

Strengthening Strategy and Results Framework through prioritization

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Summary

This report examines processes and methods for priority setting to underpin a future revision of the SRF by the Consortium. The CGIAR's four System level outcomes (SLOs) are written in development terms, and provide the goals for a portfolio of *research for development* programs for the CGIAR. This paper examines priority setting at both the strategic System level (SRF/SLOs) and at the operational level of CGIAR research programs (the CRPs).

The paper outlines a framework for articulating the critical link between research results and development outcomes (SLOs) through a prioritized set of *intermediate development outcomes*. It gives examples of intermediate development outcomes at both the System level (aggregating across value chains, farming systems and agro-ecologies) and the CRP level (referring to specific research thrusts; individual crops, value chains and systems). The paper provides frameworks for their development, recognizing the inter-linkages between the SLOs and the potential trade-offs between them. The focus on intermediate development outcomes and their relationship with the aspiration of the SLOs, as well as defining the levels and means through which research and development outcomes will be brought together for impact, can lead to objective evolution of the CRPs supported by longer-term and strategic resource allocation.

At the System level, strategic decisions need to be made on: the broad system level target domains, including regions, agro-ecologies and key commodity-based systems; competencies needed; appropriate volumes or research, which would give indicative directions for resourcing the programs; and a set of intermediate development outcomes to guide CRP evolution and performance contract preparation. At the CRP level, alignment with the SRF needs to be strengthened by developing a prioritized research agenda with a feasible impact pathway articulating the plan of delivery towards the intermediate development outcomes. The approaches to prioritization need to be optimized for the specific context of each CRP and type of research. The indicative guidance at the System level on size and balance among CRPs can be met by CRP investment proposals supported by prioritized action and delivery plans. The ISPC emphasizes that moving towards a comprehensive SRF needs to be an iterative process of prioritizing and developing the intermediate development outcomes at the System and CRP levels.

The paper further emphasizes that systematic collection, collation and synthesis of data and incorporation of trends analyses with projections about the future are important activities which require enhanced capacity to continuously improve the quality of the decision making. Discussion in the CGIAR needs to link to the global discussions on future goals for environmentally sustainable development. The System can build on the work of Centers and current communities of practice (e.g. the Consortium for Spatial Information), tied into the global community. These efforts and resources will feed directly into future monitoring, evaluation and adjustment in the programs and the CGIAR at large.

The conceptualization and proposals in the paper are supported by experiences drawn from prioritization approaches previously used at CGIAR system and Center levels and conclusions on priority setting and decision-making in other agencies and research

organizations. Among these lessons the relevant advantages and constraints to different approaches are highlighted. In real-life, prioritization needs to acknowledge the current situation, the need to make strategic choices on projections of an uncertain future, and the fact that moving to a new strategy will depend upon a mixture of analytical, economic and political stances.

For the proposed revision of the SRF, the report identifies the components and potential criteria for priority setting at both the SRF and CRP levels. It highlights the different dimensions of prioritization: economic, political and philosophical. Priority setting is challenging and demands resources, but at its best the process can generate common understanding, ownership and basis for transparent decision making.

Decision-making, particularly in the networked environment in which the CGIAR and CRPs operate, requires consultation among stakeholders. They include the CGIAR research community, the donors and the stakeholders involved at various stages of the impact pathway or affected by the research directions taken. Optimising stakeholder input into these discussions will enhance their acceptance of, and confidence in, the decisions that will determine research directions and resourcing.

Critical steps for Action Plan to revise the ARF – In conclusion, the ISPC recommends that the following steps be included in the Action Plan to revise the SRF

- Development at the SRF level of a prioritized list of intermediate development outcomes logically linked to the four SLOs
- Description at the CRP level of intermediate development outcomes that correspond with the SRF level and link CRP research to the four SLOs
- Prioritization of research in each CRP and development of a value proposition to address the SLOs through defined intermediate development outcomes
- Decisions at the SRF level on highest priority target domains in terms of geographic areas, agroecosystems and key commodity based systems agreeing on definitions of parameters such as poverty, hunger and NRM variables.
- Guidance at the SRF level on indicative size of the CGIAR research portfolio for research targeting each intermediate development outcome
- Development of performance contracts that reflect the CRP prioritized research proposals
- Updating of the SRF with respect to (i) analysis of the external agricultural research and development environment including scenarios regarding the future and drawing from strategic foresight and trends analyses; (ii) analysis of the CGIAR's competencies and comparative advantage as they evolve and viz a viz those of its partners regarding up- and out-scaling of research; (iii) defining CGIAR's strategies in different regions; (iv) installation of data gathering and synthesis capacity and agreement on consistency regarding data and metrics; and (v) the rationale and role for the CGIAR in strengthening national capacity.

The ISPC continues to offer its independent advice to the Consortium as it pursues this process. For the ISPC some optimal entry points may be the review of the detailed action plan for SRF renewal, contribution to agreed elements of the foresight and trends analysis, and a review of the new draft SRF before its finalization.

Glossary of key terms

Intermediate development outcomes represent a change, in the medium term, that is intended to affect positively the welfare of the targeted population or environment resulting in part of research carried out by the CGIAR (among others). The intermediate development outcomes are attributable to CRP level activities and are necessary precursors and logically linked to the SLOs.

Intermediate development outcomes (System level) represent accumulation of CRP outcome results with the scale corresponding to the CGIAR's target domains. They are generated as a result of multiple activities by diverse actors outside the CGIAR. They are documented through System level impact studies.

Intermediate development outcomes (CRP level) are targets representing CRP-specific thrusts and target domains. Their scales reflect CRP target domain and estimated volume of benefits. They are generated as a result of multiple activities by diverse actors outside the CGIAR. They are documented through CRP level outcome and impact studies.

Research outcomes represent adoption and further use of research outputs by immediate users targeted by the CRP, such as NARS researchers and national policy makers. They are generated as a result of research, capacity building and advocacy activities by the CRP. They are monitored and documented as part of internal CRP/Consortium monitoring.

