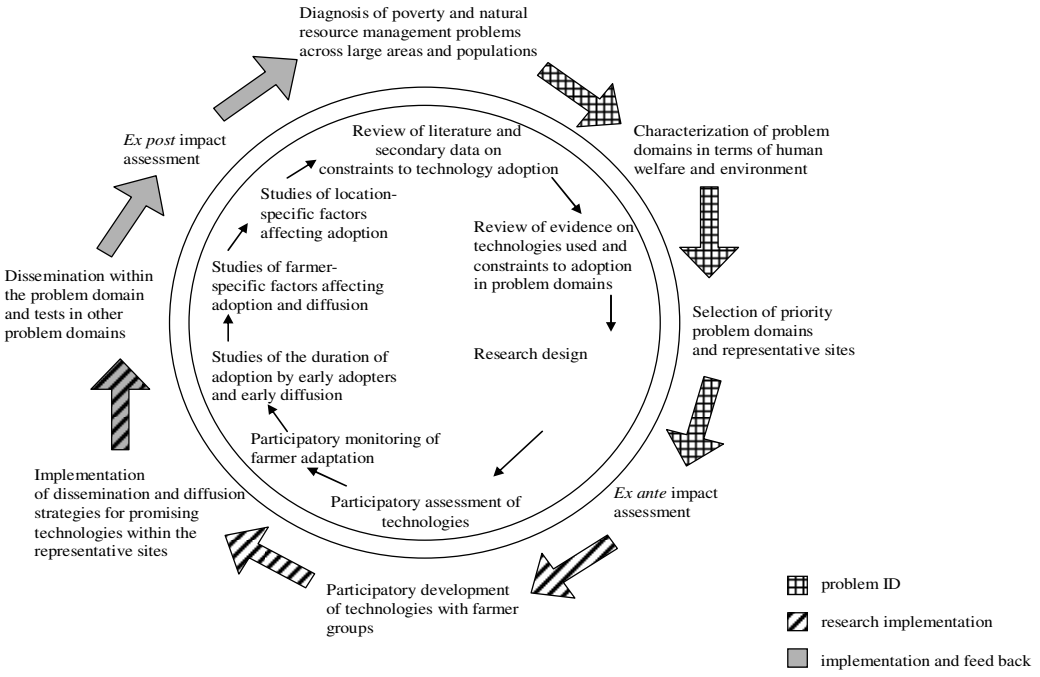
or mobilize the resources to extend its results to any but a small fraction of the 1.2 billion people across forest margins of the tropics who are still struggling to mitigate their poverty. In addressing this shortcoming, the Panel avoided taking a stand on the role of the ASB program at the development end of the continuum. However, this issue is not limited only to the ASB program, but is more generic. The SC considers that a thorough discussion among CGIAR stakeholders is needed regarding the appropriate location of CGIAR work in the research-development continuum.

The same Panel, however, noted that many of ASB's research and innovation results take a long time to yield impacts and require considerable development investments with benefits materializing in the distant future. Hall (2005) also raises this issue of timing in relation to the innovation systems concept where "knowledge may be acquired through learning, research or experience, but it cannot be considered as an innovation until it is applied."[27] The innovations systems concept is compatible with the idea of a research-development 'continuum' as defined as "A continuous extent, succession, or whole, no part of which can be distinguished from neighboring parts except by arbitrary division."[28] Dalrymple (2005) considers that feedback loops have been evident in conventional approaches making the difference between them and innovation system approaches more relative than absolute.[29]

Indeed, viewed dynamically, the research to development continuum has research problem identification as the starting point and feedback from implementation as the ending point, in a given cycle of the process (see Figure 1 for an example applied to NRM research). Along the continuum are problem definition, research design, research implementation, translation of research results into ideas and technologies for development, dissemination, adoption and adaptation, and application and implementation.[30] Such an approach, seeks to have the Center actively research into and address needs and constraints in technology generation as well as technology adoption. It is important here to note that the *diagnostic* phase of research for productivity growth, policy requirements and poverty alleviation needs to be set out – as well as the dissemination and adoption dimensions. There is both the need to plan through *ex ante* assessment (including planning for research that will maximize the chance of wide spread application of the outputs and maximizing the likelihood of spillovers) and to evaluate impacts *ex post* (Figure 1). The research for development continuum therefore relies on the whole value-chain that places importance on generating and sharing knowledge and information – which is also the major tenet of the innovation systems approach.

[27] Hall (2005) p.75 Embedding research in a system of innovation in Science Council Secretariat (2006) Report of the Science Forum on CGIAR Priorities. FAO, Rome.
[28] http://www.thefreedictionary.com/continuum
[29] Dalrymple (2005) p.2 Preliminary draft Comments on Innovation Systems and Agricultural Research.
[30] The 2nd EPMR of the International Center for Agroforestry (ICRAF) (1998).

Figure 1. The research for development continuum illustrated with respect to natural resources management research (Redrawn after Place et al. 2002)



However, what has been described above is the whole gamut of agricultural research and development. An earlier critique noted that "While there is an understandable temptation to plug every gap in the agricultural development process, including extension at the farm level, major technology transfer projects are neither feasible, given resource constraints, nor desirable given [the] primary role [of] a research center devoted to producing international public goods."[31] It is, therefore, imperative that Centers develop an appropriate strategy for positioning [themselves] properly on the research-development continuum." The issues include distinguishing between *research* on dissemination, the design of alternative pathways and approaches and the process of dissemination itself.[32]

Some have questioned whether the concepts of a Research for Development continuum, and the CGIAR's placement along that continuum, are helpful. In thinking about what research the

[31] The 5th EPMR of the International Institute for Tropical Agriculture (IITA) (2001) p.13.

[32] The recent CGIAR publication (2005) *Healing Wounds: How the International Centers of the CGIAR Help Rebuild Agriculture in Countries Affected by Conflicts and Natural Disasters*, describes the instances in which the CGIAR has been able to contribute to humanitarian relief following disasters or conflicts. These activities have clearly provided important assistance to some countries and populations in distress. However, this capacity derives from the CGIAR's long term agricultural research, custodianship of genetic resources and the knowledge of developing country agriculture entailed by these pursuits. It does not present a convincing argument that the CGIAR should devote additional efforts to country-specific dissemination of technologies or post-conflict resolution and rehabilitation.

CGIAR should undertake it is important to structure the approach around problem-solving. Ziegler (2006) contends (following Stokes) that increasing the search for knowledge and increasing the application of knowledge are two dimensions of the same issue. This in turn leads to, firstly, the identification of the sorts of research needed to address applied problems and, secondly, to investing sufficient resources (and time) to undertake that research so that the optimal solutions which result can be applied to the overall advancement of agriculture (Griffon, 2006). Of course, identifying which institute or set of partners undertakes which part of the research, facilitation and the delivery of results is still required (see for example, Craswell, 2006) as the CGIAR is only one of the actors. Tackling policy research questions, rather than biophysical ones, may need yet another paradigm in which policy research, capacity building and policy communication are considered as interactive building blocks for improved policy development (von Braun, 2006). Each of these models has value, and it is not the intent of this paper to adopt any particular one to the exclusion of others. Rather the wish is to simply pursue an example which helps locate the various types of CGIAR research effort within an array of the necessary partnerships to solve problems and to have impact.

2. Structuring international public goods research and delivery

The SC (Science Council, 2005; Ryan, 2006; Pinstrup-Andersen, 2005) has called for a refocusing of the CGIAR on IPG research. However, as Sagasti and Bezanson (2001) have pointed out, the transition from declaring the desirability of a global public good to its existence is anything but automatic: ultimately it has to be produced and delivered.[33] It is necessary to differentiate between the core component of the delivery system, which should be taken care of by the international community, from the complementary activities that are the primary responsibility of local and national entities, for its provision and existence.

The components of an idealized international public goods delivery system can be placed in three domains. As shown in Figure 2, global public goods – whether related to global commons, to global policy outcomes or global knowledge – belong in the domain of the global. The host of institutional arrangements, including international organisations and partnerships, supranational finance mechanisms, and operational policies and procedures that are in charge of ensuring that the global public good is made available belong in the domain of networks. The multiplicity of national and local activities related to actual production and consumption of the global public good, which include domestic policies and incentives, national and local financial mechanisms, and the activities of government agencies, private firms, civil society organisation and private individuals, belong in the domain of the local. The conventions, treaties and protocols that formalise agreements for the provision of a global public good – also known as global public good regimes – mediate between the upper two domains. Contracts, agreements and other lower level legal instruments mediate between the two lower domains (Sagasti and Bezanson, op cit).

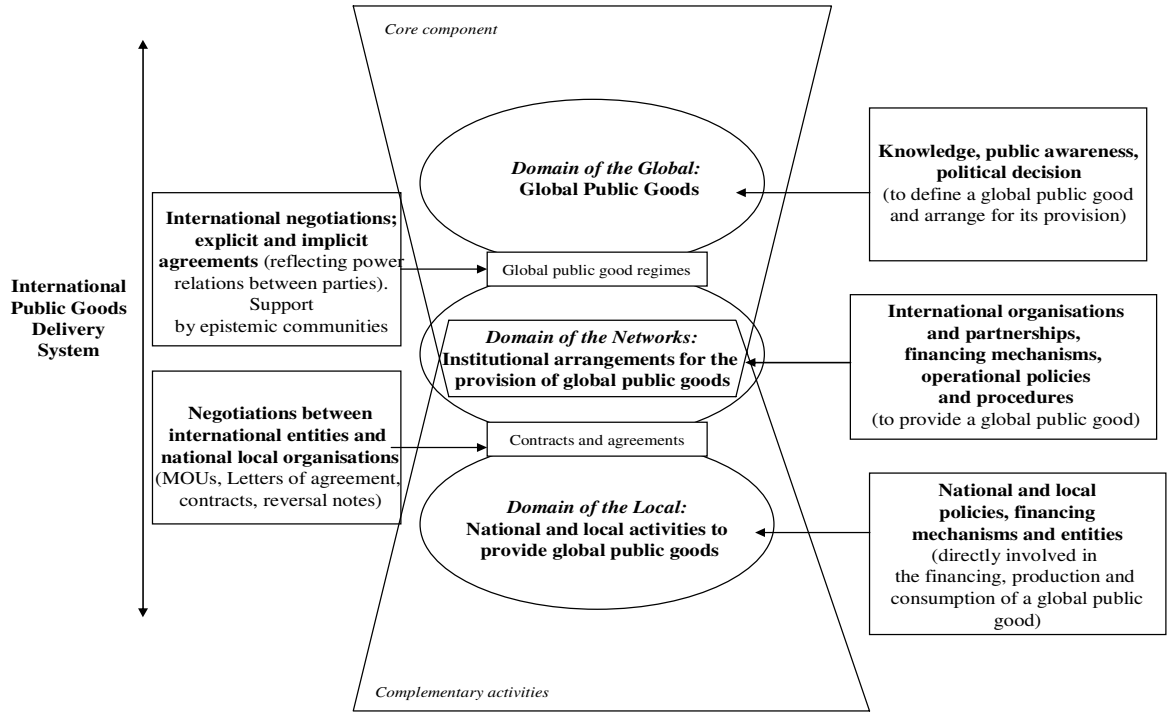
The main question is how far to go down along the continuum from global to local activities in defining what constitutes the core element of the global public goods delivery system.

The advantage of a conceptual framework of an idealized international public goods delivery system is that it identifies the elements that must be defined and put in place. The conceptual

[33] Sagasti and Bezanson use the term *global public good*, which is largely interchangeable with *international public good* as used by the Science Council and defined by Ryan. However, regional public goods are also recognized; whilst purely national public goods are not the focus of CGIAR research.

framework also underscores that there is no way of escaping values, interests and power relationships in defining what is a global public good; that the knowledge of epistemic communities is critical to underpin a decision and to establish global public goods regimes; that institutions and partnerships and financing mechanisms and operational policies and procedures are required at the international level to facilitate the production of an international public good; and that all of the preceding arrangements would be useless without the identification and involvement of national and local entities that will be in charge of actually producing and consuming the global public good. In a companion paper, Ryan (2006) notes that donors have recognized that for developing countries to benefit fully from the production of global public goods requires ancillary investments in corresponding national public goods (NPGs). Economies of scope can occur when the cost of two or more international public goods in the same institution (such as the CGIAR) is lower than when applying them through separate institutions.

Figure 2. An international public goods delivery system



(Source: Sagasti and Bezanson, 2001)

A clear focus on priority research in line with development goals and shared responsibility provides greater incentives for developing countries to invest (with support from donors) in their own national public goods (NPGs), and to maximize their capture of spillovers from the IPGs. Whilst Ryan puts it rhetorically, we would assert that the CGIAR place itself within the Research *for* Development continuum, rather than trying to indulge in both R and D without the complete array of partners. As Ryan notes (2006), in this process the whole innovation system may stand to benefit. For the change to occur there must be an acceptance by the supporters of agricultural research for such a positioning, and they must offer the right incentives to achieve the expected impacts from CGIAR research and such partnership arrangements.

3. Placement of CGIAR Research

For the CGIAR, part of the emphasis on IPGs is precisely to involve all other components of the research to development assistance spectrum with the high Priority research to "make it happen".[34] This includes equally the upstream providers of science as well as the skilled extensionists, community organizers and of course national programs contributing to complementary innovative and adaptive research. Whether one adopts circular, linear or other models of the research to development continuum, the question remains of how the CGIAR Centers are to be placed in this spectrum of contributing institutes. There is not a single answer, and the pragmatic "near the middle" is not at first sight very satisfying. Clearly we should not place the Centers entirely within the development end of the spectrum where there are other providers and when only local benefits result. Alternatively, the "blue sky" end of the spectrum is not generally appropriate for the CGIAR, divorced as it is from feasible impact pathways. However, the placement of the research will not always be at the mid-point either, as problem solving in agriculture is a dynamic not a static process. Partners interact not at one particular point of contact but at many depending upon the relative capacity and expertise of the CGIAR and its collaborators, the existence of other research providers, and depending upon the stage of the technology development and testing process. There will thus be bands – rather than points - of interaction between CGIAR Centers and their partners and the partnerships and articulation of responsibilities will differ according to the subject matter being researched. For the Centers, therefore, partnerships revolve around exercise of their comparative (and complementary[35]) advantages:

- The acquisition and mobilization of global science (at all levels, but this particularly concerns ARIs in the North and South, the large and medium-sized private sector relevant to agriculture, the funders of international science and technology).
- The conduct of project and thematic research in developing countries (with ARIs, NARS and NARES, NGOs, farmers groups and resource users).
- Raising awareness of necessary policy and associated issues affecting the future progress of agriculture in developing countries (largely with Ministries and agencies within NARS, but also with NGOs and communities of resource users, information services).
- The scaling up of positive outcomes (with NGOs, regional organizations, strong regional NARS, NARES, regional development Banks, information services).
- Resetting of the agricultural development agenda according to new possibilities.
- (regional development Banks, regional organizations, strong NARS, CSOs and community organisations, information services).
- Catalyzing funding for the above (CGIAR Members, Foundations, Regional and Global agencies, national and local agencies, NGOs, information services).

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[34] The World Bank equates the historical success of the CGIAR with its ability to generate global public goods in this way. "In the research and development continuum spanning from basic, strategic, applied, and adaptive research to technology transfer, the CGIAR has made its mark and demonstrated the genius of its framers. It has succeeded mostly because of its emphasis on strategic research of a global or regional public goods nature, with benefits that spill across national boundaries and cannot easily be obtained through private, national, or regional research, and its practical, problem-solving focus on bringing the best of known science to address the problem of food security." (WB, 2004, pp.21)

[35] Ryan (op cit) has used the concept of *"complementary advantage"* to further elucidate the role that the CGIAR (Centers or programs) will play. This approach implies that the particular role(s) of the CGIAR centers be such that they maximize the synergies and multiplicative effects from interactions with other actors/partners/suppliers in the research for development continuum, consistent with their respective mandates and comparative advantages.

We have seen that the production *and* delivery of IPGs depends on the concerted action of several players. Centers have, in the past struggled with the question of how far along the Research for Development continuum they should go, particularly in cases when suitable enabling conditions for the delivery and uptake side do not exist or are not fully adequate. The variable capacity of NARS to undertake complementary adaptive research and technology dissemination activities, even within regions, has been recognized.[36] Some have argued that in the absence of currently viable extension mechanisms (such as in the poorest countries of Africa) or where state systems have collapsed or deterred the development of efficient alternatives, including the private sector, the CGIAR has to move into the missing middle ground and conduct more development-related activities to ensure the dissemination of its own technologies. Further, it has been suggested that the CGIAR Centers do learn important lessons from involvement in development-related activities (Bertram, 2006) and that some of the outstanding "grey areas" at the research/development interface would be worthy of analysis and characterization as case studies. The counter argument might be that if the research question can be formulated clearly in advance, there would be fewer grey areas, and the CGIAR activities could be much more clearly allotted to research or development categories as suggested (CGIAR, 2005). The driving sentiment behind Ryan's analysis of IPGs (Ryan, op cit.) is that the intent of the research – the "learning component" – should be established *ex ante*. Post conflict countries may not be the most optimal sites to conduct structured and controlled experiments. Also, the CGIAR cannot be held accountable for the failure of national systems and it has neither the resources nor the comparative advantage to disseminate technologies on a sufficient scale for more than piecemeal outcomes. Extension approaches have been moving for some time towards the introduction of private incentives to extension systems to increase the efficiency of agricultural technology dissemination.[37] Centers should similarly aim to work with private partners or public national partners using private incentives where possible. WARDA, for example, is currently exploring the possibility of establishing independent private seed multiplication suppliers to disseminate its Nerica lines more effectively in Africa. Science-based advocacy to fill dissemination gaps at the national level may also be more effective than the direct involvement of global institutions.

Historically, the dilemma may in part have arisen from a technology production focus which then looked around for delivery partners. However, Systemwide approaches, including global CPs have been framed differently, including from the outset the larger set of partners required to take the program from the generation of outputs through the expected level of application. Another perhaps unexpected outcome of the CPs and their funding is the re-emergence of contract research. In days of strong core-funding Centers could commission additional pieces of research as needs arose. In the early days of the CGIAR this tended to be more strategic types of research on pests and commodity improvement. However, CPs have the opportunity today to

[36] "It is difficult to prescribe a uniform interaction given variability in the NARS, and in the biophysical and human capacity of the states concerned. The heterogeneity of NARS in terms of capacity and rates of development by region increases the complexity of interactions for the CGIAR. The existence of strong NARS accelerates opportunities for transferring aspects of research to partners and raises the requirement that the CGIAR does not duplicate existing capacities. However, the continued existence of weaker NARS in several regions means that strategic choices (about the speed and staging of research, capacity building and ensuring regional spillovers from CGIAR research) must be made according to partner strengths. Involving NARS program partners of different strengths in research consortia can assist opportunities for south-south interactions and regional spillover" Science Council (2005) and see Annex.

[37] Discussed in Rivera, W.M. and Zijp, W. (2002) Contracting for Agricultural Extension. International Case Studies and Emerging practices. CABI, UK.

commission research, or more development-oriented inputs into their overall programs, in a novel way.

4. Partnerships for Research

The paper continues to consider, as examples, three sorts of research – both traditional and emerging for the CGIAR - to examine the role of some of the key partners for the Centers and CGIAR Programs in the conduct of Research for Development.

4.1 Germplasm enhancement research

Historically, the CGIAR has proved most successful in effecting yield increases and impacting poverty through the development of high yielding varieties of crop plants. Much of the CGIAR's earlier breadth of success has come from a) a concept of wide adaptation (i.e. robustness) of the improved germplasm, and b) spillovers of new technologies (as well as a steady role in capacity strengthening through research). Pingali and Kelley (2005) suggest that spillovers from international research are likely to be highest for a commodity like wheat, which is grown in relatively homogeneous production environments, with little variability in local tastes and preferences for quality characteristics. Quality characteristics are a limiting factor in the direct transferability of varieties for some other major commodities such as maize. NARS programs have generally used varieties or crosses used in CGIAR Centers as parents for the development of varieties that are more closely adapted to particular agro-ecological environments or taste preferences. In general, large NARS engage in adaptive transfers rather than direct use of CGIAR-generated varieties and crosses. The CGIAR has contributed significantly to the improvement of research efficiency and to the reduction of research costs by enabling such adaptive transfers.