1. Introduction

The Strategy and Results Framework (SRF), approved in 2011, has several strengths that were highlighted by the ISPC in its comments in 2011. It contains a good background analysis of current and future trends in agricultural development and the dynamic research environment in which the CGIAR operates. It describes four System Level Outcomes (SLOs) that define the expected ultimate impacts from CGIAR research.¹ The SLOs occur at a high level in terms of scale and magnitude of impact. The SRF also identifies the competences that the CGIAR has or should acquire for addressing those SLOs. Some high-level research areas under each SLO are discussed and the SRF presents examples of targets where progress should be monitored. Thus the current SRF goes some way in outlining the agricultural development challenges and constraints that ought to be addressed to allow progress towards the SLOs.

This report examines processes and methods for priority setting to underpin a future revision of the SRF by the Consortium. The SLOs, expressed as development impacts, provide the goals for a portfolio of *research for development* programs for the CGIAR. However, the ISPC considers that given the difference in the character of the individual, high level SLOs and the broad disciplinary and integrated avenues of science that are required to lead to such impacts, a single normative priority setting framework is unlikely to apply across the CGIAR in a one-size-fits-all approach. The paper therefore examines priority setting at both the strategic system level and at the more operational level of programs. The ISPC believes that moving towards a comprehensive SRF will be an iterative process between these two levels.

The Program level is characterized by the initial 15 CGIAR Research Programs (CRPs) which were developed and endorsed through a parallel process. They represent the current

¹ The four SLOs described in the SRF are: (i) Reduction in rural poverty; (ii) Increase in food security; (iii) Improving nutrition and health; and (iv) More sustainable management of natural resources.

CGIAR research portfolio although the SRF recognizes the need for their further realignment with the SLOs.

2. Strengthening the *results framework* in the SRF

The current version of the SRF presents elements of the CGIAR's new strategy but does not yet present a *results framework* for prioritizing research and investment. The document highlights three important components of a prioritizing framework: redefining boundaries (for optimizing research efficiency), achieving strategic alignment (linking competences around the SLOs) and deciding on fund allocation through priority setting. The current set of CRPs reflects, to some extent, the requirement to improve efficiencies by pulling work on individual commodities or topics under the umbrella of one CRP. Strategic alignment and priority setting have not yet been systemically pursued beyond the initial selection of CRPs.

A strategic and prioritized results framework should determine both the scope and domain of the CGIAR research portfolio and help in managing and monitoring progress towards delivery of the CGIAR's contribution to achievement of the high level SLOs. The SRF is a basis for positioning the CRPs in relation to the larger agricultural research and development system and the SLOs. The ISPC considers that there are two distinct levels where prioritization should take place: the SRF/SLO level, through development of the results framework, and the CRP level. To ensure dynamic linkage between these two levels, the ISPC proposes that the results framework be defined at a level below the SLOs where the expected changes in development can be reasonably described and targeted by the CRPs in a medium-term timeframe. This framework should consist of a prioritized list of *intermediate development outcomes*² that are at the strategic level and specific enough to link them to the individual SLOs but generic enough not to become prescriptive of different research approaches (discussed further in section 4 and illustrated in Figure 1). Another dimension of the prioritized framework concerns the main target domains, agro-ecologies and key commodity based systems, which stand to benefit most from collaborative CGIAR research and thus need to be determined at the SRF level, to enable synergies between CRPs to be captured. This framework can then be used to guide development of the CRPs and their program-specific impact pathways, and to describe the CRPs' contribution to different intermediate development outcomes. Within individual CRPs, therefore, priorities need to be set regarding the specific program thrusts and impact pathways with tight linkages to the relevant intermediate development outcomes.

3. Strengthening the *strategy* in the SRF

The SRF and the 15 CRPs represent a radical change in the way the new CGIAR operates. This requires a change in culture across the CGIAR community; such a change takes time to implement. Progressive versions of the SRF can play an important role in the learning process as the CGIAR completes the reform and the CRPs evolve. This period of updating the SRF is marked by the global agreements to be reached at Rio+20 in 2012 and the approaching end of the Millennium Development Goals in 2015 (and the debate on global sustainable development goals which will likely follow). Much thinking at the highest

² Intermediate development outcomes occur logically once one or more research outcomes have been achieved. They represent a change, in the medium term, that is intended to affect positively the welfare of the targeted population or environment resulting in part of research carried out by the CGIAR (among others). The intermediate development outcomes are attributable to CRP level activities and are necessary precursors and logically linked to the SLOs.

international level is advising preparation for these events and it is therefore pertinent that the CGIAR also address the synergies and trade-offs between the priorities for development *per se* and priorities for the environment.³

The results framework aligned with the SLOs and demarcating the domain of the CRPs is an integral part of the SRF. The SRF also must provide a sense of where the CGIAR currently is regarding the most urgent challenges—defined both regionally and by strategic objectives—and for which agricultural research is a legitimate tool with which to approach their resolution. There needs to be a stronger sense of what needs to change for the CGIAR so that it can more effectively contribute to medium and longer term results in agricultural development as defined in the results framework. Therefore, an analysis of the competencies and comparative advantages—considering both of these as dynamic areas—should be presented and used to guide choices across the broad range of activities that the CGIAR could or should pursue. The SRF also needs to determine what kind of data and information are needed for continuously improving decision making.

In the CGIAR reform documents, the commitment to results and to impact is reinforced. Achieving impact on the SLOs depends on a large number of actors and interventions other than those of the CGIAR. While more is required from the CGIAR than delivery of technologies and knowledge, the CGIAR’s role relative to that of its partners and competitors in scaling up and out needs to be clarified in the strategy. One contribution to this, not sufficiently recognized to date, is the unique, value-adding role of the CGIAR in developing and disseminating best practices, syntheses and lessons in research, across locations. This role conforms to the CGIAR global remit and aim to generate international public goods. The strategy should highlight the CGIAR’s differential role in different regions and in countries at different levels of development.⁴ It needs to define the rationale and role of the CGIAR in strengthening national capacity, which is both a goal in its own right and necessary to augment the results coming from CGIAR research and multiplying the impacts.

A role for foresight and strategic studies - The forward looking analysis is not a trivial task and involves looking at future trends and expectations for all aspects of developing country agriculture and developments in research. There is need for strategic analysis, particularly in terms of trajectories of the farming future; farm size, demographics, power structures, demand, changes in the resource base, to name a few. There is also need for exploring research opportunities and likely scientific developments. Updating the analysis in the SRF can draw from trends analyses and foresight assessments done in the CGIAR and elsewhere⁵.

4. Developing a results framework for the SRF

System Level Outcomes

The SLOs are the high level strategic objectives of the CGIAR. In the SRF, the SLOs are discussed as discrete goals, and specific research avenues are discussed for each. While, to some extent, the progress towards the SLOs can be monitored for individual SLOs, the research aiming at such changes is likely to have multiple objectives and designs, particularly

³ Melamed et al., 2012

⁴ Examples of analysis of regional differences: de Janvry and Sadoulet, 2002; Ryan, 2004 and references therein; World Development Report, 2008.

⁵ Ingram et al (eds), 2010. FAO Committee on Food Security (<http://www.fao.org/cfs/cfs-hlpe/en/>). The SC/ISPC strategic studies that can inform the SRF and priority setting in the CRPs include: Social Science Stripe Study (2009); NRM study (2012) and the forthcoming studies on Urbanization and Farm size.

regarding areas where the SLOs are interlinked. The linkages between SLOs are presented in Box 1.

BOX 1. Interrelatedness of SLOs

Reducing
rural poverty

Increase food
security

Increase
nutrition &
health

Sustainable mgmt
of natural
resources

Examples of linkages:

- Calorie security is necessary for nutrition
- Income may enhance nutritional quality of diets
- Cognitive ability is needed for capitalizing on empowerment
- Optimal natural resource management may enhance health
- Poverty impacts on both nutrition and health and sustainability

Examples of trade-offs:

- Differential effect of food prices on incomes of producers and consumers
- Productivity in the short term may negatively affect resource sustainability in the long-term
- Pathways out of poverty may impact negatively on natural resources
- Productivity and equity (poor or gender)
- Increased market orientation may disempower women

Examples of uncertainty:

- Producer portion of price increase depends on ability to export
- Commodity price ration fluctuations over time and their influence farmer choices
- Increased productivity on the forest margin may increase land expansion
- Increased income from diversified farming produce may not be used for diverse diets

Research may be aimed most often at one or the other of these goals specifically but it has intentional or co-incidental spillovers towards others. *In developing the results framework, a systematic consideration of the inter-linkages and hierarchy between SLOs, and SLO-specific pathways is needed for developing an analytically solid framework.* It is important, for instance, to clarify the relative contributions to rural poverty reduction of interactions impacting on macro economic growth at national level compared to those targeted specifically at the rural poor, and to what extent research takes into account the potentially contradictory effects on rural and urban poor. In many cases, however, the spill-over effects and potential negative effects of research aiming at one SLO on another SLO are not well known and they may depend on changing political, economic and climatic variables and constraints that cannot be addressed through agricultural research. It is therefore important that the assumptions and hypotheses regarding direct and indirect effects of agricultural research are established and updated.

Intermediate development outcomes

Across the current portfolio of CRPs there is a large gap between proposed research activities and milestones and clarity of how they can lead to impacts at the level of the SLOs. The ISPC considers that a major task for the CGIAR is to strengthen the SRF by establishing a realistic and defensible results framework at the level of *intermediate development outcomes* that form the major milestones in the individual CRPs' impact pathways towards the SLOs.

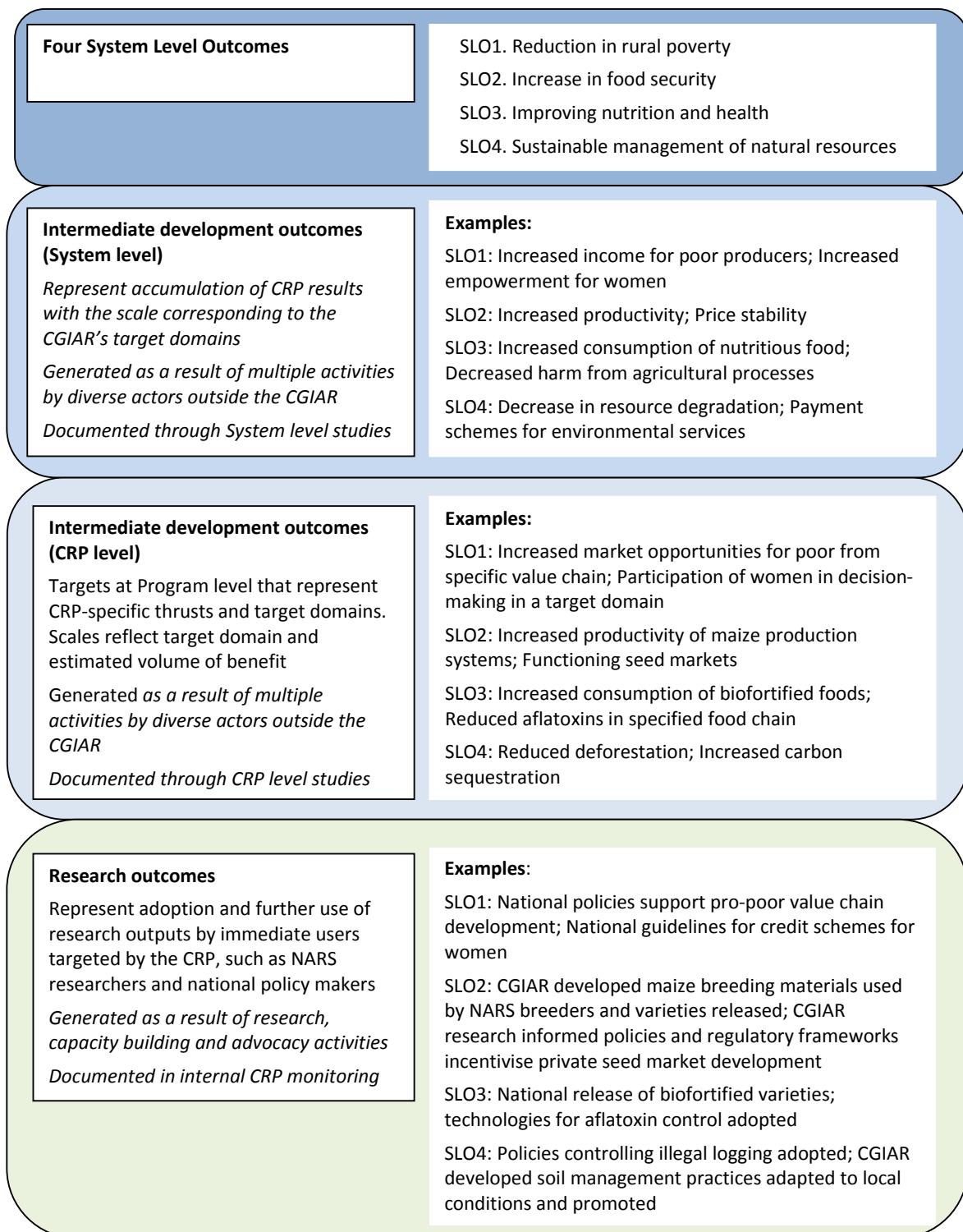
A conceptual framework including the intermediate results at the System and the CRP levels is shown in Figure 1, with examples of intermediate development outcomes.⁶ Key points here are that the results framework should reflect the constraints, issues and opportunities in agriculture-related development, forecast into the future, address issues for which the CGIAR has a comparative advantage, and serve as a guide for the prioritization, planning and monitoring processes at the CRP level.