The CGIAR would like to devolve breeding programs to capable NARS (including their emerging private sector) where these exist (see footnote 12). The intention is that: a) the CGIAR does not unnecessarily duplicate or inhibit the capacity of NARS and their partners, and, b) the CGIAR Centers can better utilize their existing expertise, acting on the comparative advantage *of the System,* to draw in new advances in genomics from ARIs and apply them to some of the major challenges for germplasm improvement (such as biofortification, or labor and water-saving technologies). Targeted and sustained capacity building in support of this programmatic strategy may be required by the CGIAR and its partners. Interaction with the private sector and large NARS in technology generation is in part underway and anticipated to grow. Appropriate intellectual property regimes to foster the CGIAR's freedom to operate and to deliver IPG are required (and see section 5.3). This research requires to be underpinned by additional public sector research approaches to natural resource management (e.g. to improve the efficiency of water use and soil fertility etc).

Further, the CGIAR needs to assess how distribution of the targeted technologies (seeds, improved varieties) can be augmented for widespread adoption and impact. Participatory plant breeding (PPB) approaches provide opportunities for the integration of on-station research and user perspectives in the development of local varieties. Although the intent is also to produce IPGs through this approach, issues related to certification, freedom to distribute local varieties widely, and the definition and attribution of impact compared with traditional breeding, require that research remains to be done to match the means to the intent. A recent interaction between the CGIAR and the private sector revealed the extensive contacts some Centers already have with

the private small-scale seed sector in developing countries.[38] It also illustrated how the multi-national private sector could contribute more effectively to this start, and to planned new research on assessing markets and value-added chains, diversification of farming methods and particularly new approaches to orphan (or underexploited) plant species for the benefit of development goals. These would seem to be practical expressions of the mobilization of some of the complementary partnerships anticipated for international public goods research.

4.2 Natural resource management research and the challenge of scaling up

There is a challenge for IPG research to increase the scale of transfer (and impact) in going from the successful pilot projects at plot or watershed level to extend the best results of research to several similar agroecologies, or different countries or regions. Perhaps more than with seed or varietal transfer, an environmental approach needs to be much more inclusive and so far the incentive structure has not brought in the private sector when compared with their mutual interest in the advance of biotechnology (or in other areas such as energy efficiency).

The study of NRM technology adoption is complicated by the nesting of individual adoption decisions in a multi-scale, dynamic context involving interactions among many actors. Resource management research is often most effectively carried out with a wide range of resource users and NGOs who have expertise in dealing with community issues. The outcomes of improved natural resource management research are often not a single technology but improved and more flexible communities of practice and policy formulation. The time frame for research is often longer rather than shorter.

The following key principles for achieving dissemination and uptake have been identified (by Sayer and Campbell, 2004):

- NRM is best scaled through networks linking people tackling similar problems.
- It requires enhancing options, scientific management and providing policy options to lower risk and create an enabling environment.
- Generate more attractive products.
- Use feedback to redefine the research agenda.
- Encourage support groups and networks for information sharing.
- Facilitate negotiation amongst stakeholders.
- Provide information to encourage policy change and institutional development.
- Make use of information management tools such as GIS and modeling (site similarity analysis).

The preferred outcome is both improved management and influence over the trajectory of change. It is necessary to combine research and management.

In other words a number of actors will be involved in the successful transfer and scaling up of CGIAR research, the most important of whom may be community based organizations, NGOs and national policy makers, as much as NARS or CGIAR Centers. [39] The challenge therefore is to

[38] CGIAR-Private Sector High-Level Workshop, Washington DC, September 2005. Facilitators Meeting Summary. Meridian Institute. 10p

[39] This is not intended to assert that the CGIAR should by-pass NARS who are a critical component of the policy forming institutions.

exchange the new knowledge with other communities of practice (often NGOs[40] and new sets of local resource users). It is important that CGIAR Centers know about and select these other communities of practice facing similar issues but the transfer should be accomplished between communities.

There are greater difficulties in estimating (and attributing) impacts from more formal NRM research within the CGIAR and from elsewhere.[41,42] However the World Bank has found good returns within its projects to the adoption and impact of *existing* NRM technologies (Kelley and Byerlee, 2003). Often the successful projects involve not just an NRM technology but broader empowerment such as livelihood support or market development approaches, which are delivered in tandem. This suggests that stronger planning linkages between the CGIAR and Regional Development Banks may be of value in addressing not just one-off improvements through research, but in coupling and integrating this to other needed development components. The CGIAR should be able to advise on the most useful practices, to recommend on domains of application and be able to identify communities of practice who could be supported through more comprehensive programs.

While intensive participatory approaches may be appropriate for achieving results at specific sites such as watersheds, it is unlikely that Centers, or even government agencies, will ever be as effective as NGOs in directly engaging poor rural people. CGIAR Centers and Programs however can play a critical role in this process by identifying principles of organizational and management arrangements that are transferable across the differing local circumstances or settings (see Table 1).

For both technology improvement and NRM practice, the synthesis of research and the development of recommendation domains for concerted development action should be the strong suite of the CGIAR. For instance, there are gaps in current knowledge of why adoption is clustered (beyond simply the existence of the relative wealth of adopting farmers) and in moving from static to dynamic studies to adoption. Improved emphasis is required on the role of social capital, extension services, private traders and community organizations in information flow and adaptation of the on-the-shelf technologies to local conditions. What are the costs of scaling up the delivery of information?

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[40] "NGOs specific comparative advantage appears to be in intensive participatory approaches with their clients to define problems, propose and test solutions, and engender community participation in NRM development efforts. in situation of farm households in marginal areas – Kelley and Byerlee (2003)"

[41] CGIAR Science Council Secretariat (2005). Natural Resources Management Research Impacts: Evidence from the CGIAR

[42] "For roughly the same biomass response per unit investment, high-value cash crops generate greater economic returns than do low value cereals, so systems that include higher-value crops exhibit markedly higher rates of adoption of NRM methods per unit land area than do semi-subsistence systems based on extensive production of staple grains roots and tubers" See Place et al. (2002) for more general findings on the outcome of NRM research.

Table 1. Examples of NRM technologies appropriate for scaling up

Technology	Research location	Vehicle for scaling	Wider application
Rice-fish culture	Northern Vietnam Bangladesh	National initiatives South-south transfer Water and Food CP	Southern Vietnam Western India Mali
Cassava-based cropping systems: Integrating Germplasm, Natural resource and institutional innovations to enhance impact.	Villages in Vietnam and Thailand	Positive spillover from project participants to non-participants. National Research system strengthening. Potential for broad scale extension	Vietnam and Thailand
Zero-tillage technology (for sowing wheat immediately after the rice harvest)	India	Technology testing, participatory local adaptation of ZT seeding machines involving farmers, scientists and manufacturers.	India (and elsewhere in the Indo-Gangetic plain).
NRM in crop livestock production systems: cactus/alley cropping.	Arid and Semi Arid areas of Morocco and Tunisia	Investment by the government in dry areas. Potential for drought mitigation, increase and stabilization of fodder reserves.	Similar agro-ecological zones.

Examples from WorldFish (Dey and Prein, 2003) and CIAT, CIMMYT and ICARDA (CGIAR SC Secretariat, 2005)

4.3 Projected research on poverty alleviation

A growing body of research suggests that poverty is particularly prevalent and persistent in "less favored lands" that are far removed from market and political centers, experience persistent conflicts, and attract low levels of government investment and services. Such areas have been less favored both by biophysical endowment (e.g. lower and more erratic rainfall, poorer soils) and through institutional and infrastructural deficiencies or high levels of market volatility. The people in such areas may be caught in a poverty trap which differs in an important way from standard economic models of growth focused on the micro (individual and household) or macro (international price effects) solutions. These have been named "fractal" poverty traps (Barrett and Swallow, 2006).[43] The challenge posed by fractal poverty traps is that interventions need to be simultaneously applied at all scales where low-productivity strategies reinforce one another.

[43] "Fractal" poverty traps - a notion which includes the concept of multiple dynamic equilibria (at multiple micro, meso and/or macro scales) which are self reinforcing through feed-back loops– are so-called since fractal patterns repeat at all scales of aggregation. "Governments, markets, communities and households are... simultaneously weak in places characterised by fractal poverty traps. No unit operates at a high-level equilibrium in such a system. All seem simultaneously trapped in low-level equilibria." (Barrett and Swallow, op.cit.)

Examples of pro-poor interventions, that need to be applied to such areas in a coordinated fashion (not all of which are research) might include; reducing variability in crop yields, public investments in water supplies that reduce illness and time spent drawing water, microfinance institutions that increase access to credit and insurance, creation of producer groups that reduce unit costs for purchased inputs and increase unit revenues from product sales; and improvements in transport infrastructure to enable participation in markets. Research to provide safety nets and that protect human health and education, keeping children adequately nourished and in school regardless of what is happening to family income are vital to ensure sustained progress.

The authors point out that at *meso* scales of analysis – communities, groups, networks, and local jurisdictions – coordination, cooperation and conflict are especially important determinants of asset accumulation, transformation of assets into goods and services, and distribution of those goods and services among units within the aggregate. Meso-scale groups may also augment private returns by regulating the use of collective natural resources, such as forests, rangelands, fisheries and waterways. Markets too are socially constructed institutions and social organisation, or reorganization, can provide the basis for collective action which can benefit even the small-holder and the poor. Thus the institutional arrangements that shape interactions among units and between scales are of particular importance in establishing the equilibrium into which a regional or local economy settles.

However, recent trends to decentralization need to be examined in terms of capacity to foster the development of groups of the poor or to link the interacting scales of authority and action that have been identified as influencing the various equilibria. Because many key factors behind persistent poverty – for example, water and health care availability, soil fertility degradation – result from processes involving policies at multiple scales of government (and linkages among those scales), some poverty traps originate at multiple scales simultaneously. For effective changes in policy to be brought about (e.g. in land tenure or community rights) pressure for change and actions are required to be applied by reforming higher level national or international agencies with the concurrence and active participation of the effected communities "at the bottom". Overcoming soil fertility problems – or other limiting factors with multi-scalar aetiology – requires some combination of public, collective and private action (Barrett and Swallow, op. cit).

In summary, research for the alleviation of poverty requires greater attention to institutions and to the development of enabling policies (as well agricultural technologies and methods) and will require greater dovetailing of the various agricultural research outputs within wider development programs aimed at several scales.

5. Catalytic research, networking and regionalization

5.1 Research to encourage spillovers

Ryan (2006) has considered other elements of technology adoption and dissemination (such as spillovers) in relation to IPGs. Scaling up research moves efficient technologies from pilot scales to higher levels of application (e.g. from plot to landscape). The scaling out of research methods to other ecoregions, or similar ecoregions in other countries, provides the spillover effects desired from internationally funded research. Enhancing opportunities for spillovers is an area for continuing research and partnership by the CGIAR international agencies, particularly the FAO

and the Regional Development Banks, being able to combine agro-ecological typologies with socio-economic measures of poverty, livelihoods and risk analyses and capacity strengthening.

The practical research expression of this recommendation is the development of GIS and modeling tools which link geographical, agro-ecosystem and poverty data. It should be carried out in parallel with socio-economic research on markets and communities, forecasting and policy research so as to be able to construct dynamic scenarios based on different interventions. This is the sort of synthesis research that the CGIAR should do, but it does not abrogate the need for long term research on major problems.[44] Organisations which only synthesize the results of others are quickly drawn into the consulting company syndrome with a progressive reduction in comparative and complementary advantage. However, in the operation of those programs the interaction between research AND development partners is required to be made stronger and more varied to make research FOR development more effective.

5.2 Networks[45]

The CGIAR germplasm and crop management networks have been absolutely crucial to the rapid dissemination of knowledge and products. The networks allowed a global community of commodity scientists to be connected to each other and to learn from each other. Although there are relatively few formal assessments, Pingali and Kelley (2005) quote a study of CIMMYT Regional Maize Program in Central America (a maize research network) which found high returns to participation,[46] especially for small countries that could not afford a critical mass of crop research and development specialists.

Networks can be subject matter based – e.g. genetic enhancement networks prove an effective means of examining genotype by environment interactions. However, some Systemwide programs are network-like, but bring together the range of required partners to tackle research challenges in an integrated, cross-disciplinary manner. The Systemwide mechanisms that the CGIAR has adopted may in consequence become more effective than the Center model in turning technologies and approaches to time-bound impacts.

5.3 Regionalization

Whilst research can develop truly international public goods, the impacts and the communities impacted are clustered at regional and local levels.

Nickel (1996) earlier proposed a possible scenario for a more globalized agricultural research system which would be a three tiered structure of regional, national and international research institutions. Each would have a distinct role, but their relationships would be interactive and mutually dependent. The CGIAR Centers have global mandates and/or serve particular regions. This is augmented by a suite of ecoregional programs which address issues common to one ecoregion and have set up the collaborative mechanisms amongst different partners which pave

[44] Science Council of the CGIAR (2005) op. cit.

[45] Note that the word *Networks* in this section is used in the more accepted (CGIAR) sense of collaborative research networks and contrasts with the "domain of networks" (Sagasti and Bezanson, 2001), or the meso-level of networks and institutions (World Bank, 2005; Barrett and Swallow, 2005) discussed earlier in this paper.

[46] Substantial work is needed on the economic and social returns to network participation, since this mode of linking researchers in national programs and the CGIAR is expected to continue into the foreseeable future. Measuring the impacts of networks is difficult, however, because of the problems in clearly identifying inputs and outputs and attributing them to participants in the network (Pingali and Kelley, 2005).

the way for greater participation and dissemination of products. There has been the recent establishment of regional NARS apex bodies, which has catalyzed regional priority setting but has had variable success in devolving tasks to research entities.

An additional unsolved issue is the appropriate means for stronger NARS to assist weaker NARS in the same region. Nickel (op cit) suggested that the very large NARS (e.g. China, Brazil, India, Indonesia) are, in effect, regional institutions, with growing public and private research sectors. However, the growth of IPR regimes globally and the increasing relative imbalance in NARS capacity might also lead to a two tier status amongst regional neighbors unless there is a consistent practice of sharing the outputs of public goods research.

The current development of regional MTPs for CGIAR research activities (for two regions of Africa in the first instance) promises to identify the proper nexus between global and regional public goods research and to help extend the possibilities of regional impact. Subregional organizations have noted the importance of creating institutional mechanisms to ensure the spillovers are internalized by all countries. The strategy with respect to participation in the production of regional/international public goods may be different - as the most effective way to produce the regional public good will be specific to the nature of the problem, and the nature of the science needed to solve the problem. It may be produced by the strongest national system on behalf of the others or it may require research and implementation by a country that is currently the "weak link" in the regional solution of a problem (such as epidemiological surveillance). Political arrangements may suggest that everyone participate equally or that a country that causes the problem must compensate the others. The sub-regional partner may have an advantage in organizing and facilitating the production of RPGs that may also be IPGs.[47]

Existing advanced capacities in some developing country NARS in a regional or international projection will increase the efficiency of resource use, while at the same time freeing CGIAR Center resources. This would allow the Centers to move upstream where they might have greater comparative advantages. The larger NARS can continue to serve as motors of this regional role if international mechanisms (possibly beyond the CGIAR) are identified to enhance south-south transfer and to provide the weaker regional members with international support within which research and development assistance of all types could be channeled.

6. Conclusions

The SC has tried to make clear the extent of partnerships required to tackle IPG research and to bring beneficial outcomes to the resource poor and to target regions. The Priorities document noted: "*Increasingly these will be national and regional agricultural research systems. However advanced research institutes and agencies, the private sector, and nongovernmental organizations have a vital role to play in achieving our common goals. Strategic choices in dealing with the "other 96%" of agricultural research will be required with the nature of the partnerships determined by the particular research.*

Among the major strategic opportunities to draw the private sector into assisting the global goals of the CGIAR will be the application of private sector biotechnologies in germplasm enhancement. Elements of a

[47] These concepts have been extracted from the outline draft Regional MTP for East and Central Africa, courtesy of Dr. John McDermott.

successful strategy need to be integrated from Center to system level, and through active PPP research utilizing proprietary technologies.[48]

There are, increasingly, opportunities to source relevant research from non-CGIAR providers. In general, outsourcing of research or for example, capturing food safety, market chain knowledge and post-harvest expertise from others, is to be welcomed as part of the principle of developing new science partnerships. An innovation systems approach should be pursued where appropriate instead of the traditional linear research through extension to farmer approach. As a minimum, there should be a strong two-way communication between farmers and researchers whether at the national or international level."

In all the above cases the CGIAR is seeking support and mediators from research and development partners - separately but within an overall frame - to help extend, enhance and complement the outputs from research. In no case has the CGIAR turned from its research mandate, or tried to become a provider of development assistance, rather it seeks to make both forward and backward linkages to its development partners to be able to deliver its much needed research results. Although these things are stated in the document describing the new research priorities for the CGIAR (CGIAR, 2005), it has not perhaps been appreciated the sort of sea-change that is required in partnerships and regionalization of delivery compared with individual Centers interacting bilaterally with regional donors on one research topic at a time. One of the several advantages of proposing Priorities for Research at the System Level is that a System perspective may be preferable to interact with the great number of actors on the key leveraging points of development, to indulge in more advocacy, to lay out the placement of key research results and the means that will need to be put in place by developing countries to obtain impact.

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[48] PPP – public private partnerships

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Appendix
Extracts of statements relating to the Research for Development Continuum and the placement of CGIAR Research[49]

- The Priorities were developed in the light of a longer term vision for the CGIAR:

  "The vision for the longer term is one in which the CGIAR is a provider of international public goods through agricultural research aimed at the alleviation of poverty. The CGIAR aims to progressively devolve some current research (particularly aspects of breeding for germplasm enhancement and site-specific natural resource management) to NARS with increasing capacity. Devolution and enhanced delivery to the poor in different localities will be effected through a range of partners. The CGIAR will move towards the solution of the complex system issues undermining moves out of poverty and the success of agriculture in developing countries, supported by genomics research and provision of science-based policy advice. It is clear that the staging of such a strategy will be different in regions where NARS have different strengths. Special attention will be paid to the building of partner capacity in sub-Saharan Africa"

- The dispersion of research effort (with an attendant increase in the chance of declining impact from CGIAR activities) - The CGIAR Centers has separated efforts into a large number of small projects, some of which were not sustainable or of sufficient size to achieve impact.

  [These problems had been noted by others: (Lele et al. 2003) "there is an overwhelming consensus... that the growing share of restricted funding is distorting research priorities, increasing transaction costs, and reducing the efficient use of resources at both the System and Center levels". Whilst there is no tangible evidence for this as yet, some feel that this phenomenon has contributed to a "strategic drift" within the CGIAR (Pingali and Kelley, 2005)].

- "*At the same time that the CGIAR has undertaken a widening of its goals and its total budget has increased, there has been a relative decline in core funding, accompanied by selective funding of a large number of specific projects negotiated with donors. Many such projects address particular (local) development problems and do not focus on the core strength of the CGIAR, i.e. as a research supplier of appropriate international public goods, knowledge, technology and capacity building that can be used widely. Moreover, the Centers compete for these funds, often leading to overlaps in their portfolios*".
- "*There is the requirement to mobilize research capacity across the CGIAR System. Projects addressing difficult issues for sustainable poverty reduction (e.g. smallholder productivity gains in Africa) need sharply focused, long-term and multi-pronged approaches involving research on different commodities, themes, and disciplines. The CGIAR as a system has unique comparative advantage in mobilizing research across Centers and in organizing complex coordinated projects. The CGIAR should, however, exploit this advantage further*".
- "*There are opportunities to enhance coordination and cooperation. Institutional mechanisms already exist to implement System-level projects through ad-hoc coalitions of Centers, SWPs, Task Force initiatives, and CPs.*"
- *"There are additional opportunities to mobilize contributions from other providers of research and extension activities to enhance the impact of the CGIAR's science and approaches. Specially taking into consideration that the CGIAR, although very relevant, accounts for only a fraction of global research efforts undertaken by several international, regional and national organizations such as advanced research institutes, private companies, national research institutes, universities, and foundations."*
- Increased accountability through performance measurement systems which linked discrete research plans to outputs and objective indicators of performance.

[49] from the Science Council of the CGIAR (2005) System Priorities for CGIAR Research 2005-2015

The Priorities document also notes:

> "*that CGIAR Centers traditionally work with selected NARS in their regions, and share information globally with many more: The intention is that in the future, all Center programs will be time-bound and increasingly include exit strategies where the products - or the program itself - will be taken over by NARS*."

This, it should be remembered is a strategic statement of intent by the CGIAR and will be put into practice with variable speed according to topic, region of the world and partnerships. However, the strategy is centrally embedded in the research suggested for genetic enhancement, one of the major planks of the CGIAR research effort. Here, research will:

> "*focus on traits of particular importance to the poor, to include resistance to selected biotic and abiotic stresses with emphasis on drought and salinity, and improvement in the nutritional content of staple foods. In addition to the benefits derived by the smallholder farmers, research on genetic enhancement and other productivity-enhancing research are expected to result in large benefits to the poor consumers in both rural and urban areas through reduced unit costs and prices. While the CGIAR will develop a genomics platform to facilitate genetic enhancement, it is envisaged that an increasing portion of maintenance research and agro-ecological research will be taken over by national agricultural research institutions*."

That is to say a progressive devolution of some aspects of breeding and genetic enhancement for new varieties is expected to national programs in the coming years.

However, the SC also noted that:

> "*it is difficult to prescribe a uniform interaction given variability in the NARS, and in the biophysical and human capacity of the states concerned. The heterogeneity of NARS in terms of capacity and rates of development by region increases the complexity of interactions for the CGIAR. The existence of strong NARS accelerates opportunities for transferring aspects of research to partners and raises the requirement that the CGIAR does not duplicate existing capacities. However, the continued existence of weaker NARS in several regions means that strategic choices (about the speed and staging of research, capacity building and ensuring regional spillovers from CGIAR research) must be made according to partner strengths. Involving NARS program partners of different strengths in research consortia can assist opportunities for south-south interactions and regional spillover*".

And as noted in the Conclusions of this paper:

> *"Increasingly these will be national and regional agricultural research systems. However advanced research institutes and agencies, the private sector, and nongovernmental organizations have a vital role to play in achieving our common goals. Strategic choices in dealing with the "other 96%" of agricultural research will be required with the nature of the partnerships determined by the particular research.*
>
> *Among the major strategic opportunities to draw the private sector into assisting the global goals of the CGIAR will be the application of private sector biotechnologies in germplasm enhancement. Elements of a successful strategy need to be integrated from Center to system level, and through active PPP research utilizing proprietary technologies.*

There are, increasingly, opportunities to source relevant research from non-CGIAR providers. In general, outsourcing of research or for example, capturing food safety, market chain knowledge and post-harvest expertise from others, is to be welcomed as part of the principle of developing new science partnerships. An innovation systems approach should be pursued where appropriate instead of the traditional linear research through extension to farmer approach. As a minimum, there should be a strong two-way communication between farmers and researchers whether at the national or international level."

"It is clear that the results from CGIAR research may have little impact in adverse policy and institutional environments, so research is therefore proposed to better understand such environments. In addition, it is argued that the CGIAR should do more lobbying and the advocacy needed to bring about the appropriate supporting environment – including investments in rural infrastructure, delivery systems and many other development aspects" (CGIAR, 2005).

POSITIONING THE CGIAR IN THE GLOBAL RESEARCH FOR DEVELOPMENT CONTINUUM: REPORT OF A WORKSHOP[50]

Summary

A workshop was held jointly by the SC of the CGIAR and the Ministry of Foreign Affairs and the University of Wageningen, The Netherlands, to facilitate a discussion among CGIAR stakeholder groups about the appropriate positioning of the CGIAR in the research to development continuum as the CGIAR proceeds to implement the System Priorities for Research.

There was agreement that the CGIAR has the correct mission and mandate and that it should continue to conduct research focused on the production of IPGs. It would be helpful to ground the CGIAR's understanding about the contemporary research for development continuum in relation to Agriculture through the examination of specific case studies, with clarity in the terminology used and the underlying knowledge model(s) which underpin research in the CGIAR. Action research on development processes is important to make research effectively contribute to the development effort – what the Workshop referred to as the "learning" part of development. There are some areas of current activity which may or may not be research, but the stakeholders as a group should examine such cases, identify legitimate practice and means to meet these development bottlenecks globally.

A major theme that came out of the Workshop was the need to analyze the issue of complementary partnerships (in their various types) required to conduct IPG research for development. Identification of the roles and partnership criteria for CPs would be part of this assessment as CPs are (one form of) dynamic partnership arrangements that may encompass the range of partnerships needed for knowledge generation, delivery and scaling. It was further noted that centers may need to be ready to play a complementary rather than a coordinating role in some partnerships. Special consideration was given to aligning policy research with other research and development needs and players.

Acknowledging the different perspectives of the CGIAR Members, continuing interaction with donors and other stakeholders in agricultural research and development should be undertaken in an iterative fashion to maintain knowledge flows, policy feedback and the various types of funding support required for research activities, policy formulation and development. Too great emphasis on short term measurable impact may lead to "cherry picking" by donors, and disregards the long-term and uncertain nature of research in complex development processes. This in turn may lead to centers searching for funds beyond their immediate mandate in order to sustain their long-term commitments.

The outputs from the Workshop will be taken up by the SC and other entities in the CGIAR. They are anticipated to inform the CGIAR-wide discussion, to encourage common understanding and to inform the planning steps for the implementation of priority research.

[50] Held on Friday 19 May 2006, Ministry of Foreign Affairs, The Hague, The Netherlands

The primary purpose of the workshop was to facilitate a discussion among CGIAR stakeholder groups about the appropriate positioning of the CGIAR in the research to development continuum as it proceeds to implement the agreed System Priorities for Research. The CGIAR System Priorities for research were endorsed at the Annual General Meeting of the CGIAR in Marrakech in December 2005, and debate led to a suggestion that the SC should organize a workshop to permit further discussion of this specific topic. The outputs from the Workshop were anticipated to inform the CGIAR-wide discussion, to encourage common understanding and to inform the planning steps for the implementation of priority research.

The Meeting was jointly organized by the SC of the CGIAR, the University of Wageningen and the Ministry of Foreign Affairs, the Netherlands who kindly hosted the Workshop. The Workshop was held as a facilitated discussion[51] according to the attached Agenda (Annex I). Two background papers were prepared[52] and several introductory briefs on discussion points were prepared by participants prior to the Meeting (these are listed in Annex II).

Welcome: Theo van der Sande welcomed participants to the Meeting on behalf of the Government of the Netherlands and the Ministry of Foreign Affairs.

Introduction to the Meeting: The SC Chair, Per Pinstrup-Andersen laid out the SC's intent in relation to CGIAR research and development as reflected in the new CGIAR Priorities for Research.

In the context of implementing the new CGIAR System Priorities there is a need to distinguish between research for development and the conduct of development activities *per se*, for which the CGIAR has little or no comparative advantage. The placement of CGIAR research should be considered in relation to the complementary activities and partners required to implement the goals of the System Priorities. Historically, the niche of the CGIAR has been to conduct strategic research and provide the link between the basic and more adaptive ends of the research for development continuum. Strategic research has longer research 'adoption lags' than more applied or adaptive research. In the case of the CGIAR and agricultural research for development this has led several investors to fund activities with more immediate impacts (although sometimes at much more local scales).

Research Priorities and IPGs

The SC has laid emphasis in the development of the new System Priorities on the strategic generation of IPGs rather than succumb to pressure to produce disparate local public goods. A recent consideration of the definition of IPGs in the context of CGIAR research (see Ryan, 2006) suggested that IPG research is determined by the *intent* of the research to produce results of use to several countries. The development and delivery of IPGs in agricultural research relies on a complementary set of national and local partners. Research planning requires *ex ante* assessment that will maximize the chance of wide spread application of the outputs and the likelihood of

[51] Although sessions were arranged by subject matter titles, the discussion sometimes ranged over generic issues as much as the implications of different research approaches. This Report provides very brief synopses of the presentations of the lead interventions (and the reader is referred to the prepared briefs for more information) and then collects some of the key points made in discussion. The latter are provided anonymously as sometimes viewpoints were contributed by individuals and at other times by spokespersons after small group discussion.

[52] One by Jim Ryan of the Science Council on International Public Goods, and a second by the Science Council Secretariat on partnerships issues relevant to the subject of the Workshop.

spillovers. Appropriate intellectual property regimes to foster the CGIAR's freedom to operate and to deliver IPGs are also required.

Placement of CGIAR research
The above requires that the CGIAR should place itself within the Research *for* Development continuum, rather than trying to indulge in both R *and* D without the complete array of partners. The placement of the research will not always be at any one point as the research for development continuum is not a static concept but a dynamic process. Partners interact not at one particular point of contact but at many, depending upon the relative capacity and expertise of the CGIAR and its collaborators, the existence of other research providers, and depending upon the stage of the technology development and testing process.

The CGIAR: comparative and complementary advantage
For the Centers, partnerships revolve around exercise of their comparative (and complementary) advantages (see Ryan, 2006; Science Council, 2006).

The realities of implementation
The SC recognizes that there is variable capacity of NARS to undertake complementary, adaptive research and technology dissemination activities. In the absence of viable extension mechanisms (such as in the poorest countries of Africa), or where state systems have collapsed, there is pressure for the CGIAR to fill the gap and conduct more development-related activities to ensure the dissemination of its own technologies. However, the CGIAR cannot be held accountable for the failure of national systems and it has neither the resources nor the comparative advantage to do this on a sufficient scale for more than piecemeal outcomes. Science-based advocacy to fill dissemination gaps at the national level may also be more effective than the direct involvement of global institutions. Research for the alleviation of poverty requires greater attention to institutions and to the development of enabling policies (as well agricultural technologies and methods) and will require greater dovetailing of the various agricultural research outputs within wider development programs aimed at several scales. Partnerships are required with agencies that provide complementary research and development inputs, such as the FAO and Regional Development Banks, to combine agro-ecological typologies with socio-economic measures of poverty, and capacity strengthening. Priorities for Research at the System Level allow the System to interact with the great number of actors and to focus on the key leveraging points of development, to indulge in more advocacy, to present key research results and the means that will need to be put in place by developing countries to obtain impact.

Session 1: Plant and Animal Improvement and the R for D continuum[53]

Theo van der Sande: The CGIAR is clearly about the provision of public goods – for private goods it is the market that sets priorities. However, the statement that the CGIAR provides IPGs is not in itself a solution but rather part of the problem. The problem is "How and with whom to determine priorities?" Stakeholders in the CGIAR are to be distinguished from Members – and anyway individual donors cannot and should not set the priorities; they may already have too much influence. Positioning is a continuous process, and must allow for interactions with the research community, stakeholders *and* with donors so that all have confidence in the outcomes.

[53] *Disclaimer: This report of the discussions was prepared by the Science Council Secretariat and does not necessarily reflect the views of the individual participants.*

Robert Bertram: Balancing the emphases on research and development is a concern of a donor agency like USAID which provides roughly half of its funding as unrestricted core and half as project-restricted funding. IPGs will remain the focus of the system but obstacles to achieving impact are greatest where the need is greatest. Centers need to take an active role, particularly identifying alternative sources of supply for some activities - but should not do extension work. Donors effectively gave Centers 'hunting licenses' to find co-funding, but the System should be careful about the effects of restricted resources which can shift the core platform of Centers from research to service providers (exacerbated by incomplete overhead recovery on restricted projects). The brief (See Bertram) focuses on getting the balance right, emphasizing the need to be as strategic about our development activities as we are in research activities. By focusing on the comparative advantage of the Centers and research for development, a strategic analysis of case studies of CGIAR programs might be warranted to help provide guiding principles for engagement and partnerships in the future. The need to consider designing incentives to align funding support for (long-term) research rather than development activities is also raised.

Bob Ziegler: The linear research for development continuum model (and probably circular models as well) are misleading because they lead to decisions being made in relation to a single point of reference. Instead he presented an earlier framework (Stoke's *Pasteur's Quadrant*) which relates discovery science to application. The approach is best illustrated in relation to specific programs which are launched with the *intent* of application and achieving development impacts through agriculture. The example of submergence tolerance in rice shows how basic science (in this case physiology and genetics) can be brought together in collaborative programs to deliver products for the poor (see Ziegler).

Points made in discussion

- CGIAR should not move into development but link up better with partners.
- This requires a better understanding of the external environment (including donors and the people within these organizations), the CGIAR itself might need to change and think about the "dogma" of strategic research.
- An important part of that external environment is the changing funding structure – historically, the earlier club of donors originally pooled risk; donors are now minimizing risk by "cherry picking" shorter term research or development impacts.
- For donors, research creating knowledge only is not very useful, and they may be more oriented to voices seeking impacts in relation to national plans.
- There is no disconnection between potentially placing CGIAR research upstream and having impact – if Centers go to the national level or below that they will work with those national partners best suited, otherwise the CG will be crowding out NARS and other partners.
- The continuum is just that – an overlapping arrangement with Centers and other partners; going downstream, the role of the Centers diminishes.
- The research has to be measured against the larger picture, realizing that markets and consumers have a growing influence; international research is only a minor component when measured against total ODA.
- The key is to look at the intent and impact of research in an iterative fashion; we are not looking at just technology and technology adoption, nor research and development separately. For instance, research on plants and animals should be linked into the improvement of agricultural systems.
- The conduct of research is governed by international norms (including publishing in refereed journals). However evidence from Norway suggests that good scientists are active on many fronts (also publishing in popular journals and contributing to debate in society – so there is

no real controversy). Advocacy and partnerships are required to amplify the impacts of research - but the incentive system is poor with the CGIAR Centers competing for the same funds as NARS.

- Centers work with NGOs etc to test technologies; not to disseminate them.
- The delivery issue is important: some NARS are strong – some are weak. Should centers take over the role of NARS in such countries then they create (unwanted) dependence. Centers have a good role in capacity building. Donors could put some pressure on governments (in a fashion similar to encouraging structural adjustment) to build strong research and extension capabilities.
- If the CGIAR continues to produce public goods – and if NARS continue to accept these - this is not a sign of failure of NARS or development, rather an indication of the international role played by the CGIAR.
- A measure for judging the level of involvement of the Centers may be "how much learning should we do?" Involvement in downstream work has to have a component of learning in it – if this is identified then the dilemma becomes less acute.
- May be this gives us a better measure than talking of boundaries, and making sure that the knowledge is accessible in terms of institutions, quality etc.
- IPG research is required in NRM as much as it is in varietal improvement, breeding or other fields, but we have been less good at identifying these outcomes and the scaling from pilot research.
- Part of the case study analyses may be the need to distinguish which, and which amounts of, funds go to produce national, regional or IPGs.

Session 2: Natural Resource Management and the R for D continuum

Frank Rijsberman: Contrary to some papers on the topic, viewing the research for development continuum from the point of view of improvement research on animal and plants or from an NRM perspective is not greatly different. NRM research is not just location-specific (and see Craswell) as one inherently thinks of the connectivity of natural systems (e.g. the food cycle, the water cycle, the carbon cycle). The emphasis is on I (integrated) NRM linked to participatory research. There is the same categorisation of basic and adaptive research and concern for production of IPGs (new capacities in weather forecasting, for instance). If the process is much the same, then so too are the dilemmas – e.g. whom to involve and where; in scaling, who will be responsible for delivery?

Eric Craswell: Took up the question of whom to involve in INRM research using the example of global change research. Given the number of international players in this field, the Pasteur's quadrant example (see Craswell) can also be used to consider the comparative advantage of institutes which could contribute to the different aspects of knowledge generation and for application (to the advantage of INRM research in agriculture). It should be noted that there are catalytic roles to be played within this international framework, particularly as many ARIs do not necessarily have a development perspective.

Hamid Narjisse: Noted that the broad coverage of CGIAR science and the variable capacity and diversity of NARS partners has positioned the CGIAR to do adaptive not strategic research (with the exception of genetic improvement). Mobilization of upstream research is required and the CP format is a good vehicle for bringing the necessary ARI and NARS partners together to conduct multidisciplinary research required for INRM. CPs also can commission research through competitive mechanisms (see Narjisse for an example of an outline program for research on

water use efficiency). However, CPs need to evolve and not remain static clubs of partners. Networking of research results to regions with similar challenges is required.

Michel Griffon: The question is not defining the place for the CGIAR but the role. As a research organisation, the CGIAR needs to understand what is required in the overall context - the questions should be posed in relation to research on major constraints to the improvement of agriculture. This will include a realistic estimation of how long the research is likely to take. He introduced the idea of "*boucles*", or loops, feeding required knowledge from specific programs of research into the overall improvement of agriculture. Using the example of soil fertility (see Griffon) it is clear that research can be conducted with short, medium and long term horizons. The roles of ARIs, NARS and the CGIAR Centers are different for different types of research. Inherent in such an approach is an understanding of changing perspectives of farmers with time (e.g. under the pressures of international trade policy) which should help frame relevant research, and the need to properly distribute research roles amongst different partners.

Rudy Rabbinge: Revisited a paper (Rabbinge, 1997) illustrating the continuous evolution of the CGIAR towards broader partnerships and then, subsequently, the CP approach. The CGIAR is a mission oriented organization, not a university. This requires that the Centers and Programs consider not only concrete products but assistance to processes. This in turn requires a different attitude: one which is more open, with a clear vision of what stakeholders need and how the System can work with such stakeholders.

Points made in discussion

- As a clarification - not all northern institutes are ARIs; several NARS in the south are ARIs.
- There is no fundamental problem with the mission of the CGIAR; it may be more on operationalization, or its interpretation by some stakeholders.
- NRM is different from breeding – the environmental dimension is bigger, so the connections between site specificity and the wider R&D needs have to be stronger. Much successful NRM research requires simultaneous policy change for impact. This does not affect the mission of the CGIAR, but should influence the definition of what the CGIAR can do and what partners can do. May be the relationship with partners is what we need to revisit.
- Given the growing number of players globally, the "time and space" occupied by the CGIAR may be shrinking. There is an opportunity for learning from within, for better information and synthesis of knowledge to help these global partnerships.
- We need better coordination in the CGIAR, understanding the influence of policy and political agendas to get NRM to work. Working at the regional interface it is difficult to define what research is the overriding priority.
- The CGIAR mission is correct, the centers have different mandates and it may be useful to review these. In agreement (with Ziegler, Griffon) it may be better to concentrate on problem solving than in categorizing types of science.
- The international INRM agenda is set by natural resources policy and markets. Currently, for the CGIAR, partnerships are CGIAR-led and CGIAR-driven. Operationalizing the CGIAR Priorities can only be done through more effective relational management and active partnerships.
- The private sector seems to have found a way of relating basic research to market mechanisms. The CGIAR seems to try to fix market failures – is the vacuum in which we work real or not? "If the NARS are not any good we should take over" is not the right way. CGIAR should know more of other initiatives and link up (influencing, joining in) with these.

- Global, transboundary, systemic problems – this is where the CGIAR should be. NRM issues have an even stronger public good character; who are the other partners for producing public goods? There is a raised expectation for the CGIAR to produce IPGs (and regional and national public goods) but perhaps the CGIAR sank too far down this path without finding the other partners to take over.
- There is nothing wrong with the mission and mandate of the CGIAR: doing R for D you need to do more research work ON Development. Some of these are social science issues and social science is underrepresented in SC skills.
- Yes, we need partnerships, but realistic partnerships that help achieve our work. We need to articulate the philosophy of partnership without simply holding hands with everybody. What are our attitudes to innovative science in the CGIAR?
- Some structural adjustment policies have led to the collapse of extension services and extending NRM technologies is difficult. Often smallholder farmers do not realize the (value of) their natural resources so integrated natural resources research for development cannot be put in place without functioning local institutions.
- Working only at the international level would be the cheapest case but may not reduce poverty. INRM research has not been confronted sufficiently hard enough to prove its impact on poverty at more local levels.

Moderator's summary of session
- There is no need to change the Mission and mandate of the CGIAR.
- Partnerships will be required.
- Identifying how the CGIAR fits into the range of players is a challenge.
- Need to define what we mean by science as opposed to research for development (is there a difference?).

Session 3: Policy Research and the Research for Development Continuum

Phil Pardey: The definition of public goods might be a moot point - very few goods are truly public – it is the way they are made available and utilized that makes them public or not. The international agricultural sector is in a process of change and is transiting to a new paradigm for R&D where there is a particular concentration: four countries cover 75 per cent of ARD, and a new emphasis in Eastern countries China, India, Korea (and Brazil). Africa continues to stall. With greater work in molecular science, the borders are blurring between agricultural and other biological science. Because of the concentration of effort, IP protection has the potential to have tremendous impacts in these fields in relation to IPGs. Available indicators suggest that policy research in OECD countries, and perhaps economics research in the USA, is somewhat reduced (see Pardey). The CGIAR has a strength in providing *research-based* advocacy on policy issues and it will be important that the CGIAR's advocacy in relation to development is always based on science.