At the System level intermediate development outcomes are described as aggregate outcomes, and the expected scale of benefit relates to the target domains (geographic and agro-ecological) that have been defined in the SRF. At a CRP level the scale and specificity of the intermediate development outcomes adhere to the program thrust and its specific prioritized target domains. The realization of intermediate development outcomes is, however, not in the control of the programs and depends on multiple, often iterative steps (illustrated in the Figures in Annex 1) conducted by other players and necessarily with substantial additional investment⁷. While the CRPs are accountable for their outputs and have some control over the near-term adoption and use of their research results, the development outcomes derive, particularly at scale, as a result of activities, policies and investments outside the CGIAR. Consideration of the external context and the drivers that influence change happening at scale is therefore important in impact pathway design. The CRPs need to consider the extent to which to involve development partners and, for example, policy makers and end-users in research planning. Despite the time lag from research interventions to change among the targeted populations and environments, the CRPs are expected to document these development outcomes through periodic studies on outcome and impact. At the aggregate, CGIAR's impact assessment also takes place through SPIA coordinated studies.

⁶ Greater detail is given in Annex 1, which highlights the level of integration of different research areas in a pathway towards the SLOs and how different research areas often have multiple goals.

⁷ The need for additional investments (for national research and development activities and capacity development of all types) is estimated to be 10-fold the CGIAR research investment in order to realize the anticipated impacts at the level of the SLOs (SRF draft, 2009; Lele et al., 2010)

Figure 1. Contribution to SLOs through intermediate development outcomes at System and CRP level⁸



⁸ Further examples of the Intermediate development outcomes at System and CRP levels are given in Annex 1

5. Priority setting: purpose, feasibility and challenges

Different dimensions of priority setting - By definition, priority setting implies making choices regarding what is done and what is not done. Priority setting processes can have economic, political and philosophical dimensions. The economic dimension is most often emphasized in the literature on agricultural research prioritization (largely involving *ex ante* estimations of economic returns to research). It is built on dual considerations, namely that resources for research are not finite and research is expected to generate benefits, which then are estimated and measured in economic terms. The political dimension, emphasized in much of the literature discussing the *process* of priority setting, combines the fact that (i) most donors and recipient country governments represent political constituencies and, (ii) political decisions influencing resource allocation choices need to be made within research institutions, including partner institutions. In real life situations priority setting is often primarily a political process including negotiation and the results from a prioritization process are but one input to decision-making.⁹ The philosophical dimension arises from there being different values, moral preferences and research paradigms. Given that the CGIAR's objectives are related to concepts of values (human and environment), the philosophical dimension is relevant for deciding where the CGIAR should operate.¹⁰

Priority setting at two levels – Priority setting is usually done at multiple levels (national, program, subprogram, project).¹¹ This reflects the reality in the CGIAR and is also implied in the SRF (2011). Because of the difficulty in matching strategic level considerations to quantified priority setting at the program level, and because of the overlapping goals presented by the non-mutually exclusive paths to the SLOs, the ISPC considers that a pragmatic approach to prioritization would be to define separate frameworks for the prioritization process at each level—the System and CRP levels—and to identify, with much greater clarity, the point of intersection between these frameworks and their reciprocal effects. At both levels it is useful to define the results that are expected from the process and a plan for their implementation. At the System level the current SRF needs to be strengthened by clarifying the relative ability of CGIAR research to contribute to meeting the four SLOs and by developing the results framework as discussed above. The CRP research priorities should reflect both the alignment of CGIAR research with developing country needs for agricultural development in the future and the problems and challenges where agricultural research can contribute to the solution. Planning of feasible impact pathways should be explicit showing the “cause and effect” of the research in the overall change process. The helpfulness of linking outputs to impacts through intermediate development outcomes has been recognized in the literature.¹² A plausible theory needs to link the intermediate development outcomes to the SLOs.

Discriminatory strength of priority setting - Because the areas of research that can arguably address the SLOs vary vastly in terms of risk, goals, timeframes, complexity, scale, stakeholder context etc. it is unlikely that one priority setting approach could be used to rank

⁹ See for instance Chapter 7 by ILRI in Raitzer and Norton, 2009.