Joachim von Braun: When working on food security, do we focus enough on research for implementation? It is not a continuum – rather a dynamic relationship between the building blocks of research, capacity and policy communication (see von Braun). Operationally IFPRI needs (maybe 10 per cent) of the very top people to connect to the top in the profession. Work should be outcome-oriented (poverty alleviation). New approaches (experiments in social science) don't fit into a continuum. To be effective in a range of issues, IFPRI cannot choose to be in one place (the "middle" or otherwise) amongst these areas – but should be present (have expertise and activities) in all these aspects.

Andrew Bennett: The CGIAR has set out its mission and mandate, and policy analysis and advice can be hugely influential in obtaining results. However, it should be remembered that policies are sovereign (and are often made irrationally – with personal relationships, timing, and political considerations sometimes more important than content). Centers are businesses. Market forces are increasingly important (Syngenta, for instance, is thinking more about consumer attitudes). Donors for research tend to have the ultimate say – but perhaps policy researchers work too closely to their donors. Positioning the CGIAR should take account of four forces – comparative advantage, strategic opportunity, gap-filling or pragmatic approaches and market forces (see Bennett). As there is a degree of schizophrenia amongst donors generally about the placement of funds, we have to accept it. Continuity is vital – and the CGIAR is not in a position to manage the markets. Rather than worrying about the place in the continuum therefore, we need to progress, recognizing the external forces and the balances between funding for development, funding policies and funding research.

Guido Gryseels: Building on these perspectives, the role of the CGIAR in capacity building has perhaps been less well articulated. Many of the new areas for policy research are in the realm of institutions and institution building. In the absence of ISNAR there is an apparent void; how is the CGIAR going to tackle these challenges?

Points made in discussion

- For clarification - policy research on development strategies is different from doing policy research to support research. Similarly, research on strengthening NARS is different from capacity building - there are many (non-CGIAR) management schools which can play a part in institutional strengthening, but who are currently unconnected to the real world of development. Importantly, there is also research on the appropriate funding mechanisms to support research and to bring these elements together.
- Research is important, but capacity strengthening is at least as important and advising policy makers of this is a key task; external factors (particularly political instability) retard progress.
- Currently there is a rather large number of institutions at the national, regional and international levels connected directly or indirectly to agriculture and the environment. External forces cannot be controlled. We need a better articulation of the global architecture for research (for both the implementation and funding aspects) and the situation of the CGIAR within this architecture.
- There are challenges in showing impact for investments in policy research. Policy is not so much an area of research itself but mainly a tool to increase the impact of research and its use. There is a two-way interaction therefore between research and policy, and the CGIAR should examine these interactions, its effectiveness and its niche. Does it have the right networks to make its policy outputs effective? To date, demonstration of CGIAR impact has not had an influence on funding in this field.
- Policy research is not very different from the other fields. Experimental analysis still requires "compare and contrast" if not "control" situations. Research in one country could very well become an international public good. However, evidence of good national policy has a significant effect on others – so policy research and messages should be closely connected to policy makers through networks (which transmit messages in appropriate language).
- The challenge for policy research is that the policy domains that are relevant are rapidly increasing: e.g. land tenure, credit, health, IP, decentralization, social security policy, intervention policy – and these do have an impact in CGIAR science. Dovetailing the issues to provide coherent advice is one of the challenges.

- Yes, policy research needs test plots. Yes, the impact assessment of policy research is difficult, but IFPRI is attempting to do this.
- In logframes specifying a research plan, the purpose is clear but the risk and assumption column is often underutilized. The CGIAR perhaps has not given thought to the major issues of dysfunction which affect outcomes and impact.
- Partnerships across fields (like agriculture and the environment) can make for more coherent international approaches.
- Centers don't use the available data of IFPRI, FAO, IPCC etc sufficiently in their planning – we detect inertia to changing issues.
- National policy research in developing countries is extremely weak, so, as we have argued above on crowding out the NARS, may not the activities of IFPRI become the excuse for governments to use the provided solutions?
- [From the IFPRI Director General]: the advice that IFPRI offers is peer reviewed so this may eliminate any undue Center influence. However, conducting international policy research does not necessarily lead to a local capacity to do such research.
- We need a rational decision-making process for determining opportunity costs to the choices for research.

Session 4: Concluding statements from small groups for future action

On the implementation of scientific priorities at the system level

The implementation of the CGIAR priorities for research is aimed at having greater impact through the exercise of many of the elements that have been discussed: comparative advantage, multiplier effects through the coordinated capacity of the Centers, the facilitation of partnerships and to extend involvement with ARIs and NARS (especially through building platforms to attract new stakeholders), less frequent reviews, and to encourage innovative new lines of research. The CGIAR cannot make its own rules about good research. The context is key and it will have to undertake both upstream and downstream research. The workshop has been useful in highlighting partnerships and the question is how to develop these high quality partnerships and the development of capacity.

On partnerships and performance

Historically the CGIAR has made advances, but is still moving around the mountain (of poverty alleviation and food security) rather than moving the mountain itself. Are there key lessons that we are failing to learn? Principally it may be in the formation of partnerships – all partners have their own mandates (many are not bench researchers) therefore we have to define "what is my niche, what is yours?"; "what is my task, what is yours?". CGIAR is good at leading partnerships but many centers have little experience to expose themselves as 'junior partners'. And we should be accountable to our goals – performance measurement at all levels (Center and scientist) should reflect this.

Examining partnerships

One way forward is to compile case studies that illustrate where conflicts exist between the R and D elements of the continuum or where there is good harmony (and include definitions of terminologies and of concepts). Analyze the drivers and basis of conflict etc. and make recommendations on boundaries – on what is an acceptable balance. From a donor perspective a comprehensive program would be to fund research and related development (for each priority) together. There is an opportunity to engage with the FAO in partnerships and an evaluation of successful FAO-CGIAR partnerships would probably show good outcomes at the global and

regional level – more synergies at the national level are necessary. There are previous studies of partnerships in the CGIAR, but if the CPs are to be advanced as a likely partnership mechanism for time-bound research programs, the implications for funding existing activities may need to be examined also. Partnerships should be tackled more from the point of view of joint ventures in the future, and the partnership aspects of CPs may provide good cases in this respect. Different research priorities will require different sorts of partnerships.

Building policy effectiveness

Donors should be seen as intrinsic parts of the partnership. Donor policy makers will also benefit if the research they invest in feeds back in the form of policy advice. Political agendas are to a large extent formed by government to government relations. There is a role for the CGIAR in highlighting issues and trends – the "observatoire" function. Globalization of the policy agenda setting would argue for keeping the CGIAR flexible and not to form it as an international organization.

Moderator's Meeting Summary

- Ground the CGIAR's understanding about the contemporary research for development continuum in relation to Agriculture through the examination of case studies, with clarity in the terminology used and the underlying knowledge model(s) which underpin research in the CGIAR.
- Revisit the issue of partnerships (in their various types) required to conduct IPG research.
- Examine Future trends, which may include:
    a) Decentralization (and subsidiarity)
    b) Intergovernmental relations
    c) Adding coherence to the debates in other aspects of development (including education and health)
    d) Identification of the roles and partnership criteria for CPs
    e) Continuing dialogue with donors
    f) Continuing the process of focusing the CGIAR.

Science Council's Chair concluding remarks

- Following discussion, there seem to be no calls to reconsider the mission and mandate of the CGIAR System.
- There is agreement on the requirement for strategic research focusing on IPGs. However, the decentralization of donors and the national priorities of NARS tend to go against this so that operationalizing the intent is complex (we may need better definitions). We need to protect the intent and funding for the intent.
- We cannot hold the CGIAR accountable for impact, since there are so many elements in developing and deriving impact from research. But the CGIAR does need to be accountable for its promised outputs.
- We heard the need to be flexible, open to different types of partnerships, the suggestion that others lead - but what about accountability? This will need to be examined.
- Partnerships must be driven by programmatic needs; partnership is not an end of itself.
- How do we get others involved with the goals of the CGIAR? This is the mobilization of science.
- The CGIAR should do more in science-based advocacy.
- There needs to be action research on delivery systems and to put research into the development effort – what we have here called the "learning" part of development.

- There is nothing inherently wrong or distorting about restricted funding, as long as it is calculated on full cost.
- We heard calls to be responsive to market signals – but also to be client/demand driven. The SC has tried to establish the new position for the system precisely because markets fail (and because the poor have no say in those markets). Clients should be the beneficiary and not the donor.
- There are roles for the CGIAR in both creating and managing knowledge and in capacity building (the SC has confirmed that this is critical in its report on Priorities - suggesting allocating 10% of total budget to freestanding capacity strengthening and more on research-linked capacity building).
- We must take into account the strength of NARS but we should not compete. There may be instances where we substitute for weak NARS, but this should not be for long to avoid crowding them out.

The SC Chair thanked the Hosts, the Government of the Netherlands (through the persons of Theo van der Sande and colleagues) for their efforts and hospitality in holding the meeting, the Workshop Moderator Jim Woodhill for facilitating the discussions, and the participants who had contributed actively to a most useful Meeting. A Meeting Report was promised for circulation within two to three weeks of the Workshop.

ANNEX I
Workshop Agenda

CONSULTATIVE GROUP ON INTERNATIONAL AGRICULTURAL RESEARCH

SCIENCE COUNCIL

Workshop

"Positioning the CGIAR in the Global Research for Development Continuum"

Friday 19 May 2006
Ministry of Foreign Affairs, Bezuidenhoutseweg 67
The Hague, The Netherlands

Background
The primary purpose of the workshop is to facilitate a discussion among CGIAR stakeholder groups about the appropriate position of the CGIAR in the research to development continuum as it proceeds to implement the agreed System Priorities for Research. The question of the most appropriate role of the CGIAR-sponsored Centers within the R/D continuum has been discussed extensively by the SC and by other stakeholder groups. At the 2005 Annual General Meeting of the CGIAR in Marrakech last December, a discussion of the matter led to a suggestion that the SC should organize a workshop to permit further discussion, the output of which would then be fed into the more formal discussions within the CGIAR leading, hopefully, to a consensus.

Agenda
Since the most appropriate position of the CGIAR may differ among areas of research, the workshop discussions are divided into four such areas followed by an overall concluding session. The following issues are expected to be covered in the discussions: what NARS demand from the CGIAR, what the CGIAR can offer, what donors are willing to pay for and how advanced research institutes (public and private sector) can mobilize agricultural sciences related to the System Priorities to collaborate with the CGIAR in achieving the MDGs.

8:00 - 8:15	Coffee and Registration
8:15 - 8:30	Welcome by Ministry of Foreign Affairs, Wageningen University, and the Science Council of the CGIAR
8:30 - 9:00	**Introduction** - Per Pinstrup-Andersen
9:00 - 10:30	**Plant and Animal Improvement R/D** Panel: T. Van de Sande, R. Kiome, R. Bertram, B. Zeigler

Discussion

10:30 - 11:00 ***Break***

11:00 - 12:30 **Natural Resource Management R/D**
Panel: F. Rijsberman, E. Craswell, H. Narjisse, M. Griffon
Discussion

12:30 - 14:00 ***Lunch***

14:00 - 15:30 **Policy R/D**
Panel: P. Pardey, J. von Braun, A. Bennett, G. Gryseels
Discussion

15:30 - 16:00 ***Break***

16:00 - 17:30 **Conclusions**
Panel: E. Pehu, M. Kapiriri, M. Gale, P. Hartmann, R. Haug
Discussion

17:30 – 17:45 **Closing** - Per Pinstrup-Andersen

Format
In order to facilitate constructive discussion, the number of workshop participants will be kept to less than 40 with additional space for observers. Representatives from all the CGIAR stakeholder groups will be invited. There will be no formal presentations. Instead, selected individuals will be invited to give five-minute introductory comments for each of the sessions. They will also be invited to prepare ahead of the workshop a 2-5 page brief for distribution at the workshop. The introductions as well as highlights of the discussion will be kept on record by the SC Secretariat. The SC will prepare a background note which will be distributed prior to the workshop. The session will be chaired by the SC Chair and moderated by a professional moderator.

Organizing committee
Per Pinstrup-Andersen, CGIAR Science Council Chair
Ruben G. Echeverría, Executive Director, Science Council of the CGIAR
Theo van de Sande, Acting Head, Ministry of Foreign Affairs
Niels P. Louwaars, Coordinator CGIAR, Wageningen UR

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Rapporteurs & moderator:

39. Niels Louwaars (Wageningen UR) - Rapporteur
40. Peter Gardiner (Science Council Secretariat) – Rapporteur
41. Jim Woodhill (WUR) – Moderator - jim.woodhill@wur.nl

ANNEX II
Discussion briefs developed by Workshop participants

Discussion briefs:

Bennett, Andrew. "Positioning the CGIAR in the Global Research for Development Continuum".

Bertram, Rob. "Beyond International Public Goods: But Just How Far?".

von Braun, Joachim. "Policy Research for Development: The Building Blocks".

Craswell, Eric. "The Research Continuum - the Case of Research on Integrated Natural Resources Management".

Griffon, Michel. "Elements or Long Term Orientations of Agricultural Research",

Narjisse, Hamid. "Positioning the CGIAR in the research for development continuum".

Pardey, Phil. "Positioning the CGIAR in the Global Research for Development Continuum".

Zeigler, Robert. "Research for Development *versus* Research for Discovery: A False Dichotomy".

Theo Van de Sande. "Science Council priority setting reconsidered."

POSITIONING THE CGIAR IN THE GLOBAL RESEARCH FOR DEVELOPMENT CONTINUUM

MIND THE GAP!

Andrew Bennett, 15/05/06

A recent CGIAR publication, 'Science is Delivering Results' states *'The CGIAR promotes science-based global efforts to alleviate poverty, especially in rural areas ----. The alliance mobilizes agricultural and environmental science to reduce poverty, foster human well-being, promote agricultural growth and protect the environment.'*

This implies that the CGIAR wants to measure or attribute the impact of its outputs to improvements in the lives of poor people, productivity and environments.

The outputs of the CGIAR are knowledge; information; analyses; technologies; human capital and germplasm characterized, conserved and improved. The extent to which these outputs will have the desired outcomes and impacts will depend on several factors which are, or should be, captured in the 'risks and assumptions' column of a log-frame. Partnerships and alliances are frequently cited as the means by which the output of the CG will reach the intended target group.

The products of the CG will frequently require additional investments in time, infrastructure and resources to transform or adapt them into forms that can be used. Their impact will depend heavily on externalities e.g. policies, markets, etc. Many of these stages are beyond the control of the CG. However if the members of the CG could work together in facilitating the transfer and use of CG outputs then the impacts might be predictable and greater. The longer this chain the greater the risks and hence the harder attribution becomes.

Policy analysis, timely and well presented can be hugely influential – for example CIFOR published a paper on the impact of corrupt practices of the forests of Indonesia and the loss of income from royalties not collected. The report was released at a time of a change in government and gave rise to the 'forest law enforcement and governance programs' in Indonesia and elsewhere. The impact was not solely based on the 'quality of the science' or its public goods nature – but presentation, timing and a little opportunism. It is possible that the forest communities may have realized some small increase in their control over forest resources but it would be difficult to assess whether they are less poor.

When positioning the CG, we should be clear of whether the key criteria for assessing performance will be the quality of the science, the extent to which the products are available as public goods or on the impact that they have on development processes and the livelihoods of poor people.

In position the CG in the continuum I suggest that there might be four approaches, these might complementary and not necessarily mutually exclusive:

- Comparative advantage
- Strategic
- Gap filling or pragmatic
- Market forces

Comparative advantage
The staff, knowledge, infrastructure, networks and communications of the CG are invaluable but with increased decentralization there is a growing challenge to the importance of critical mass. Comparative advantage can change over time. The ability to forge alliances could become increasingly important.

Strategic
This is the approach advocated in the current priorities paper. The main outputs would be 'global public goods' accessible to all and where the CG would identify the uptake pathways and potential beneficiaries, with delivery being achieved through strategic partnerships. This would allow the CG to devote the majority of its resources to the development of 'non-commercial' generic technologies and knowledge.

The risks with this model are those associated with adaptation and transmission and whether there are adequately conducive policy, technology, infrastructure, market and investment climates. The danger is that these elements will not come together with out leadership, policies and resources. The simplistic criticism will be that the products of the research were inappropriate or had not been discussed with partners – stakeholders.

Gap-filling
This would be a more pragmatic approach and could result in CG play different roles in the continuum in different parts of the world and with different subjects/themes. Where national research systems and institutions are strong or the private sector active then the CG could be more 'strategic' in its approach; however in Africa the picture is different: the delivery systems are weak and unlikely to be able to fill the 'gaps'. In the this case should the CG work only where there are effective partner organisations or adopt more of an advocacy role for investment, even if this risks alienating some partners?

Market forces
The Centers of the CGIAR are essentially, not-for-profit businesses with a growing need to secure adequate funding in an increasingly competitive and uncertain market. They are funded primarily from 'official development assistance'. These funds come from central research or sectoral departments or from geographical departments with strong regional imperatives. The increasing trend towards direct budgetary assistance has not resulted (yet) in increased follows of resources to national or even regional (research) institutions essential for rural development. The budgets for country based programs are usually greater but more likely to be focused on specific development goals.

While the funding for the CGIAR appears to show a modest upward trend, changes in the value of the US dollar and rise in costs has placed all the Center budgets under pressure. Changes in donor staff and policies have added a layer of uncertainty and risk which makes partnerships less stable and more difficult to sustain. Despite the huge investment in the development of MTPs there does not – as yet - appear to be a high correlation between agreed MTPs and the award of donor funding. The current trend on donor funding for research is towards restricted funding for specific activities and related outputs.

The Millennium Development Goals have added to this trend by focusing attention on measurable progress against specific targets for the reduction of poverty, hunger and environmental conservation

or reduced vulnerability – not on the development of good science or international public goods. Most aid agencies are therefore keen to see demonstrated impact and not necessarily papers published.

It is a very brave center that ignores these market signals as most have found that their reserves a quickly exhausted by events outside their control.

Conclusion

In positioning the Centers of the CG we must use comparative advantage, strategic, opportunistic and market criteria. Given the vulnerability of the Centers the 'market' is the one that they cannot afford to ignore. Can the members of the CG change the market environment and create incentives and the resources needed to bridge the gaps?

BEYOND INTERNATIONAL PUBLIC GOODS: BUT JUST HOW FAR?

Rob Bertram

Current Reality: Although the main work of the CGIAR is and should remain the generation of international public goods, obstacles to impact from CGIAR research are often greatest in areas where the need for improved technologies and policies is greatest. The reality centers face is that, in some instances they must take on an activist role in generating technology uptake through public, private and NGO partners in order to see impact from their research realized. This is not equivalent to implementing direct extension activities, where the CGIAR centers have little or no comparative advantage. Instead, lack of a "demand pull" for the products of research may require centers to engage catalytically in sparking adoption of their products. Conceptually, these activities reflect the lack of alternative sources of supply; the response to such situations takes centers further down the Research to Development continuum than they would go under ideal circumstances.

The reality faced by centers is not new, but as core funding has become scarcer, the pressure to expand their project portfolios has grown substantially greater. The shift away from a donor of last resort funding approach toward a simpler match of other contributions in 1996 increased incentives (the proverbial "hunting license") for attracting project support. Centers have had to rely increasingly on regional and bilateral projects that often incorporate substantial capacity building and technology dissemination activities. At the same time, pressure from the CGIAR membership to show demonstrable impact has continued to increase. Thus, both budgetary reality and a desire for impact have helped to push centers further down the continuum toward development-oriented interventions with direct effects on hunger, poverty and the environment.

A second effect of project-type support has perhaps been less well characterized. Placing development-oriented projects on a program platform can gradually shift core capabilities away from long-term strategic research and towards delivery of development services. Such a shift may be inadvertent, or it may be a conscious decision to invest fungible resources in the areas where they are most likely to attract new funding. Ideally, such shifts would be unnecessary if centers could fully cover indirect costs associated with implementation of projects. But despite many years of discussion, many projects still fail to cover such costs (for a variety of reasons). Centers have tended to understate indirect costs, either to satisfy donors or to strengthen their competitive position in a development market.

The point here is not to downplay the importance of many of the development-related activities taken on by the centers. In many cases, these programs build the impact that sustains core funding, helping to keep a center's research programs financially viable. They have also included vital efforts responding to drought, disease and civil unrest. They have widened the constituency of the CGIAR, bringing it into closer contact with NGOs and others working at the grassroots and along a relief to development continuum. Beyond this, development-oriented projects can succeed, despite the problems noted above, in helping centers attract and retain outstanding staff. These research staff may develop an in-depth knowledge of adoption chains from laboratory to field, which can feed back in positive ways into research planning. As has been frequently noted, such activities offer opportunities for generating international, and more especially, regional public goods associated with the process and dynamics of technology and policy uptake by partners at all levels.

Getting the balance right: The crucial question, which has been raised by the SC, is just where and how the CGIAR system should position itself on the research to development continuum. There are probably multiple answers to this question, depending on the type of research (seed-based technologies may be more readily disseminated than natural resource management packages) and availability of partners and institutions. Where there is institutional failure, there may be no good option other than to assist those engaged constructively in putting functional systems in place. Ultimately, there is a need for balance, reaching to where center research is productive and makes a difference, but not at the expense of its research, and without venturing beyond a center's area of competence or to where it competes with others more suited to delivery of technology. Analysis to help discern an appropriate balance should take place at several levels.

Programs

The position of development activities in the CGIAR system needs to be clarified, and opportunities for efficiencies, synergies and economies of scale analyzed. While the primary role of the centers as generators of international public goods is recognized and reaffirmed, their catalytic role in technology adoption at the national and sub-regional levels, especially in Africa, is important and needs the kind of analytical approach given to their research activities. By raising the issues of center's unique comparative advantage and research for development, the SC has laid the basis for approaching developing activities more strategically.

As has been suggested, examples may offer a helpful means for characterizing the range of development-oriented activities which the centers undertake. Following are some examples that cross a spectrum from strategic to adaptive to applied research, and then beyond into what is nearly pure technology dissemination. In all instances, however, centers' partners are the primary actors in development activities.

> *Sustainable Commercialization of Seed in Africa (SCOSA*): Led by ICRISAT, this relatively recent activity involves several CGIAR centers and two non-CGIAR partners, Iowa State University (seed policy) and IFDC (input market policy and development). The program can and does involve a range of other partners at the national, sub-regional and Africa-wide levels, including the Africa Seed Trade Association. The rationale for the program for the CGIAR is clear: lack of viable seed systems, particularly for publicly-bred crop varieties, poses a major obstacle to adoption of CGIAR-based (and other) seed-based technologies. The program builds on years of experience at ICRISAT and other centers in analyzing and helping partners fill gaps in seed systems, particularly those just entering commercialized farming or still not benefiting from market opportunities.
>
> It should be clear that the goal of this program is not for the centers to become seed providers or companies. The focus is basically on three activity areas: 1) develop and foster adoption of rationalized, phytosanitary science-based policies to expand investment and market opportunities for the private sector; 2) generate and provide policies to promote robust input supply systems that serve smallholder farmers; and, 3) compile and disseminate information on availability of public-sector technologies to increase access by both the public and private seed sectors (this includes, for example, the outcomes of years of studying and promoting services to resource-poor and risk-averse farmers—for example the use of smaller seed package sizes.)

SCOSA does generate new analysis and information on technology dissemination and adoption, but its primary focus is to enable the development of viable seed systems in areas currently underserved areas where improved technologies could make a substantial difference. Although the benefits may include greater adoption of CGIAR-generated and other appropriate technologies, success will be measured by increased investment by others in developing seed systems.

Adoption of orange-fleshed sweet potatoes in southern Africa: The work of CIP and IITA in Mozambique is an excellent example of how CGIAR researchers energize a range of partners to see that a beneficial technology is adopted. With substantial support from bilateral and regional donors, a center scientist has for years reached out to public, private (e.g. supermarkets) and NGO partners to foster adoption of beta-carotene rich varieties of sweet potato in Mozambique and neighboring countries. Partnerships were formed with the NARS and with many small organizations capable of multiplying and disseminating vegetative planting materials to literally hundreds of thousands of families. The material is accompanied by nutrition education, which has helped shift preferences away from white types towards more nutritional orange-fleshed types. Throughout the period, the scientist at the heart of the program maintained an active research program in both sweet potato and cassava. Outreach to partners led to much wider adoption than would likely otherwise have been the case, attracted substantial funding from nutrition-oriented sources, and may have helped set the stage for greater interest in access to improved technology. This example is not unique in the CGIAR, but it does show how an active researcher can be uniquely situated to help catalyze adoption of, and demand for, CGIAR technologies.

Smallholder fish ponds in Bangladesh: Many areas of Bangladesh are ideally suited to small fish pond management. WorldFish saw this as an opportunity to introduce a suite of species and management practices that could maximize productivity and efficiencies (e.g. species that live in different depths so that competition between them is relatively small). The adoption of higher productivity fish ponds provides employment and income generation, especially for women, and can also improve diets in families who largely subsist on rice. Widespread adoption of the technology required an extensive network of public and NGO partners, with the center providing a driving force in sharing information with partners who could then integrate it in their development programs. Opportunities for adaptive research on the technology and the process of its adoption were present, and approaches were generated that could be applied in neighboring countries. These included models of how women could operate fish fry production businesses. The success of the program has been widely recognized, culminating in the award of the World Food Prize to the scientist involved. It would be interesting to ascertain the extent to which this success has led to replication in other programs, as well as its usefulness in generating enthusiasm for smallholder aquaculture as a means to reduce poverty and malnutrition.

Resource-conserving agriculture in the Indo-Gangetic plain: The technological centerpiece to emerge from the Rice-Wheat Consortium supported by the World Bank and others is a shift towards low- or no-till rice/wheat systems. The benefits are well known, including increased system productivity, reduced use of energy, greater water use efficiency, increased soil organic content and enhanced opportunities for integration of legumes, vegetables and other crops in the rotation. Arguably, such a system could be adopted on its merits, but CIMMYT, in partnership with other centers and the national systems, has catalyzed a rapid expansion

across South Asia. In this instance, the work of one person has been critical in engaging farmers' organizations, small-scale farm equipment producers, traders and others in moving to a more profitable and more environmentally-friendly production system.

Working with partner NARS and other centers, CIMMYT has promoted extensive adaptation of the basic technology packages across more than a million hectares across four countries, adapting it to various situations (including wheat-sugar cane, wheat-rice-mungbean, wheat-maize, rice-vegetables-legumes, and others) and on different soil types and among different socio-economic groups. Agronomist, soil scientists and economists and other disciplines have all been brought to bear on a continual refinement of the technology packages. Currently, efforts are expanding eastward towards poorer areas with less water control, offering perhaps even greater poverty impacts.

Deployment of virus-resistant cassava in East Africa: An epidemic of a new and virulent strain of African Cassava Mosaic Virus (ACMV) decimated Uganda's production of the crop in the mid-1990s. Working with a set of partners (NARO, many NGOs, etc.), IITA led an effort to rapidly multiply and deploy resistant varieties ahead of the moving front of the epidemic. Although a substantial development effort was underway, IITA's role remained largely in strategizing and coordinating efforts of a number of partners, including those in Tanzania and Kenya. The center continued its research program, but because of the related development efforts, was able to help the Ugandan cassava industry rebound. The virus remains a problem, but there is no doubt that major benefits occurred because of the center's willingness to engage with partners working at the field level. The effort could be usefully studied to gain a greater understanding of how research and development efforts are interdependent. An ancillary benefit of the activity was the goodwill and support it generated at high levels in development agencies.

Dissemination of crop seed in relief efforts: When a major drought was forecast for southern Africa in 1990, CGIAR centers were called on by USAID and other development agencies to develop scenarios and help the region prepare by multiplying crop varieties that could better withstand drier conditions (e.g. a number of ICRISAT sorghum and millet varieties.) At first, there was some resistance in the centers to undertaking such efforts, but substantial funding for regional research networks hung in the balance and in the end, they worked with a range of public and private partners to help gear up for the drought (which ultimately failed to reach expected proportions). After the Rwanda genocide in 1994, a group of donors funded centers to work with NGOs in an effort to restore that country's crop diversity and offer its devastated farming communities the benefit of improved seed. That was the first of a series of efforts during the rest of the decade which led to a sea change in how the centers perceived their role post-disaster, as well as increased attention to mitigation and preparedness to help farm-level crises from occurring. These efforts also brought the CGIAR into much closer cooperation with the NGO community.

Considerable research was undertaken during the period, often done in conjunction with agriculturalists working in relief organizations. Social scientists studied the behavior and resilience of traditional seed systems. This led to an improved understanding of how new technologies are perceived and adopted, and of how relief efforts could be more effective. In addition, the efforts themselves led to broad impact when measured in terms of adoption of CGIAR-generated varieties (some of this was captured in TAC studies in the late 1990s). The

experience in Mozambique, Angola and elsewhere showed that partnership in relief efforts could bring the benefit of CGIAR research (e.g. improved varieties or cereals and root crops) to people who were not able to access more traditional channels.

The above are all examples of how centers have made significant impact by working in partnership with development-oriented programs. They vary in the degree to which they generate public goods that can be applied more widely, but many of them have led to regional efforts built on an example undertaken with bilateral or emergency relief funding. It is not unusual for a single individual or team to play a pivotal role, providing the energy to tap relevant technologies and policies, seek additional, dedicated funding and, most importantly, work catalytically to help interested partners succeed in adapting and disseminating research products.

The SC could consider these and other examples in helping the system gain greater insight into Research to Development linkages that involve the centers. Categories could emerge, paving the way for a more strategic analysis of how each fits into the CGIAR agenda. Activities could be broadly grouped according to the degree of new technologies or management approaches they generate, as well as their implications for activities beyond the country in which the work occurs. A study of such efforts might also consider how centers could work together more efficiently, as frequently more than one center has technology or policy products that could be useful in promoting more integrated and system-oriented technological or resource management changes.

Incentives

If the CGIAR's primary role is in the generation of international public goods from research, the system's incentives should reflect this fact. Multilateral research funds are scarce, while bilateral and regional development-oriented funding is relatively plentiful. In recent years, system-level matching funds provided by the World Bank (only a portion of Bank funding) have made little or no distinction between the types of activities carried out by a center; i.e., they have been based on overall center budget size. One option worth thinking about would be to consider the benefits associated with matching funding preferentially targeting research rather than a center's entire portfolio of activities. (This would, in a sense, resemble past practice when there was a distinction between "core programs" and "special projects," but would not entail going back to a donor of last resort system.)

Discerning the difference between research and non-research funding would, as implied in the preceding section, not be a simple undertaking. Substantial additional analysis and discussion could be required, but a good start has already been made in the SC's review of the centers' individual projects. By preferentially funding research rather than development, matching funds could help to strengthen the long-term strategic research programs of centers; these are often the activities hardest to support through short-term projects, as well as those that are most likely to lead to important breakthroughs and productivity or environmental gains.

Such an approach would provide an incentive for centers to emphasize research, and for donors to fund it, since their investments would be compounded by support from Bank matching funds. Donors (or windows within a donor) wishing to fund development activities (e.g. technology transfer, some types of capacity building) would be expected to provide full support to those efforts (see next section). Other incentives that favor research could also be developed.

Overheads

For nearly twenty years, the system has tried to ensure that projects provide full indirect costs. Despite these efforts, this problem of inadequate overhead remains, with both centers and donors bearing some of the responsibility. Given continued pressure on multilateral research funding, the system should make certain that centers' overheads reflect the true indirect costs of special project implementation, so that by taking on such projects a center's core research program is not skewed towards delivery of development goods and services.

The CGIAR Secretariat could, with direction from the membership and guidance from ExCo, work with the centers to ensure that centers charge, and donors pay, the full overhead costs associated with project implementation. In situations where a donor is somehow prevented from covering full indirect costs, the Secretariat and centers should work toward cost recovery by assigning substantial direct costs to the project so that it is not a burden on the regular program. Following through on the issue of overheads provides an additional incentive for donors to provide unrestricted, or less restricted, funding, in the knowledge that they are supporting direct and indirect costs of research, rather than subsidizing project-based development activities.

Conclusion

Both research and development-oriented activities based on research are vital to CGIAR impacts, especially in those areas where demand and uptake flows of technologies and policies are weak. Improved analysis of the various types of activities and the linkages among them could help the CGIAR to be more strategic, and less opportunistic, in how it approaches development linkages. The system could also consider incentives towards its most important role (international public good research), without bypassing engagement in technological and policy change that reduces poverty and hunger and improves natural resource management. Funding and financial practices could be reviewed and modified to favor research, recognizing its central role in the CGIAR's mission, as well as the relatively scarce resources available to support it.

POLICY RESEARCH FOR DEVELOPMENT: THE BUILDING BLOCKS[54]

Joachim von Braun, IFPRI

Food policy research does not fit well with the concept of research for development (R4D): policy processes, political economy realities, and the role of policy and institutional innovations in addressing these realities demand a systems perspective and a concept that accommodate fundamentals changes and shocks. A mix of basic research—drawing on innovative theory—and applied research is called for, depending on the issues to be addressed. A "continuum" perspective is not the answer.

Our concept at IFPRI is a triangular one of research, capacity strengthening, and policy communication. For each country setting or policy issue, these building blocks must be optimally combined for maximum impact for pro-poor development. This approach is thus a set of building blocks, combined in different ways, not a continuum.

Considering our past record in research, our comparative advantage, and the relevance of alternative suppliers, IFPRI puts a high priority on research with capacity strengthening for impact. The concept of capacity strengthening includes some research content in order to be innovative and impact oriented.

Setting research priorities at IFPRI

IFPRI uses four sets of criteria to determine its priorities:

1. The work program must conform to IFPRI's mission to provide policy solutions that reduce hunger and malnutrition.
2. Research and outreach should address emerging issues that most directly affect food security, nutrition, and poverty.
3. Research, capacity-strengthening, and policy-communications activities should be based on IFPRI's dynamic comparative advantage to produce results applicable to many countries—that is, international public goods.
4. Stakeholders and partners should be consulted to identify food policy research that all parties believe will help develop policies to reduce hunger and malnutrition.

These criteria work as a decision tree: research and outreach activities must meet all four criteria in order to be included on IFPRI's agenda.

What should we guard for?

We must not deviate from our mission. We must clearly distinguish research (our mission) from technical servicing (not our mission). We are not equipped for, nor do we have comparative advantages in, purely theoretical research or technical servicing. We should not try to fill the gap when other organizations do not succeed in executing their mandates. Where possible, we outsource non-core activities. If we try to "do it all," we will dissipate our efforts, ultimately compromising our

[54] Brief prepared for the Workshop on "Positioning the CGIAR in the Global Research for Development Continuum", The Hague, The Netherlands, May 19, 2006.

mission as well as those of other organizations. IFPRI, like other centers, has an advocacy responsibility to encourage related organizations to play their roles. While we are designed to produce international and global public goods, overemphasizing this could mean going broad at the cost of going deep. Research is thus provided to a limited number of countries for a certain issue.

Towards a strategy focused discussion

Policy research in the CGIAR clearly needs to position itself between fundamental research and technical servicing. We fall between institutions that do fundamental research, like universities, and agencies that are responsible for technical servicing, such as national agricultural research systems (NARSs), the International Fund for Agricultural Development (IFAD), the Food and Agriculture Organization of the United Nations (FAO), the World Food Program (WFP), and private consulting firms. On the other hand we have to be properly linked to the other actors. Hence applying a systems perspective rather than a continuum perspective is more appropriate.

Research, combined with capacity strengthening and policy communication for impact

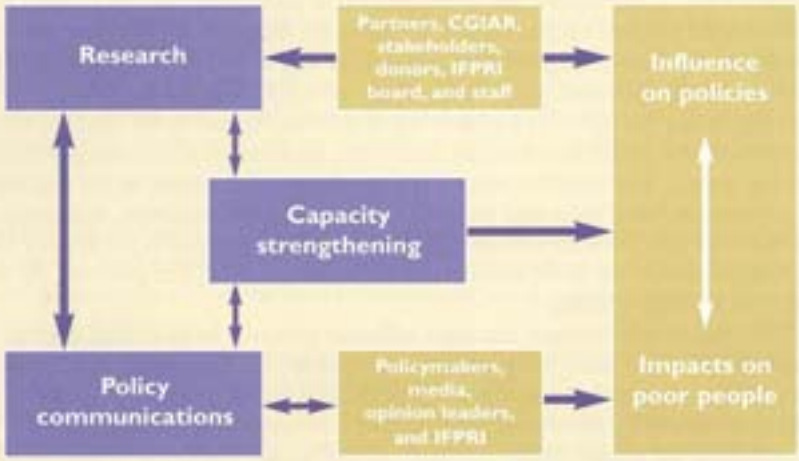
Attaining impact will depend on many cause-and-effect relationships. Knowledge of the main constraints to achieving impact is required to optimize the returns to investments in policy research. A thorough analysis of the *ex post* and *ex ante* impact pathways for research projects will help the effectiveness of policy research. We need to foster policy, institutional, and organizational change in order to enhance the impact of agricultural research and innovation on food security, poverty reduction, economic growth, and sustainable development. Research and related outreach activities in this area are geared to bring about change in agricultural innovation systems so as to increase the contribution of research to agricultural development for poor people. This work needs to be carried out in close consultation with the affected stakeholders, including NARSs in developing countries and new partners in the private sector and civil society.

Because policy research does not fit well with the concept of R4D, it is better to focus on the building blocks that are required to firmly link research to development. The IFPRI strategy has incorporated two major building blocks to link our research to development, namely policy *communication* and *capacity strengthening* (Figure 1).

We do not conduct research in a vacuum. Two-way communication through vehicles such as multi-stakeholder dialogues and close interaction with policymakers and stakeholders in developing countries keeps research activities relevant. The role of capacity strengthening is particularly important as a building block linking research to development. Capacity strengthening has been a strong contributing factor to agricultural growth, poverty alleviation, and economic development. IFPRI, as a global player in food policy research, can play a key role in strengthening capacity for policy research and analysis through the development of a broad strategy for capacity strengthening. Not only do capacity-strengthening activities strengthen the capacity of local partners, but they also strengthen the capacity to meet the needs of partners. We also use techniques such as the "balanced score card system" to evaluate to what extent different building blocks in the system are contributing to our overall mission. Only when we can optimally combine the critical triangle of research, capacity strengthening and policy communication will we truly be effective.

Figure 1

A food policy research framework



This figure provides a conceptual framework for understanding how food policy research can influence policy, and through policy change help achieve sustainable food security.

THE RESEARCH CONTINUUM - THE CASE OF RESEARCH ON INTEGRATED NATURAL RESOURCES MANAGEMENT

Eric T. Craswell[55]

Research paradigms for integrated natural resources management (INRM) in agricultural systems continue to evolve but the following elements and characteristics are widely recognized to be important:

1. Goals include both productivity and resources conservation/protection;
2. Client/User participation;
3. Consideration of equity including gender analysis in research planning and implementation;
4. Systems approach that encompasses physical, biological and human components;
5. Integration of these components at a range of scales from plot to catchment and river basin, to ecoregional and global;
6. Focus on policy and institutional issues that influence farmer and community decisions;
7. Focus on knowledge (both indigenous and scientific) as part of innovation and information systems.

The Research Continuum

Addressing the complex demands of INRM effectively requires a systems approach that is both inter-disciplinary and participatory, and covers the full range of the research continuum. Craswell and Penning de Vries (2001) presented the following diagram (Fig. 1) of the research continuum showing the primary research domains for the different types of institutions.

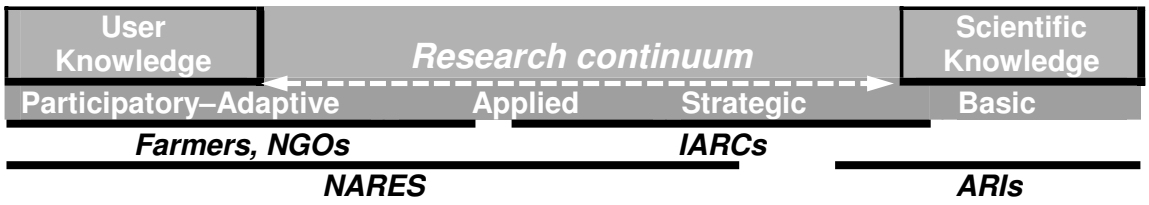


Fig. 1 Primary domains across the research continuum of INRM

The position of the IARCs, straddling strategic and applied research, belies their important comparative advantage as international leader and orchestrator of INRM research. A key part of that leadership role is in strategic research designed to develop research tools and methodologies, including methodologies for participatory research. On the continuum, the essential role for the IARCs is with strategic research because few NARES can devote much of their resources to strategic research, whereas many ARIs in industrialized countries lack the development perspective required to make their basic and strategic research relevant to farmers' needs.