¹⁰ These dimensions are well explored by Smith, 2001 and Sibbald et al., 2009

¹¹ Byerlee, 2000

¹² “Demonstrating the linkage between inputs (money, staff, authority, etc), outputs (programs operated and services delivered) and outcomes (impacts in the outside world) continues to pose serious theoretical and analytical challenges, but ... progress has been made with techniques like logic models, result chains, intermediate outcomes, adjusted performance measures, data envelopment analysis..” Thomas, 2008.

across all areas of research using a fixed set of criteria or a normative method.¹³ Thus it is not realistic to expect that priority setting can accurately discriminate between all options for research. Quantified *ex ante* estimates of benefits depend on multiple assumptions and there are areas of research where qualitative estimates are a better representation of expected benefits (such as natural resources policy). Furthermore, research is often pursuing new areas where there is no history to provide *ex ante* estimates. The systems-oriented CRPs are an example of this. At sub-CRP level, fast moving biotechnology and genomics research is another example. While it is essential to assess the utility assigned to alternative research options, be they estimated quantitatively or qualitatively, this utility is often not directly comparable across different areas of research. Discrimination between alternatives is strongest among options where similar quantitative data, and *ex ante* estimates can be generated, for instance prioritizing among alternative biotic stresses in maize systems or among different commodities in the CRP3 set provided that assumptions and data are similar.

Challenges in priority setting - Priority setting is generally considered demanding both in terms of resources, time, skills and availability of data and information and constrained by the difficulty in reaching agreement.^{14 15} The challenges in priority setting seem to relate, above all, to two factors: difficulty in gaining the confidence of very different stakeholder groups on the results of the process due to lack of understanding or consensus on essential values; and the effect of context in the choice of priority setting methods and tools, which relates to the issue of what constitutes evidence in priority setting. In general, the absence of studies documenting successful priority setting processes has been noted in the literature.¹⁶ The Science Council (2004) emphasized that priority setting is not only an analytical comparison but a management process, which, given the large number of uncertainties and elements of judgment, can at best provide a well described and well explained view of future research that carries internal logic and makes sense against all available evidence, and is respected and accepted by the key stakeholders and decision makers. In the CGIAR, experiences from several Centers have been recently documented.¹⁷ One of the major frustrations in priority setting at Centers has been the fact that funding over a decade or two became increasingly restricted risking atomization of research and rendering prioritization futile.¹⁸

Need for a consultative process - The SRF and priority setting processes are influenced by the fact that the CGIAR partnership has changed from what it was before the reform. There is a new, strong sense of linking the CGIAR into a bigger system of agricultural research for development (which is also demonstrated by the GCARD as an additional element of CGIAR stakeholder relations and involvement). This partnership nature is strongly emphasized also at the CRP level. Consequently, the framework within which the CGIAR and CRPs discuss priorities is wider now than before and requires more extensive dialogue. However, reaching the level of inclusivity and methodological optimization that is necessary for priority setting at a CRP level is not practical at the level of the System for agreeing on broad targets and domains. Thus context-specific well-structured consultative process is required at both levels.

¹³ Smith (2001), Campbell (2010)

¹⁴ SRF (2011); Indicated in several of the Center cases in Raitzer and Norton (2009)

¹⁵ “Although the establishment of priorities is an acknowledged necessity, it can be a painful and divisive process. It is a lengthy and costly process, through which building consensus is important among the participants. Approaches to priority setting must be tailored to match the situation. One size does not fit all.” Saritas 2006.

¹⁶ “Priority setting has been described as a series of unconnected experiments with no systematic mechanism for capturing the lessons, or evaluating the strengths and weaknesses of each experiment.” Martin and Singer, 209.

¹⁷ Raitzer and Norton (2009) compilations of lessons is a rare one.

¹⁸ See for instance Chapter 3 by CIP in Raitzer and Norton (2009)

Decisions on resource allocation - Strategic prioritization at the System level should aim at defining the indicative framework within which the relative emphasis of research for each SLO will be broadly determined. Decision-making at the SLO level is not well suited for predetermining the sets of activities and the required funding at operational level. The current distribution of funds is a reflection of the size of the Centers' pre-reform operations and volume of contracts and donor choices in support of new programs. The results framework can be used for shifting emphases on basis of new analysis revealing new opportunities and accumulated experience of progress. *The indicative guidance at the System level on size and balance among CRPs can be met by CRP investment proposals that need to be supported by prioritized action and delivery plans.*

Methods and tools for priority setting

Methods and tools are an intrinsic part of the priority setting process. They are chosen to facilitate a systematic consideration of criteria, data, assumptions, results expectations and diverse interests so that the process is fair, transparent, credible and acceptable to stakeholders¹⁹. No single priority setting method is equally applicable to all areas of research and scales. Availability of resources and information also influences the process and choice of methods. Therefore, different approaches (process and use of methods) may be required at the strategic CGIAR System level compared to those required at the more operational level in the CRPs. There are resources, however, such as maps, simulation models, option analysis and decision-making tools (including virtual stakeholder consultation tools) that have application both at the System and the CRP levels. The literature on priority setting for agricultural research has most commonly considered economic methods,²⁰ although Smith (2001) discusses agricultural research that falls outside the economic surplus and benefit/cost techniques. Byerlee (2000) classifies priority setting approaches as supply- or demand-oriented, the two often combined. With the objectives of research becoming broader and the needs of expected beneficiaries receiving more emphasis, there has been a shift from supply-driven approaches (typically within the research systems) to demand-oriented ones (involving a greater range of stakeholders) and including in the process a broader range of parameters and data at different levels. This shift has been accelerated by agreement on specific target domains and emphases on poverty and environmental objectives rather than broad-based technology growth. New challenges in agricultural research, such as the effects of climate change and risk are also influencing approaches to priority assessment.²¹

Priority setting methods are broadly divided into formal (analytical, measurement-based methods) and informal, consultative ones that may include some measurement. These are often used in combination. A detailed description of the most commonly used methods for prioritization of agricultural research are briefly described in Annex 2, and experiences in prioritization methods used in the CGIAR are elaborated in Annex 3.

Criteria - A key step in any priority setting at any level is to agree on the criteria used for discriminating between options. Criteria may depend on the goals of the research and the values of those who participate in the process. Hence, selection of criteria is an important

¹⁹ At CGIAR System level, the main stakeholder groups are researchers/research managers, partners at national and regional level and donors. At the program level the key stakeholders come from more narrowly defined constituencies of international and national research partners, development partners and research beneficiaries, program researchers and donors.

²⁰ Norton et al. (1992), Alston et al. (1996)

²¹ See for instance Chapter 9 by CIMMYT in Raitzer and Norton, 2009.

step. It often includes agreement on the weights among chosen criteria. The CGIAR (TAC and Science Council) has traditionally used three criteria for system level priority considerations and in research program review. As formulated in 2005²² these were: (i) Expected impact of the research on the major CGIAR goals (poverty reduction, food security and nutrition, and sustainable management of natural resources) taking into account the expected probability of success and expected impact if successful; (ii) Production of international public goods; (iii) Alternative sources of supply and CGIAR comparative advantage in the conduct of the research. These criteria are reflected in the current SRF. However, they encompass several components that need to be judged at different levels of the process. Probability of success has multiple dimensions, for instance at the research, adoption, up- and out-scaling and impact levels. Comparative advantage comprises of considerations of risk, urgency, feasibility and in its traditional sense assumes an ability to estimate comparable opportunity costs. The current debate on the effects that agriculture has on environmental sustainability may require cross-sectoral criteria to be agreed to judge the trade-offs between environmental goals and, for instance, productivity goals.

Multiple over-laid criteria are likely needed at different stages of the process. Data and information to allow consideration of the criteria are also needed but not always available. A consultative process inevitably involves subjectivity particularly when the options cannot be accurately evaluated for each criterion. An *indicative* list of criteria are shown in Box 2. It is an intuitive list drawing from literature and program proposals.

BOX 2. Examples of the kinds of criteria that could be used at different levels of prioritization

- Severity of key agricultural problems (System)
- Ability to address them through agricultural research (System)
- CGIAR competences and feasibility to expand them (System)
- Comparative advantage and likely changes in it (System/CRP)
- Relevance to SLOs (System/CRP)
- Opportunities in eco-regional or geographic targeting (System/CRP)
- Complementary and competing priorities of stakeholders (System/CRP)
- Existence of alternative suppliers (System/CRP)
- Plausibility and extent of benefits (CRP)
- Valuation of alternative benefits (CRP)
- Sustainability of benefits (CRP)
- International Public Goods dimension (CRP)
- Equity, particularly gender (CRP)
- Severity of constraints to adoption and feasibility to address them (CRP)
- Urgency (CRP)
- Probability of adoption and time scales (CRP)
- Ability to leverage on partnerships (CRP)
- New research opportunities (CRP)
- Risks and research constraints (CRP)

²² System Priorities for CGIAR research 2005-2015

Prioritization at level of the SRF

At the SRF level, strategic decisions need to be made on:

- The broad system level target domains, including regions, agro-ecologies and key commodity-based systems;
- Competencies needed;
- Appropriate volumes of research, which would give indicative directions for resourcing programs; and
- Set of intermediate development outcomes to guide CRP evolution and performance contract preparation

These decisions depend on a number of considerations, such as

- The likelihood of addressing the SLOs through agricultural research;
- Ability to estimate the likely benefits from different areas of research, for which a cluster of quantitative and qualitative estimates will be needed;
- Balancing between benefits of very different nature and accruing at different temporal and spatial scales;
- Addressing trade-offs between, for instance, macro and micro scales²³ and pursuing increased production while preventing resource depletion over the longer term; and
- Appreciation of the complexity of the interactive systems that influence change at the SLO level.

These considerations should influence both the scope of engagement in terms of addressing SLOs and how differential levels of outcomes from the different research activities are determined.

In the CGIAR, System-level priority setting could be expected to help identify the most important and urgent development problems which constrain achievement of the SLOs and which agriculture research can potentially help to solve. Regional differences, both in terms of research volume and importance of specific problems, would likely emerge. Given that most CRPs have specified their target regions or agro-ecosystems, an initial iteration is needed between priority setting at System and CRP levels to ensure alignment. (Further iterations during the lifetime of the CRPs can also be used to adjust resource allocations as progress is made.) Priority setting at this stage (through revision of the existing SRF) could confirm the extent of focus on traditional areas of research, such as targeting food security through certain commodity-based systems, or propose incremental changes. It could help define an optimal focus on the relatively new area of nutrition and health and help to clarify the pathways for agricultural research to enhance nutrition and health, which are not yet well understood.²⁴ A total overhaul of the research portfolio in the CGIAR with some well established key competencies and major assets is not the aim. Yet, the System needs to strengthen its analysis-based responsiveness to new challenges, locating critical mass more efficiently and managing inevitable risks through a prioritized portfolio approach.

A major requirement for a prioritized results framework is to give indications of where the CGIAR should focus its research efforts. The size of resources applied to any one SLO would be an example. However, the interrelatedness of the SLOs suggests that strict SLO-based allocations (i.e. a CRP directed solely to the outcomes required for one SLO), would not

²³ Ryan (2004) discusses the discrepancy between macro level priority setting and local level effects with respect to poverty alleviation.

²⁴ Shankar, 2012

provide appropriate guidance for developing CRPs. Determining activity or sector-based allocations would ignore the fact that several different programs can pursue similar goals, often through integrated research, and produce a more likely overall impact.²⁵ For determining volumes, scope and resourcing in the broad terms, an entry point may be found through an analysis of:

- The SLOs regarding their distinct nature, interlinkages and hierarchy,
- The constraints at the intermediate level (for example related to productivity, prices or land use change) that the CGIAR is in best position to address;
- A coherent system-wide approach to capacity building to be developed; and
- The current balance of competences and assets.