The above linear model of the research continuum does not capture the multidimensional nature of research, so like others at this workshop, I turn to Stokes (1997) whose book Pasteur's Quadrant provides a valuable framework for this sort of analysis. As depicted in Fig. 2, the position of the IARCs in Pasteur's Quadrant reflects their comparative advantage and their leadership role in orchestrating the research agenda. In this schema, an arrow between the Farmers/NGO quadrant and the Pasteur's quadrant points to the need for client orientation of the

[55] Global Water System Project, Center for Development Research, Bonn, Germany (www.gwsp.org)

IARCs' research. While the arrows between quadrants show important interactions, the quadrant-based analysis misses the importance of overlaps which provide the basis for research collaboration.

Fig. 2 Mapping out INRM Programmes

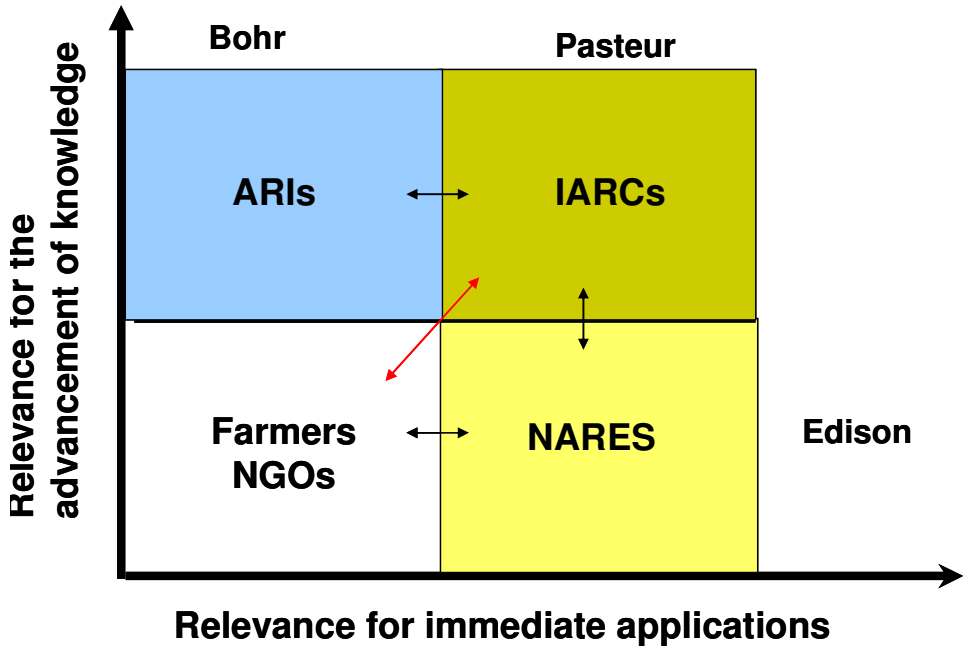
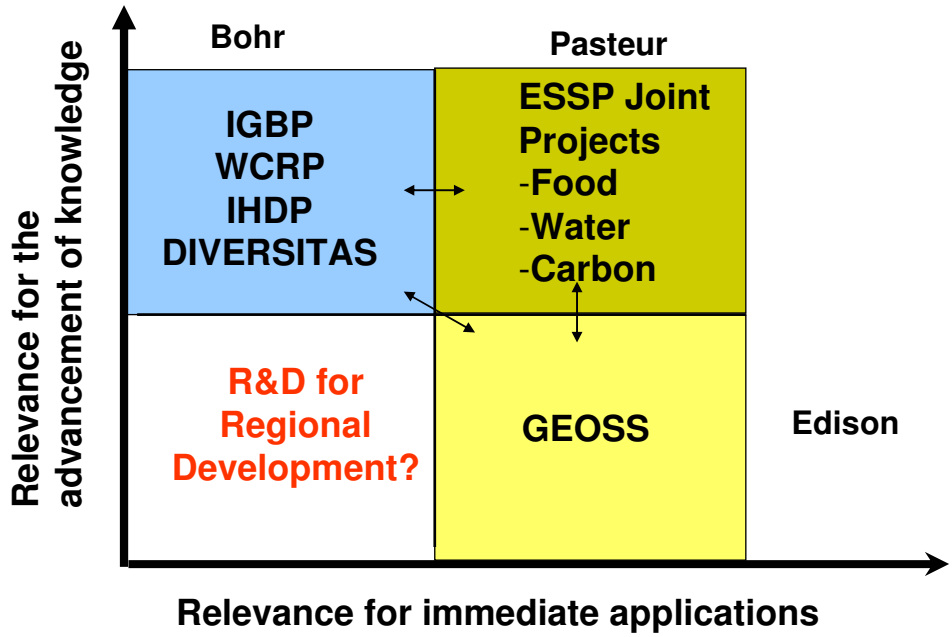


Fig.3 Mapping out GEC Programmes and R&D for Regional Development



In Fig. 3 above, I include an analysis by Carlos Nobre of the Global Environmental Change programs presented at a recent meeting in Pune. The point I would like to make is that the four main Bohr Quadrant programs[56] provide a valuable relatively untapped source of basic research results for INRM in agriculture. Secondly in Fig. 3 the equivalent Pasteur's Quadrant joint projects, addressing food (GECAFS), water (GWSP) and carbon (GCP) are open to collaboration with the IARCs, and much more could be done. Recent discussions between different groups in the development and global environmental change research programs point to greater collaboration, and the success of the Millennium Ecosystem Assessment is the harbinger of change in the right direction.

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[56] Global Environmental Change Programmes: the International Geosphere- Biosphere Programme (IGBP), the International Human Dimensions Programme (IHDP), the World Climate Research Programme (WCRP) and DIVERSITAS, an international programme of biodiversity science

ELEMENTS FOR LONG TERM ORIENTATIONS OF AGRICULTURAL RESEARCH[57]

Michel Griffon

1. How can we define the basic long term equation of agriculture sustainability:[58]

Produce and provide…

- Provisioning services; Produce and provide enough food (and enough food variety), enough fiber, enough fuel, but also genetic resources (and fresh water as agro-ecosystems are ecosystems);
- provide support services: species habitat, recycling of nutrients, soil formation and protection, production of atmospheric oxygen, insure water cycle ;
- provide also regulating services : resistance to invasive species, pollination, seed dispersion, climate regulation, erosion regulation, water regulation and water purification, pest regulation, disease regulation, natural hazard regulation;
- provide also cultural services: spiritual and religious values, knowledge systems, education and inspiration, recreation, ecotourism and aesthetic values, cultural roots.

Insure acceptable and relatively stable levels of income through diverse livelihoods and through the price system

Under constraints…

- Climate constraints
- Area limitations
- Labor constraints
- Input prices constraints due to scarcity (oil, fertilizers)
- Toxicity of inputs for human health, animal health, environment

and with the necessity of maintaining renewable resources cycles**:**

- Water cycle
- Bio-geo-chemical cycles (N,P,K,C, …)
- Fertility and trophic chains of the soil.

but also with opportunities… starting, many times, from a low capital basis and an eroded natural capital.

Agriculture is greatly determining the future of biosphere (locally, regionally and globally. The management of agriculture is becoming highly systemic, multipurpose and integrated.

2. What could become different in a long term context (as much as we can define it)?

Energy price

- Oil and gas scarcity (50 years) will increase energy prices.
- Fertilizer prices will increase: nitrogen is based on gas production; fossil deposits extraction costs depends on oil prices; transport costs will increase.
- Greenhouse agriculture costs will also increase.

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[57] Synopsis for Michel Griffon's intervention at the CGIAR Science Council Workshop on Research for Development Continuum, The Hague, May 19 - 2006

[58] Using the Millennium Ecosystem Assessment categories

Land use competition

- Competition for land between food production, biofuel production, and biodiversity will be intensified in many regions.
- It could lead to a long term tendency of price increase (subject to discussion).

Raw material scarcity

- Chinese demand and future Indian and other countries demand could create series of sector scarcities, for example steel for agricultural machinery, or simply basic food grains (subject to discussion).
- We can also note that fossil phosphate and potash are non renewable resources.

More water scarcity in many places

- Crisis in WANA, but also potentially in China and India.
- Interrogations in Europe and US.

Climate change

- Increase of frequency and length of droughts, mainly in Sub Saharan Africa, Brazil, South China, India and Europe (subject to discussion);
- Increase of cyclones and storms frequency in tropical and subtropical areas;
- Increase of length of growing period in Canada, Russia and North China: new opportunities;
- Geographic changes in production surpluses.

More limitations on chemicals

- Limitations for herbicides (plant resistances, environmental toxicity).
- Limitations for pesticides (insect resistance, biodiversity losses particularly for pollination, human health, …).

3. What could be done to find solutions to the future equation in terms of technology and policy orientations? An exploration.

Soil fertility: partly substitute ecological fertility to chemical fertility

- Fertilizer prices will increase and fertilizer losses will have do be drastically reduced.
- New sources of P, K and N will be produced by cities (waste) and used by agriculture.
- Crop residue and fertilizing crops would have to be used to maintain fertility.
- Biological – ecological fertility of soils will have to be increased, using an optimization of the complex ecological process starting from ligno-cellulose and leading to nutriments trough the biological activity of fungi, termites, arthropods, worms, bacteria, … Tillage would have to be reduced.
- The pedogenesis process could be activated : Nutriments would have to be extracted from the deep soil rock, using deep rooting crops as extractors in order to feed the P cycle.
- Better use animal fertilization.
- Use GMO (crops or bacteria) able to synthesize N and P that could be assimilated by crops.

Reduce mechanization costs

- Reduce tillage: minimum tillage or no tillage; use direct sawing, mulch based, cover cropping systems.
- Use precision agriculture.
- Use strippers.

- Better conservation of water in the soils.
- Better conservation of water tables; landscape planning.
- Develop "drop irrigation".
- Create drought resistant new varieties (conventional, GMO crops).

Weed management
- Better knowledge of allelopathy for various uses (crops associations, GMO crops, GMO bacteria).
- Explore plant proteome and identify new active molecules for GMO synthesis.
- Use mulches or surface tillage.

Develop a wide set of integrated pest management techniques
- Better knowledge on trophic nets as bases for biologic management of pest and diseases.
- Develop landscape planning and rotation management.
- Develop genetic resistance (GMO).
- Explore plant proteome and identify new active molecules for GMO synthesis.

Improve genetic knowledge
- Better use the capital of gene banks: explore gene banks and define a sequencing strategy.
- Improve (rapidly) productivity of locally adapted varieties.
- Develop robust population crops (combination of varieties with different traits but the same growing length).
- Explore soil metagenome.
- Develop "high flow" proteomics.

Improve scientific integrated landscape ecological planning
- Diversify agroforestry combinations.
- Develop methodologies for integrated landscape ecological planning.

Improve quality of public policies
- Define better ecological use of ecosystems (grazing, no tillage and conservation agriculture, Green Revolution agriculture, intensive horticulture, aquaculture, …) in order to reduce rehabilitation costs.
- Define food and nutrition policies to reduce hunger and on the other side, avoid cardio vascular diseases.
- Assess the transition costs from conventional to new production systems.
- Define incentives for public good provision by agricultural producers.

POSITIONING THE CGIAR IN THE RESEARCH FOR DEVELOPMENT CONTINUUM

Hamid Narjisse[59]

1. Determinants of CGIAR positioning in the research for development continuum

Positioning the CGIAR in the research for development continuum should be derived from its combined comparative advantages. These are determined by a set of criteria including:

1. amount of funding, and type of restrictions attached to it.
2. capacity and scientific expertise of CG centers.
3. scientific environment in which CG centers operate.
4. strength and capacity of partners NARSs.

A quick analysis of these criteria, as they pertain to CG centers, leads to the following conclusions:

- Donors have their own agenda. They are essentially interested in research that produces technologies leading preferably to immediate, measurable development impacts.
- As consequence of current funding mechanisms, CG centers tend to engage in a variety of projects and topics. This dispersion of efforts precludes them from developing a critical mass of expertise in any specific area in term of scientific capacity and highly complex equipments.
- Most centers operate in developing countries. As such, very few enjoy the benefit of an attractive scientific environment comprised of stimulating academic institutions, dynamic advanced research institutes and a vibrant private sector with strong R&D department.
- NARS partners of CG centers are very heterogeneous and well differentiated in their capacity, specific needs and expectations from their interactions with CG centers. Such diversity excludes any possibility for a uniform interaction between CG centers and partners NARSs, which further complicates their efforts to attain a mutually beneficial partnership.

Given the comparative advantages of the CGIAR, its working conditions and the environment in which it operates, it is quiet clear that:

- Most CG centers do not meet the requirements for developing a viable and sustainable strategic basic research programs. In stead, except for germplasm enhancement, their comparative advantage resides most likely in the area of applied research focusing on adapting technologies to the conditions of partner countries and exploring appropriate adoption approaches.
- The CG centers partnership efforts should be necessarily modulated to fit the needs and the capacity of the countries targeted by these efforts. Issues of complementarity and subsidiarity are essential guiding principles of this modulation.
- Under these conditions, it is imperative for CG centers to acquire and mobilize science developed elsewhere, essentially by advanced research institutes and to some extent by the private sector to meet the continuously growing and changing demands on the CG system.

[59] INRA. Morocco

2. Guiding principles for positioning the CGIAR in the research for development continuum

Positioning the CGIAR in the research for development continuum can only be relative, as the presumed separation between strategic basic research and applied research is not a clear cut distinction. Given the constraints facing CG centers, its strengths and weaknesses, the concept of Challenge Programs (CP) as it was framed may be considered adequate response to CGIAR concerns and needs. In deed, adoption of this concept, providing an opportunity for contract research and commissioned scientific investigations, will allow CG centers and emerging NARSs to establish closer links to other players and to draw in new advances in science, convert them into appropriate technologies and apply them to overcome prevailing development challenges.

In addition, the CPs, because of their competitive grant mode of operation, will enhance efficiency and effectiveness of both CGIAR and NARSs and optimize their comparative advantages. It will also contribute to building strong NARIs through better access to relevant and advanced science as well as new approaches to research management. Because of research outsourcing to non CG institutions, CP constitute also an appropriate mechanism to achieve desired complementarity between CG centers, NARIs from the South and ARIs. An obvious outcome of such fruitful synergy between partners is the avoidance by the CGIAR of NARS duplication or inhibition of their capacity.

As the CPs evolve, a special attention should be devoted to promoting networks of organizations including not only CP partners but also other stakeholders not directly involved in the implementation of CP. This will be useful in encouraging information exchange, knowledge and experiences sharing and consequently enhancing international spillovers.

3. Application of the proposed model to the area of natural resources management

Work on natural resources is usually long term and regional in nature. It involves complex approaches and has necessarily a biophysical, social, economic, institutional and political dimension. Consequently, it is difficult to expect payoff on short term and at the global level.

The model suggested above is particularly relevant in investigating natural resources management, where a workable synergy between CG centers, ARIs and NARSs can produce useful technological outputs, particularly in the area of improving of water use efficiency.

3.1 Rationale and Significance

Water scarcity and mismanagement generate usually a process of land abandon with known negative effects on social cohesion and environmental protection. During the past two decades a number of research projects have been undertaken to study ways to improve crop water use efficiency. Nevertheless, water use is still far from being at optimum. The main reasons are: (i) the lack of optimization of agronomic practices aiming to save water and to reduce evapotranspiration, (ii) the inadequate management of irrigation resulting into waste of water and (iii) the unknown water requirements of specific crops. For these reasons, water use efficiency (WUE), defined as the ratio between the yield and the water supplied, is low.

Attention should therefore be devoted to focusing on appropriate and sustainable water management and integrating participants from different lead research institutions and professional backgrounds, in order to formulate common frames necessary to develop the techniques and methods to improve water used efficiency in the arid and semi-arid climate.

3.2 Partners

Advanced Institutions

CSIRO (Australia)
INRA (Montpelier, France)
Rothamsted Research, University of Nottingham (UK)
University of Wageningen (Netherlands)
University of California Davis (USA)

CG Centers

CIMMYT
ICARDA
IFPRI
IWMI

National Research Institutions

3.3 Research topics

Improvement of WUE through physiological and genetic research

The overall objective of this research is to provide new and efficient screening tools (phenotyping, and controlled environment assays) in order to better identify drought tolerant genotypes in segregating populations, and to improve the understanding of the metabolic and genetic bases of target secondary trait(s). Important considerations relate to their impact on plant performance under water-limiting and non-limiting conditions in the selection throughout screening protocols.

The specific objectives are to:

- Identify physiological traits underlying water use efficiency and heat tolerance, their genetic control, and develop tools for plant breeding.
- Identify genotypic characteristics and management practices and systems that maximize performance under various environments (drought stress, heat stress, favorable conditions).

Expected Outputs

- Development of efficient methods to associate molecular variation with phenotypes.
- Demonstration of the utility of association studies for revealing gene-phenotype relationships.
- Identification of new traits or refinement of the use of already identified traits associated with drought tolerance including plant morphology, partitioning, adaptation mechanisms, and/or the differential regulation of physiological and metabolic pathways.

Tasks allocation between participating partners

Institution	Description of work
INRA Morocco	Phenotyping (spectral reflectance indices, Modulated chlorophyll fluorescence, canopy temperature, phenology, yields), Field trials
Advanced institutions and CG Centers (CSIRO, UB, UK, INRA France, CIMMYT)	Carbon isotope discrimination (◎13C), 15 N, leaf porosity, gas-exchange parameters, rooting system, water soluble carbohydrates, QTLs, Controlled assay and experiments

Improvement of WUE through Crop Management

The overall objective is to improve crop production both in quantity and quality, through development of an integrated crop management strategy for efficient use of water and mineral nutrients.

Expected Outputs

- Management Improvements of WUE and NUE for strategic crops.
- Mapping Adaptation of crops to variable environments.
- Improving WUE of crops through better use of cropping system management.

Tasks allocation between participating partners

Institution	Description of work
NARS	Physiological responses (spectral reflectance indices, Modulated chlorophyll fluorescence, canopy temperature, phenology) and yields, water use, nitrogen content, Field trials
Advanced institutions and CG Centers (IWMI, CSIRO, U. of Nottingham, University of California Davis, CIMMYT, ICARDA)	Gas-exchange parameters, rooting system (dynamic, architecture…), water soluble carbohydrates, NUE traits, WUE, NIRS, Field trials and controlled chambers experiments

Modeling for WUE improvement

The objective is to test, adapt and validate Simulation Models for Crop Growth, Crop Management Strategies, and Crop Evapotranspiration.

Expected Outputs:

- Guidelines and recommendations for the use of a simulation model as decision aid to evaluate water and nutrient use efficiency.
- Agronomic strategies for optimal use of water.

Tasks allocation between participating partners

Institution	Description of work
NARS	Field trials, model testing and validation, agronomic management sub-routines, plant/crop physiology sub-routine
Advanced institutions and CG Centers (University of Wageningen, INRA France, IWMI, CIMMYT, ICARDA, FAO)	Model development/adaptation, Models description and use, programs (e.g. CROPWAT, GECROS, SIMTAG, WHEATMAN)

Modeling of water and nutrients dynamic

Developing a model that simulates water and nutrients movement in the soil is very useful for a better control of quantities of water and fertilizer to be supplied in order to reduce the extent of deep percolation of water and carried nutrients. Development of such model would require a thorough soil characterization as well as a good understanding of nutrients transformation.

Tasks allocation between participating partners

Institution	Description of work
NARS	Field trials, model testing and validation, agronomic management sub-routines, plant/crop physiology sub-routine
Advanced institutions and CG Centers (University of California Davis, IWMI)	Model development/adaptation, Models description and use, programs

PAPER PRESENTED AT THE CGIAR SCIENCE COUNCIL WORKSHOP: "POSITIONING THE CGIAR IN THE GLOBAL RESEARCH FOR DEVELOPMENT CONTINUUM"

Philip Pardey[60]

Conceptual Preamble

The substantial deliberations on characterizing the products of the CGIAR as International Public Goods (IPGs) is, perhaps, helpful in contextualizing the role of the CGIAR, but not much use in a practical, priority setting context. For one, it could be construed to rule out products like hybrid crop varieties that are intrinsically excludable on technical grounds. More fundamentally, most research products are not intrinsically public—technically, non-rival and non-price excludable—or private goods; they fall in the "shades of grey" category, have multiple attributes (with some attributes that are more or less rival or excludable than others), and, above all, can be made more or less public (or not) through policy and practical actions on the part of the CGIAR or others. For example, a new advanced breeding line of rice can be ceded to the public domain, or, alternatively the CGIAR may seek plant breeders' rights (PBRs) on that variety in multiple countries thereby making it excludable for commercialization, but not breeding, purposes in those countries. In addition the CG could file for utility patent protection on the variety in the United States, which if successful confers the CG with the legal right to exclude *all* others from using, making, selling or importing that particular variety in that jurisdiction. That is, it is as much *how* the CG opts to *use* its research products, not necessarily something intrinsic in the product itself that determines if the output is more or less a "public good."