The priority setting approach needs to satisfy both the core group that engages in the revision of the SRF and SLO/portfolio level decision making, and the broader CGIAR community and its stakeholders. This is because any shift in the relative emphasis on domains, systems or specific SLOs needs to be reflected in program adjustment and funding and be understood and accepted by those involved in order to lead to effective implementation. Therefore, the process to determine SRF level strategic choices needs to be consultative and involve the key stakeholder groups: CGIAR consortium and office, research leaders across the CGIAR, key external stakeholders representing active partners, and donors. It is important that there is a broad disciplinary span and ownership by all groups and that the process is grounded in the work done in the CGIAR and its unique context. Due to the demands to cater for a cross-section of perspectives and interests and secure confidence among those involved and affected, the process would benefit from external professional facilitation and external leadership. There are considerable costs and the process needs to be sufficiently resourced. However, major resources (including data, information and maps) are already available within the CGIAR, for instance modeling capacity.

The SRF updating and decision-making process should cover:

- Updating the analysis of the external environment and subsequently determining the broad target domains, agro-ecosystems and commodity-systems that describe the CGIAR orientation at macro level;
- Scheduling work on acquisition, commissioning and synthesizing reports and information for the aforementioned analyses;
- Completing a design of intermediate development outcomes and their linkages to multiple or discreet SLOs;
- Identifying the set of intermediate development outcomes, which should be as small as possible but as big as necessary (using explicit, agreed criteria);
- Decisions on the relative importance of the intermediate development outcomes which will be reflected in the broad range allocations to research addressing each outcome.²⁶

Prioritization within CRPs

Priority setting at the CRP level is an urgent task for supporting the development of a single, coherent portfolio of CRPs. Several CRPs have included prioritization in their plans and a few are completing the process. Most, however, still have to define more clearly the research

²⁵ “..we started from a position that the CGIAR could achieve the greatest impact by integrating research on increased productivity, natural resources management, and institutional and policy change.” SRF draft, 2009.

²⁶ The actual funding decisions would depend on the quality of the proposal to address the SLO through the prioritized intermediate outcome. Chosen research (components of CRPs) should be sufficiently resourced.

topics and areas, and the approaches and pathways, which provide the most convincing value propositions for delivering results towards the SLOs. It is anticipated that greater clarity in the intermediate development outcomes will help the CRPs to define their targeted development outcomes as well as the high priority research. An analysis of the constraints and conditioning factors should create understanding of each CRP's likelihood of having outcomes through different avenues and thus inform the choice of research approaches, partnerships and capacity building strategies.

At the CRP level, priority setting should identify what the program will do and, as importantly, will not do. Given that most programs are not created *de novo* but result from accumulation of continuing work of different relevance or urgency to meeting SLOs, priority setting with such CRPs could be expected to help transition from a compilation of earlier activities to a coherent program agenda well aligned to the SLOs. Priority setting could help identify areas of research to be discontinued, for instance due to reasons of low feasibility of research, ability to devolve to national research institutions, stalled progress and limited prospects of research success, or loss of comparative advantage due to new sources of research supply. It could also help identify areas where the current scale of the approach is too limited for research to be effective, or areas that can be scaled-down without loss of likely effectiveness. The assessment of CRP proposals conducted by the ISPC revealed the need for assessing priorities and strengthening impact pathways for improving focus.

Appreciating pluralism in CGIAR research - Notable differences between the CRPs and the areas of research, influence the design of the impact pathways and prioritization at CRP level. The timeframes from the start of research to reaching benefits is generally long and the feasibility and reliability of attributing the benefits to research interventions varies. There are multiple constraints along the impact pathways that will differ substantially between different types of research and different CRPs and CRP components, starting from the uncertainty of the scientific advances themselves. Several iterative steps requiring enhanced human capacity, adaptation, adoption, policy changes, institutional incentives, and up- and out-scaling will have to take place for eventual impacts to accrue that often dependent on other development advances in the societies and communities and are fully realized several decades after the research was done.²⁷ Countries and regions that are constrained regarding infrastructure and institutions and have high levels of rural poverty tend to be the primary targets of CGIAR research. This makes it even more important that the constraints to uptake (i.e. the context in which the research results will be applied) be taken into account in priority setting, impact pathway development and monitoring of progress. Insurmountable constraints that cannot be addressed by research, capacity building or partner strategies may render certain activities, or activities in certain locations, a low priority.

The expertise, lessons, and methodological considerations to be found in the literature implicitly if not explicitly apply to situations of single organizations, sets of technologies, research areas, or program (i.e. having certain necessary elements of unity, and potentially culturally more similar than the set of different organizations and research approaches that comprise the new CGIAR at this moment of transformation). In the CGIAR Center experiences, the importance of demand-driven approaches including consultative methods and combining different approaches is generally emphasized; however, always recognizing

²⁷ “Even a relatively narrow question of how many farmers adopt a new variety is dependent on such factors as agroecological conditions, education of the farmer, availability of extension services, access to output markets, availability of credit, or efficiency of input markets. These were all factors in place in the Asian green revolution, but all to varying extents ineffective in sub-Saharan Africa.” Lynam, 2007.

the importance of the supply side in terms of generating the potential of science to solve priority problems. There is a need to fully engage scientists, research managers and external partners. This will be a common element in priority setting across all CRPs, even if the methodologies and approaches, and criteria to be used are determined within the CRP-specific context. At some point, impact pathways need to converge, to contribute effectively to the SLOs. Within the CRPs, however, differences in goals, scale, timeframe, risk, complexity, partnership etc will influence the choice of priority setting approaches, including data needs and level of stakeholder involvement and process details. The divergence in practices and approaches illustrates how different research paradigms influence the consideration of objectives and evidence when prioritizing and evaluating plausible outcomes. In the CGIAR, the paradigms in systems research (Series 1) and resource management research (CRPs 5, 6 and 7) are likely to be different from those for commodity research (Series 3). An example of such discussion in the health sector is given in Box 2.

However, *the differences in the research contexts that should determine the most appropriate priority setting approaches should not undermine the requirement for the adoption of common measures and metrics for similar data, phenomena and outputs (such as definitions of poverty and measures of livelihood; units of carbon or water saved; and measures of productivity) used and reported by different CRPs in different settings – without which it will be impossible to chart System progress through research.* Thus these issues need to be considered within the SRF.