In my view, the R *and* D and *R for* D dichotomy do not have much traction either. The U.S. National Science Foundation and the OECD, for example, consider R&D (in words, research and *experimental* development) to be creative work "undertaken on a systematic basis in order to increase the stock of knowledge including knowledge of man, culture and society, and the use of this stock of knowledge to devise new applications." Moreover, the objective of basic research "is to gain more comprehensive knowledge or understanding of the subject under study without specific applications in mind." They characterize applied research as "gaining the knowledge or understanding to meet a specific recognized need, and experimental development is the systematic use of the knowledge or understanding gained from research directed towards the production of useful materials, devices, systems or methods, including the design of prototypes and processes." This is all quite distinct from the process of *economic* development, which may or may not involve R&D in the sense just defined.

The latest incarnation of the CGIAR mission statement (or at least the last time I looked in late 2005) reads:

> *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 (CGIAR 2005).*

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This unequivocally speaks to an "R&D for economic development" conception of the CGIAR.[61] The practical, and difficult, question seems to be "to what extent does the CGIAR get involved in non-research activities to further its economic development objectives" (and, as a corollary, "to what extent does it engage in a particular line of R&D with substantial development potential, given the technology transfer and commercialization constraints that are evident), rather than being overly concerned with the practically indeterminate question about the international public good character or intent of the research. It may be more manageable (but still not a simple matter) to discern if the work is research or not (and then to make a decision about how much and what type of non-research effort the CG should directly engage to further the economic development impacts of its (or others?) R&D) rather than meaningfully locate that research on a public-private goods spectrum.

One final concern I have with the background documents supplied for this session CGIAR (2006), Dalrymple (2006) and Ryan (2006) is their emphasis on the concept of public goods rather than specifics about the *changing* structure of market failures in agricultural R&D and the implications that has (and is likely to have) for the CGIAR, and, relatedly, b) a lack of emphasis on the *changing* external environment, and the fundamental implications this has for CGIAR. In my view, much more attention is warranted on these aspects as the CG *continuously evaluates and repositions* itself in the ever evolving "global R&D for development (!)" continuum.[62]

Some restructuring or consolidation of agricultural R&D institutions, in some instances on a geographic basis, is implied by the changing nature of the research being undertaken, its focus relative to agriculture, agribusiness, and the environment, and the spatial and economic applicability of the results, as well as by the changing nature of economies of size, scale, and scope in research.[63] In addition to changes in the organization of research institutions, there is also scope for more economic rationalism in the processes for managing research, allocating research resources, and in the structure of incentives for scientists (although little of the formal economic evaluation have ever been deployed .for priority setting purposes at a systemwide level in the CG).

One of the key ideas is market failure in agricultural R&D arising from incomplete or ineffective property rights over inventions, which mean that inventors are unable to fully appropriate the returns to their research investments. Market failures in research can happen at the level of firms within a state or country, states within a country, or among countries—in any context where the distribution of benefits from adopting the results does not closely match the distribution of the costs incurred in doing the research.

Market failure leads to private-sector under-investment in agricultural R&D, a phenomenon that can account for the major result from the empirical literature across different commodities and different countries, that agricultural R&D has been, on average, a highly profitable investment from society's point of view (Alston et al. 2000). In turn, this suggests that research may have been under funded, and that current public intervention may be inadequate.

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[61] This long-standing debate dates back to the inception of the CGIAR. Ruttan (2001, 26), the first economist to work for a CG center, recalls the founding Director General of IRRI, David Chandler at a Saturday morning staff seminar during IRRI's early days as saying emphatically that "The purpose of this institute is not to do good science!…The purpose of this institute is to raise rice yields in Asia!...And raising rice yields in Asia may require that you do good science!"

[62] See the appendix for some new perspectives on this aspect.

[63] The rest of this section is taken, almost verbatim, from Alston and Pardey (2006).

This is not to say that the amount of public spending necessarily should increase. Changes in government intervention can take many forms. Some commentators focus on increased funding of R&D from general government revenues, but this is only a part of the picture. Governments and international treaties and conventions can also change the incentives for others to increase their investments in private or public R&D (as well as what research is done, by whom, and how effectively). A premise that public intervention is inadequate implies simply that the nature of the intervention ought to change so as to stimulate either more private investment or more public investment.

Policy options available for stimulating private funding or performance of agricultural R&D include:

- improving intellectual property protection;
- changing institutional arrangements to facilitate collective action by producers, such as establishing levy arrangements; and
- encouraging individual or collective action through the provision of subsidies (or tax concessions) or grants in conjunction with levies.

Among economists at least the notion of market failure in the context of R&D is reasonably well understood. What is largely missing from the literature is a consideration of the distinguishing attributes of developing countries, and the implications these attributes have for R&D decisions taken at both the national and international levels.

First, less-developed countries are commonly characterized as having a comparatively high incidence of incomplete markets, resulting from high transaction costs and inadequate property rights, which in turn may be attributable to inadequate infrastructure and defective institutions, among other things. To the extent that they exist, information problems, high costs of transport and communication, ill-functioning credit markets, and the like, combined with less-educated farmers, are likely to make it harder to capitalize on new inventions. In rich countries, we might discount the issues of risk and capital costs as factors that discourage investment in invention, but in less-developed countries these factors might take on a different meaning, especially if capital markets do not function well—for whatever reason.

Second, the types of technologies suited to much of less-developed country agriculture have hitherto been of the sort for which appropriability problems are more pronounced—types of technology that have been comparatively neglected by the private sector even in the richest countries. In particular, until recently, private research has tended to emphasize mechanical and chemical technologies, which are comparatively well protected by patents, trade secrecy and other intellectual property rights; and the private sector has generally neglected varietal technologies except where the returns are appropriable, such as for hybrid seed. In less-developed countries the emphasis in innovation has often been on self-pollinating crop varieties and disembodied farm management practices, which are the least appropriable of all. The recent innovations in rich-country institutions mean that private firms are now finding it more profitable to invest in plant varieties, and the same may be true in some less-developed countries, but not all countries have made comparable institutional changes.

A third factor is that in many less-developed countries, prices have been distorted by policies in ways that meant incentives and opportunities for farmers to adopt new technologies were diminished. Only when we achieve a reasonable rate of inventor appropriability of the returns to the technologies that are applicable in less-developed countries, combined with an economic infrastructure that facilitates adoption of those technologies, can we expect a significant private-sector role to emerge.

Accepting that markets may fail, for whatever reason, we have to consider the possibility that governments in less-developed countries also might fail—in this case, fail to take sufficient action to correct the under-investment in agricultural research—for both economic and political reasons. For instance, and as a fourth factor accounting for their low rates of investment in agricultural R&D, government revenues may be comparatively expensive, or have a comparatively high opportunity cost in less-developed countries. This can be so because it is comparatively expensive to raise government revenues through general taxation measures. And it can be seen to be so when we consider that many less-developed countries are characterized by under-investment in a host of other public goods, such as transportation and communications infrastructure, schools, hospitals, and the like, as well as agricultural science (Runge et al. 2003). These other activities, like agricultural science, might also have high social rates of return.

Fifth, there are political factors to consider. In rich countries, agriculture is a small share of the economy, and any individual citizen bears a negligible burden from financing a comparatively high rate of public investment in agricultural R&D (for instance, in the United States public expenditure of US$3.8 billion on agricultural R&D in 2000 amounts to less than US$14 per person per year). The factors that account for high rates of general support for agriculture in the industrialized countries can also help account for their comparatively high public agricultural research intensities. In many less-developed countries, where agriculture represents a much greater share of the total economic activity, and where per capita incomes are much lower, a meaningful investment in public agricultural research might have a much more appreciable impact on individual citizens—and the problem is that this burden is felt now, while the payoff it promises may take a long time to come, and will be much less visible when it does.

Finally, even among the rich countries of the world, most have not had very substantial private or public agricultural science industries; so why should we expect the poorest countries of the world to be more like the richest of the rich in this regard? The lion's share of the public (as well as private) investment in agricultural science has been undertaken by a small number of countries, and these have also been the countries that have undertaken the lion's share of scientific research, more generally. Typically, these have been the larger, economic power-houses, especially the United States. Differences in per capita income, the total size of the economy, and comparative advantage in science (reflecting not just wealth but also the nature of the society), may all be factors that have determined the international distribution of the burden of agricultural R&D investments.

It might not make much economic sense for small, poor, agrarian nations to spend their comparatively scarce intellectual and other capital resources in agricultural science, on their own behalf, in a world in which other countries can do it so much more effectively, and are doing so. And, in the past it has been an effective strategy for many nations to free-ride on the efforts of a few others in agricultural R&D. Both inadvertent technology spillovers and international initiatives such as the CGIAR and bilateral agricultural R&D development aid might have crowded out some national investments in agricultural R&D in less-developed countries.

An important consideration is economies of size, scale, and scope in research, which influence the optimal size and portfolio of a given research institution. In some cases the "optimal" institution may efficiently provide research for a state or region within a nation, but for some kinds of research the efficient scale of institutions may be too great for an individual nation (see, for example, Byerlee and Traxler 2001). Many nations may be too small to achieve an efficient scale in much if any of the relevant elements of their agricultural R&D interests, except perhaps in certain types of adaptive research. A particular problem for global efficiency in agricultural

science, and for many smaller countries, is that we still do not have effective institutions for financing and organizing research on a multinational basis for those instances where the research is applicable across multiple countries and where individual countries are too small to achieve efficient scale (notwithstanding institutional innovations for funding multi-national agricultural research such as the CGIAR, FONTAGRO, or FLAR).

Issues for CG Policy Research in Particular

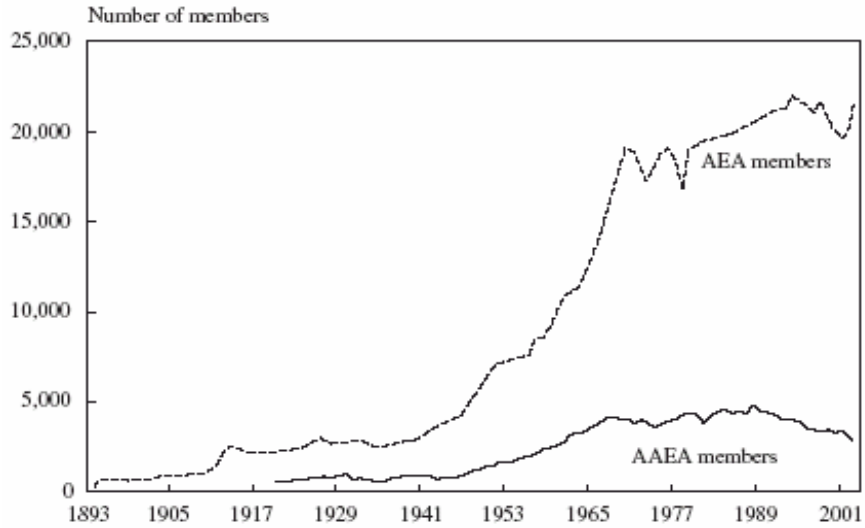
Points to consider when positioning CGIAR policy research

External environment

Pardey and Smith (2004) show that the professional capacity of economics research is slowly growing in less developed countries, but is still woefully thin (and, arguably, more limited than developing-country capacity in the agricultural science generally).

Critically, growth in membership in the American Economic Association has slowed if not stalled and AAEA membership numbers have been declining for some time (perhaps signaling a diminished "public service" role for these rich-country professionals). Agricultural economics associations in the United States and many other developed countries (e.g. U.K. and Australia) are facing similar situations, agricultural economics departments are closing or merging with other departments or changing in ways that reduce their emphasis on agriculture, and the foreign to domestic student ratio has risen dramatically in many of these rich country departments.

FIGURE 2.4 American Agricultural Economics Association and American Economic Association memberships



History of success

IFPRI has a distinguished record of policy research (and outreach/advocacy) that is recognized globally. Policy/social science research capacity in some of the CG centers has a similar record. IFPRI is now changing its mode of operation, increasing its on-the-ground regional presence, while the policy research capacity in the other CG centers has diminished.

Scale, Scope, and Location

The changes just noted raise questions that relate directly to efficiencies in the conduct and international impact of CG policy/social science research. Is a "decentralizing" mode of operations compromising research efficiencies (especially given the important role that location has regarding transfers of tacit knowledge)?[64] Is the conception of research and choice of subject matter shifting more to localized concerns at the expense of issues of international import? Is the unique capacity of the CG to conceive, conduct and coordinate multi-country and even multi-national research being reduced (types of research that is harder for university based initiatives)?

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[64] A policy *research* shop with international reach and renown surely requires more than 3-4 researchers and less than 100 (maybe in the 30-60 range?).

Appendix

New Perspectives on the Changing Environment for Agricultural R&D[65]

- New global data on agricultural R&D reinforce longer-run trends observed earlier—namely a fairly widespread scaling back, or at best a slowing down of support for publicly performed research-for-agriculture, especially among rich countries (and Africa). In part, this points to a shifting emphasis from public- to privately-performed agricultural R&D in the rich countries, but also to a shift in government spending priorities generally.
- Inevitably, this will affect productivity prospects in agriculture for the countries in question. And, as Pardey, Alston and Piggott (2006) suggest, a more subtle and arguably more important consequence is that slowdowns or cutbacks in rich-country spending will curtail the future spillovers of ideas and new technologies from rich to poor countries. These rich/poor country linkages will be even more attenuated as the funding trends proceed in parallel with other policy and market developments, like strengthening intellectual property rights and biosafety regulations and a reorientation of rich-country R&D away from productivity gains in food staples toward concerns over the environmental effects of agriculture, as well as the food quality, medical, energy, and industrial applications of agricultural commodities.
- Intellectual property policies and practices are but one dimension of the incentive to innovate. Potential market size and the cost of servicing the market—which in turn is dependent on the state of communication and transportation infrastructure, farm structure and size, and farm income—are important dimensions as well. So too is the pattern of food consumption. As incomes rise, larger shares of the food expenditures go on food processing, convenience and other attributes of food—areas where significant shares of private agricultural research effort are directed.
- Importantly, both the supply and demand for spillover technologies appears to be changing. Notably, rich countries are reorienting their agricultural R&D away from the types of technologies that are most easily adapted and adopted by developing countries (Pardey, Alston and Piggott 2006). In addition, intellectual property rights and other regulatory policies—including biosafety protocols, trading regimes, and specific regulatory restrictions on the movement of genetic material—are increasingly influencing the extent to which such spillovers are feasible or economic.[66]
- On the demand side, some developing countries have expanded their own research capacity and shifted upstream, reducing their emphasis on adaptive R&D (examples include the largest developing countries: Brazil, China, and India). These countries have become a potential source of new technologies for the poorest and smallest countries, which will (or often should, given economic realities in the current and foreseeable future) continue to emphasize adaptive research.

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[65] This section is outtakes from Pardey, P.G., N.M. Beintema, S. Dehmer, and S. Wood *Agricultural Research: A Growing Global Divide?* International Science and Technology Practice and Policy center and International Food Policy Research Institute: St. Paul and Washington D.C., in preparation.

[66] The nature of collective R&D is changing as a consequence of these changes and we need to much more aware of the changing nature of collective action in R&D, which entails many forms of game playing behaviour. See E. Binenbaum and P.G. Pardey "Collective Action in Plant Breeding," Selected Paper prepared for presentation at the American Agricultural Economics Association Annual Meeting, Providence, Rhode Island, July 24-27, 2005.

RESEARCH FOR DEVELOPMENT VERSUS RESEARCH FOR DISCOVERY: A FALSE DICHOTOMY

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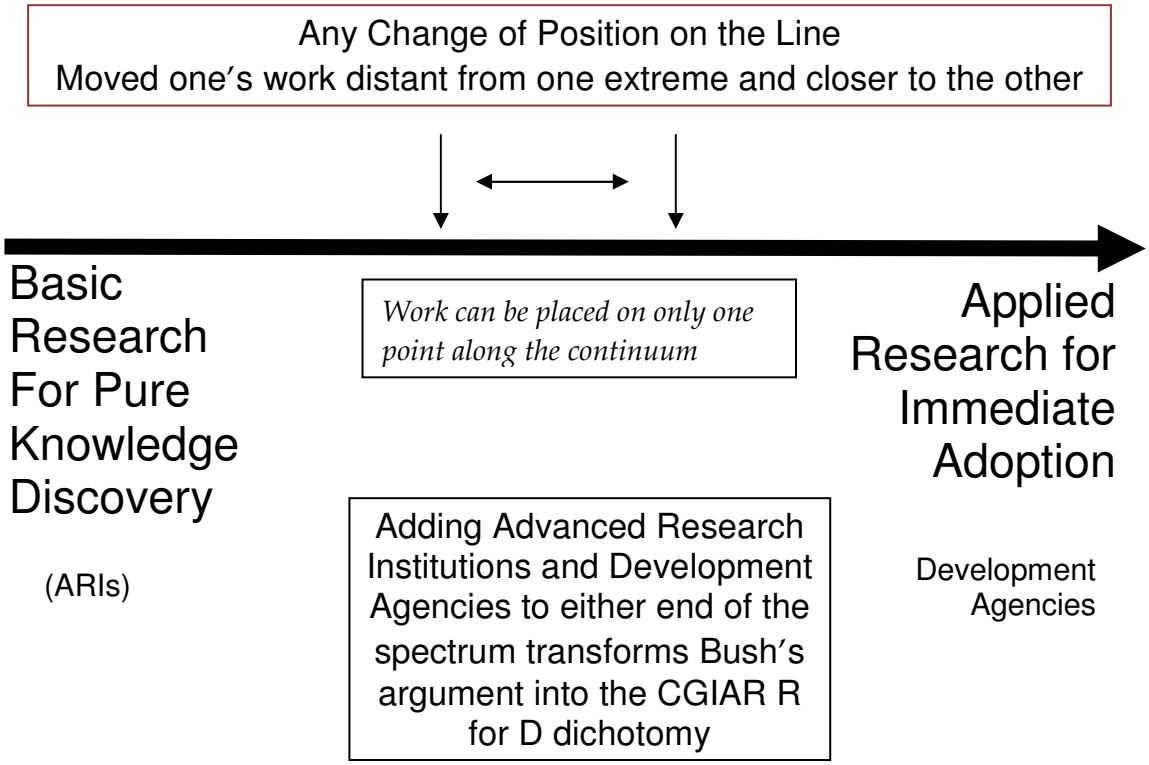
The arguments in this paper are essentially lifted from Donald E. Stokes' book *Pasteur's Quadrant: Basic Science and Technological Innovation*[67]

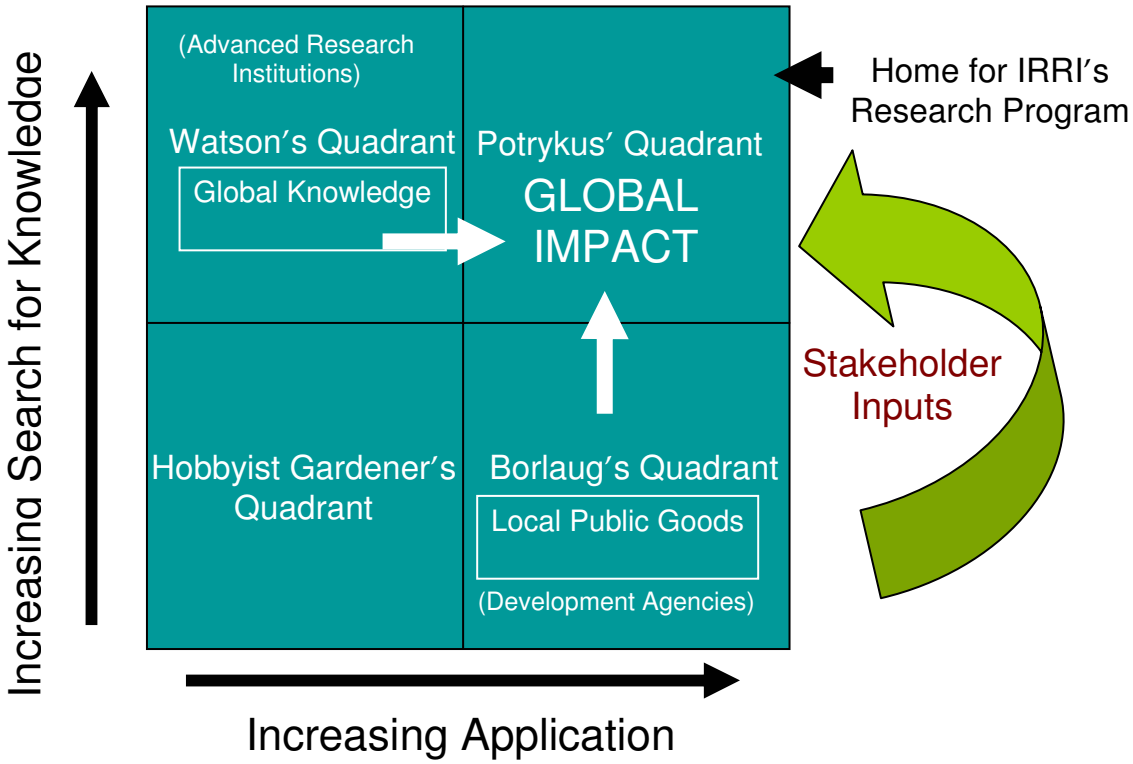
The discussions around the "research – development continuum" that fixate some in the CGIAR today mirror discussions in the US scientific community over a half century ago. Vannevar Bush, a brilliant engineer and visionary (he is credited with, among many other things, conceptualizing hypertext that drives the Internet) advised Presidents Roosevelt and Truman that the nation needed a scientific research mechanism that fostered pure discovery science. He argued that only unfettered research could be the incubator for new knowledge that would then percolate, or be distilled, into practical application. Discovery and application were not only distinct in his eyes, they were mutually exclusive. This thinking led to the creation of the US National Science Foundation that, until very recently, devoted itself to supporting only basic discovery research, eschewing research with an application dimension.

Bush's model was:



[67] Stokes, D. 1997. Pasteur's Quadrant: Basic Science and Technological Innovation. Brookings Institution Press, Washington, D.C. 196 pp.

Donald Stokes, from the Brookings Institution, argued in 1997 that the Basic: Applied research was a false dichotomy. Rather, the two were different axes representing continua from the generation of little new knowledge to great discovery and little practical application to very large practical significance, respectively. As economists tend to do, he mapped out the resulting two dimensional space[68] into quadrants, naming the upper right hand quadrant "Pasteur's Quadrant". Translating his work in CG-relevant terms yields the following graphic. Ingo Potrykus, creator of Golden Rice and pioneer in rice transformation that made this possible occupies Pasteur's quadrant for our purposes. Norm Borlaug could not have cared less for "why" wheat semidwarfs were short. Just get the lines out!



(After Stokes, 1997, "Pasteur's Quadrant…")

A current example of the interplay between discovery science and broad application and impact is the incorporation of submergence tolerance in "mega varieties" (grown on tens of millions of hectares) in South Asia. Flooding is a serious problem on tens of millions of hectares in South and Southeast Asia and parts of Eastern Africa. Like almost all crops rice does not tolerate being completely submerged for more than just a couple of days. Millions of farmers suffer partial to complete crop losses from flooding every year.

Submergence tolerance was identified in materials from IRRI's gene bank in the late 1980s. However, it proved impossible to transfer this valuable trait in breeding programs with any acceptable degree of efficiency. An aggressive program between an ARI (UC Davis in the US) and IRRI led to the identification of the gene, its sequence and function. This knowledge yielded precise DNA sequences that allowed specific markers to be developed that permitted a rapid marker assisted selection back cross approach to be used to covert rice varieties popular with

[68] Some argue that a 2 dimensional model is far too simplistic to capture the richness of discovery, application, development, society etc. That may be so, but for the purposes of this discussion two dimensions suffice; and I am personally uncomfortable entering into *n*-dimensional hyperspace.

farmers in flood-prone areas to submergence tolerance. Also, by knowing the genes that control tolerance for submergence scientists can systematically search the gene bank for variants of the gene that may be even more effective than the one in use. Even more important, when other sources of submergence tolerance are identified, detailed knowledge of gene function will allow breeders to identify distinct mechanism and combine them to provide even greater protection.

_Sub_1A encodes an ethylene responsive-like factor that confers submergence tolerance to rice
(In Press in a very high profile journal)

Kenong Xu*, Xia Xu*, Takeshi Fukao†, Patrick Canlas*. Sigrid Heuer‡, Julia Bailey-Serres†, Pamela C. Ronald*§, David J. Mackill‡§

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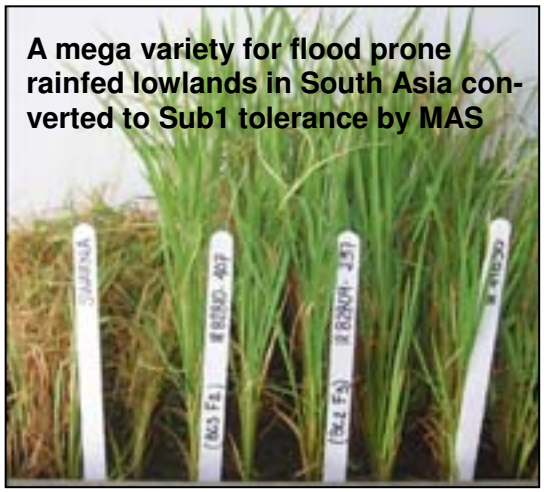
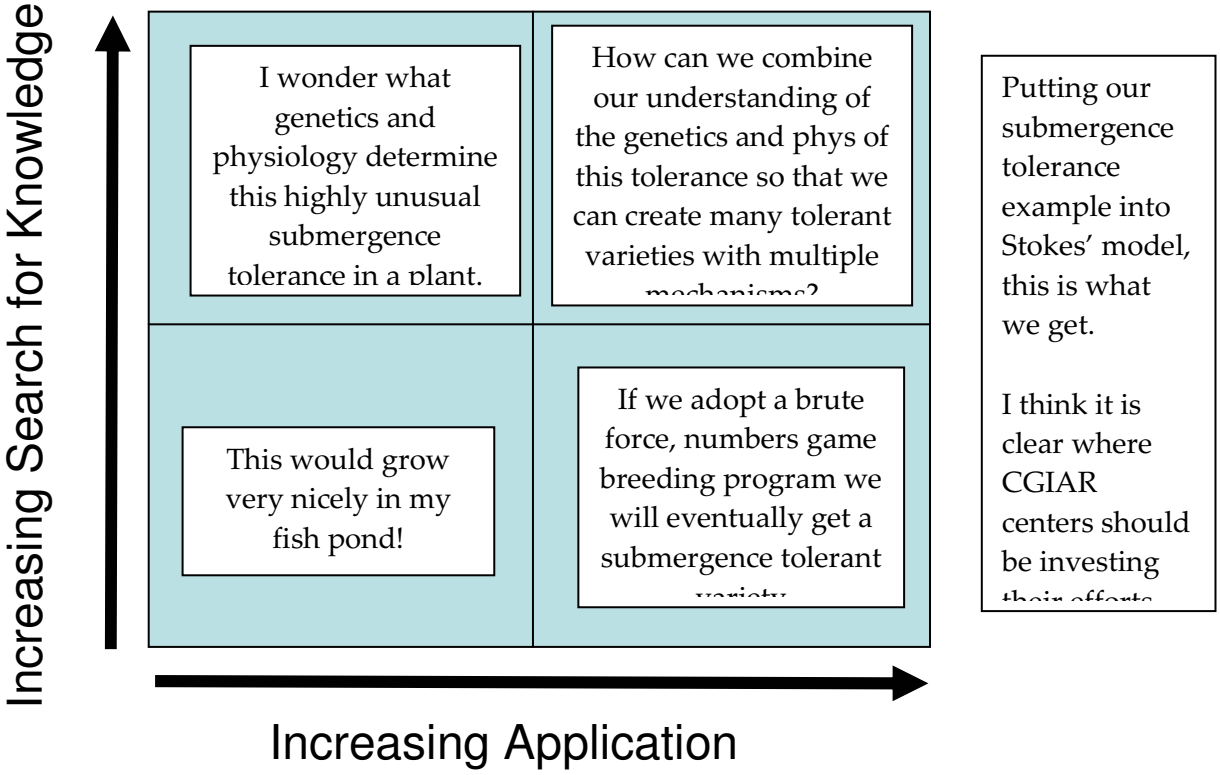
Sequence data from this article have been deposited with the EMBL/GenBank Data Libraries under accession nos. DQ011597-DQ011607 and DQ453964-DQ453966





Putting our submergence tolerance example into Stokes' model, this is what we get.

I think it is clear where CGIAR centers should be investing

SCIENCE COUNCIL PRIORITY SETTING RECONSIDERED

Theo van de Sande

Research in a global context

Growth in agriculture generally has a disproportionate positive effect on overall poverty because more than half the population in developing countries resides in rural areas. Poverty incidence is much higher in rural areas, reaching 82 percent of rural population in low-income developing countries. Therefore, a necessary component in meeting the MDGs by 2015 in many parts of the world is a more productive and profitable agricultural sector. This can only be achieved in the articulation of four central themes of expanding markets and trade, improving the sustainability of agriculture, mobilizing agricultural science and technologies, and strengthening agricultural outreach, education, and adaptive research.

The ability of the agricultural sector to transform rural economies and the lives of rural producers is intimately linked to application of both existing and new knowledge from the agricultural and environmental sciences. Research on agricultural and natural resource management problems can and should play a key role in helping to meet the MDGs and to reduce poverty, raise incomes, and achieve more sustainable development, particularly in Africa.

Improved technologies and practices alone cannot do the entire job of sustainable agricultural development. A combination of improved incentives and policies, reinvigorated institutions, and increased investments must occur if agriculture is to develop and the benefits are to be spread widely. However, without improved technologies, practices, and policies, few development programs will move very far or have lasting effect. Improved technologies, adapted to farmer needs, capabilities and profitability, are a necessary condition for pro-poor agricultural and rural development.

Science and technology capacity is not the only factor relevant to development. It is one component within a set of factors—along with policies favorable to competition and an enabling environment for strong knowledge institutions, sound fiscal and macroeconomic policies, accessible quality education, information and communication technologies systems that permit the flow and dissemination of knowledge and information, affordable and accessible health services, and good governance—that build the climate for investment, growth, and empowerment. These factors are mutually dependent, and strength in complementary institutions becomes more important to science and technology the more deeply they permeate a society and economy. At the same time, the stronger complementary institutions and policies become, the more S&T can contribute to overall development.

The CGIAR priority setting

The mission statement of the CGIAR is to contribute to food security and poverty eradication in developing countries through research, partnership, capacity building and policy support, promoting sustainable agricultural development based on the environmentally sound management of natural resources. This cannot be achieved by a single Center and requires complex partnerships with each other and with an increasingly large and diverse range of partners.

Strategizing and a proper process of priority setting is vital to achieve this, both at the level of the Centers as well as the CGIAR. The change in the CGIAR and Center missions from simpler

production goals to the more complex, development oriented goals of poverty eradication, food security and environmental protection has necessitated a shift from a simple, center priority setting process to a complex, participatory partner- consortium priority setting system.

If the research agenda is identified and executed successfully, the development agenda will more likely be implemented successfully. The SC priorities for the CGIAR 2005-2015 can not be considered a successful attempt to identify a research agenda, preventing the CGIAR from contributing effectively to poverty reduction and sustainable development, and meeting the MDGs.

1. The priorities are not in line with the systemic character of the challenges facing sustainable development and poverty alleviation. In a rather traditional way, the priorities refer to what have been the strongholds of the CGIAR in the last decades. What is needed is a strategic document giving direction to the CGIAR on how to utilize its assets in a global context and contributing to meeting the MDGs. As a guiding principle, this is even insufficient at the level of the individual CG centers. Let alone that it is capable of forging linkages and creating synergies at the level of the CGIAR at large.[69]

2. The current priority setting document fails to position the CGIAR, both within the agricultural research community as well as within the agricultural development community. In short, it fails to position the CGIAR as a partner in development as well as in research.

   The estrangement in the broad sense is largely the result of the unjustified marginalization of relevance and the neglect of the needs of the other players. The SC has not been secretive about its position that sustainable development, relevance and capacity building can be done as a side activity in the remaining 20 per cent free space if the Centers so desire. SC tends to neglect the fact that CG is supported from development cooperation funds and not from science funds. Of course, CGIAR research has to be excellent. It is difficult to see how less than excellent research can effectively contribute to sustainable development and poverty alleviation. However, excellence can and should not be an end in itself. CG has to excel in the research it has a comparative advantage in and the other partners in development can utilize in their attempts to realize the MDGs.

   The estrangement from the rest of the AgResearch community is largely the result of the inward looking bias on excellence. The SC fails to identify a specific niche of the CGIAR vis-à-vis Advanced Research Institutes, National Agricultural Research institutes (some of whom can also be considered advanced) and privately funded AgResearch.

   The isolation is further enhanced by the marginalization of a capacity strengthening/building role. The CGIAR is a comparatively small player in the international AgResearch community and has no monopoly on public domain research (which by definition is international).

   The SC tends to associate science and technology with the creation of new knowledge, through "frontier" or "cutting edge" research. Although this image has a strong hold on the popular imagination, it feeds a partial and biased view of what is important in functioning S&T systems at the service of sustainable development and poverty alleviation. The vast majority of an S&T workforce uses what a very few have discovered, adapting, converting and applying knowledge locally.

[69] For the very same reason it is questionable whether the Africa Task Force report on sub-Sahara Africa is adequate in its recommendations. A programmatic realignment can not be achieved by creating new headquarters.

Prioritization within the context of AgDevelopment and AgResearch is essential for identifying and consolidating the specific CG niche. Mere consultation with the other players is not enough by far. This raises questions concerning the stakeholders to discuss and answer what kind of research, how much of it, and through what mechanisms should it be carried out to help achieve these development goals.

3. As indicated above, networking and partnership are vital in determining and maintaining a specific niche for the CGIAR within the context of AgDevelopment and AgResearch. At the level of the CGIAR as a collectivity, it is easy to see that these capacities are underdeveloped, especially with respect to AgDevelopment. Instead of improving, the SC and its priorities are aggravating this serious omission. The SC has never been very enthusiastic about typical network programs such as the CPs because there was too little science and too much networking (merely regarded as transaction cost!) and capacity strengthening. SC priority setting for the entire CG is further adding to the isolation and fossilization of the CGIAR at large by not prioritizing capacity strengthening. Furthermore, the SC keeps on reminding the Centers what it considers to be the core business of the CGIAR and what not (see for instance the reply of the SC to CIMMYTs response to their EPMR).

   From a dynamic perspective, however, it might greatly contribute to the value of the CGIAR-at-large as a partner in development if it would accept a capacity building/strengthening role vis-à-vis the other partners, either in research or in development. Accepting such a role would not compromise the core business of either the CGIAR or the Centers, provided it is the result of a carefully designed CG-wide comprehensive strategy, not just on research, but also including policy advice, capacity strengthening/building and genetic resources. On the contrary. Such an interaction is highly functional in defining the priorities and maintaining CGs role as a partner in development, thereby preventing the CG from becoming redundant. The SC priorities document drives the CGIAR back into the isolation of a scientific tower of excellence.

It is clear that currently the CGIAR is insufficiently equipped to meet these requirements, especially at the consortium level, and the current priority setting process is insufficient. At the Center's level, though in varying degrees, a beginning is made with agenda and priority setting based on open, transparent stakeholder consultation of research and development partners and investors. In addition, many examples can be found of cooperation between Centers and other development partners, including NGOs, extension organisations, NARs and other AgResearch organisations in the design and implementation of the development activities. Other examples are collective programs around common goals with national partners, regional and sub-regional organizations. All these experiences inspire the individual Centers in writing down their vision and strategy documents.

At the consortium level, the CGIAR could profit greatly if these documents were used as the cornerstone for strategizing its development efforts; identifying opportunities, avoiding duplication, forging linkages between centers and between the centers and other development partners, formulating stronger common positions, and creating impact. Institutionally, the CGIAR is in dire need of a *Development Council* that is responsible for designing and implementing CGs contribution to AgDevelopment and the MDGs, on a global level or on (sub-)regional levels. Such a strategy is based on the direct and indirect (i.e. through the individual centers) consultation of the other partners in development and an agreed division of labor. The Development Council (chaired by the current chair and supported by the Secretariat) takes care that better efficiencies and effectiveness are achieved and collaboration in programming

(presently exemplified by the Challenge Programs, Systemwide and ecoregional programs and many bilateral projects) is expanded. It is responsible for turning the CGIAR into a learning organisation, exchanging information and experiences, identifying opportunities for spillover and cooperation, designing long-term strategies and set priorities within the broader perspective of optimizing CG efforts in the broader AgDevelopment agenda and developing and maintaining a specific CG identity and niche.

The Development Council itself must be characterized by a multi-stakeholder composition and supported by CG-wide Advisory Councils on strategically important areas such as science, policy advice, capacity strengthening and genetic resources. Doing justice to the (new) identity of the CGIAR as a network organisation and *partner in development*, these Advisory Councils should take the responsibility to reconsider ongoing activities and provide for a logical, coherent framework on their specific area. In practical terms, it seems logical to invite IPGRI to take the lead in designing an integrated, CG-wide strategy on genetic resources and feed that into the Development Council. The same is true for ISNAR on capacity-building/strengthening, for IFPRI on policy advice and for the SC on science.

What is needed finally is a thorough reconsideration of the role of the donors in the CGIAR. Jointly we are supporting a broad specter of partners in AgDevelopment: NGOs, NARs, SROs, ARIs, extension, governments, as well as the CGIAR and other international activities. With a view to sustainable development, this support is granted to strengthen capacities in developing countries to create opportunities and solve problems, tailor made, based on local ownership and priority setting. In that respect, it is the responsibility of the CGIAR to program and strategize with their partners in AgDevelopment. *Donors should refrain from interfering with priorities, as they do with other activities they are supporting, and actively support that the CGIAR interacts with the other AgResearch and AgDevelopment activities and institutions to determine policies, strategies and activities.*

ACRONYMS

AAEA	American Agricultural Economics Association
ACMV	African Cassava Mosaic Virus
APAARI	Asia Pacific Association of Agricultural Research Institutes
ARD	Agricultural Research and Development
ARI	Agricultural Research Institute
ARI	Advanced Research Institute
ASARECA	Association for Strengthening Agricultural Research in Eastern and Central Africa
ASB	Alternatives to Slash and Burn
CDDC	Center Deputy Directors Committee (of the CGIAR)
CIMMYT	International Maize and Wheat Improvement Center
CLAN	Cooperating Libraries Automated Network
CONDESAN	Consortium for the Sustainable Development of the Andean Ecoregion
CSIRO	(Australia's) Commonwealth Scientific and Industrial Research Organization
CSO	Civil Society Organisation
DFID	UK Department for International Development
FAO	Food and Agriculture Organization of the UN
FARA	Forum for African Agricultural Research
FLAR	Latin American Fund for Irrigated Rice
FONTAGRO	Regional Fund for Agricultural Technology
GFAR	Global Forum for Agricultural Research
GPG	Global Public Good
IAR	International Agricultural Research
IARC	International Agricultural Research Center
ICARDA	International Center for Agricultural Research in the Dry Areas
IDRC	International Development Research Center
IFAD	International Fund for Agricultural Development
IFDC	International Fertilizer Development Corporation
IFPRI	International Food Policy Research Institute
IFPRI	International Food Policy Institute
ILAC	Information Learning and Change
INRA	Institut National de la Recherche Agronomique (France)
INRM	Integrated Natural Resources Management
IPCC	Intergovernmental Panel on Climate Change
IPG	International Public Good
IPGRI	International Plant Genetic Resources Institute
IRRI	International Rice Research Institute
IWMI	International Water Management Institute
NARES	National Agricultural Research and Extension Services
NARO	National Agricultural Research Organization
NARS	National Agricultural Research Services
NGO	Non-governmental organization
NIRS	Near Infrared Spectroscopy
NPG	National Public Good
NRM	Natural Resources Management
NUE	Nitrogen Use Efficiency
ODA	Overseas Development Assistance
OECD	Organization for Economic Co-operation and Development

PBE	Plant Breeder's Rights
PPB	Participatory Plant Breeding
PPP	Public Private Partnerships
QTLs	Quantitative Trait loci
RPG	Regional Public Good
S&T	Science and Technology
SRO	Subregional Organization
TAC	Technical Advisory Committee (of the CGIAR, forerunner of the Science Council)
WANA	West Asia North Africa
WUE	Water Use Efficiency