BOX 2. Health sector example

In the health sector there has been more recent discussion, than in the agriculture sector, on the effect of shifting research paradigms on research strategies; for instance comparing disease-focused research with systems and policy research where there are considerable analogies with the agriculture sector. Drawing from the experience of epidemiological (rather than biological) approaches to non-communicable diseases, Morris et al (2006) highlight that there often isn't strong statistically valid evidence of the causal association between a number of interrelated agents and the problem being addressed. In priority setting, this tends to shift favor to single agents amenable to quantitative evaluation of cause-effect relations. Yet an approach to consider only one agent misses added and interactive effects, including environmental, behavioral and societal influence on the cause and outcome. Morris et al. highlight the importance of seeking new ways of gathering, arranging and interpreting evidence and embracing new modes and means of intervention within an evaluative culture. They propose a strategic framework where the goals are clearly articulated, there is a framework for assembling evidence of the causal pathways; the evidence informs priority, and evaluation is embedded within the culture. Such strategy should inform and evaluate the policies and actions necessary for a beneficial change.

Recognizing the role of “components” in research - The areas of research that in the CGIAR lead most directly to development outcomes include commodity research, NRM research and systems research (illustrated in Annex 1). Of these, priority assessment methods are relatively well developed for commodity research regarding individual productivity-enhancing or cost-reducing technologies. There are also areas of research that have no direct development effects at all. For instance genetic resources research, biotechnology, bioinformatics and genomics research are aimed at improving the efficiency, quality and direction of commodity-oriented research and have no direct development effects. Priority

setting approaches have been described, for instance, for biotechnology²⁸ and prioritization can help choose among many alternative investment options which have considerable risk, cost and partnership implications and cross-linkages to other CRPs. Some areas of research have their effects largely through complementing other areas. Often a package of technologies, policies and managerial adjustments contribute to the results particularly for achieving longer term sustainability and context relevance. Much of policy and social science research is intended to improve the opportunities for other research through targeting, to facilitate uptake and to monitor effects.²⁹ Part of NRM research is intended to improve the realization of the potential benefits from, for instance, high yield potential. Integrated systems research, which is a relatively new area in the CGIAR, is aimed at sustainability and improvement of adoption by changing community behavior and addressing risk-, vulnerability- and empowerment-related constraints to development. The variability of pathways and levels by which different areas of research contribute to the ultimate results from research is challenging for priority assessment when it is difficult to determine the extent to which the component research interventions accelerate success or improve sustainability. However, part of the internal CRP prioritization and monitoring needs to be for improving efficiency or research, strengthening the impact pathways, and increasing the likelihood of results rather than planning and monitoring the main development outcomes.

Capacity building - A component of agricultural R&D where the CGIAR's role has been debated is capacity building. It is recognized that the CGIAR has had, and can continue to have, a significant input to the development of national capacity.³⁰ It is also recognized that capacity in developing countries is highly variable and can be a significant constraint to adoption and building national and regional ability to maintain and leverage the successes from international research. Out- and up-scaling depends crucially on that capacity.³¹ The capacity building activities in the CRPs thus also enter the impact pathways and need to be strategically planned. There may, however, be opportunities for economies of scale in planning for capacity building at the System level and thus a coherent system-wide approach to capacity building should be considered at SRF level and find detailed articulation in future CRP descriptions directly linked to their impact pathways.

Decisions on resource allocation - In a two-step process, the actual funding propositions should be guided by strategy but derived through a “bottom-up” process on the basis of proposed research, prioritized within CRPs. A mechanism commonly used elsewhere selects priorities on the basis of the quality of the research proposed, involving a competitive call of proposals for prioritized themes or topics.³² The new CGIAR System does enable some competition at the portfolio level,³³ but given the different stages of development of different CRPs, it has not been possible for this to be undertaken on basis of the quality of the science proposed. Competitive elements within CRPs are likely to strengthen the quality of the

²⁸ Braunschweig, T., 2000

²⁹ Social Science Stripe Study (2009) identified three major areas of useful interventions for social science for improving productivity growth, poverty reduction and sustainable NRM: (i) via technology innovation in close collaboration with natural scientists; (ii) through institutional innovation; and (iii) by directly informing agricultural and rural development policy.

³⁰ Training study 1995

³¹ “success is only possible with input at different levels and from many disparate constituencies whose capacity to implement change may be variously constrained” Morris (2006)

³² Experiences from other organizations are discussed in a supplementary document

http://www.sciencecouncil.cgiar.org/fileadmin/templates/ispc/Expert_advice/Advice_to_the_CGIAR/Experiences_of_strategic_priority_setting_outside_the_CGIAR.pdf

³³ The Challenge Programs represented an experiment to introduce competition for program development.

science as the CRPs evolve; so far any competitive elements have been limited to resourcing some research by partners. CRPs can also show the process of alternative research avenues and approaches “competing” within a program and how decisions were made. That said, priorities at the System level do need to continue evolving as well, given the rate of change and the economic and environmental context within which the CGIAR operates, but such changes need to take into account and balance the need for emerging issues with the continuity of research for the long term horizon and long-standing problems. The collation of data to enable monitoring of progress towards delivery of intermediate development outcomes will be an important tool to enable this prioritization to occur.

Literature

- Alston, J.M., Norton, G.W. and Pardey, P.G. 1995. Science under scarcity: Principles and practices for agricultural research evaluation and priority setting. Cornell University Press. Ithaca, NY. 513 pp.
- Braunschweig, T. 2000. Priority setting in agricultural biotechnology research: Supporting public decisions in developing countries with the Analytical Hierarchy Process. Research Report No. 16. ISNAR, The Hague: International Service for National Agricultural Research.
- Byerlee, D. 2000. Targeting poverty alleviation in priority setting for agricultural research. *Food Policy* 25: 429-445
- Campbell, S. 2010. Deliberative priority setting – a CIHR KT module. Canadian institutes of Health Research. <http://www.cihr-irsc.gc.ca/e/43533.html>
- deJanvry, J. and Sdoulet, E. 2002. World poverty and the role of agricultural technology: Direct and indirect effects. *Journal of development studies* 38:1-26.
- Douthwaite, B., Kuby, T., van de Fliert, E. and Schulz, E. 2003. Impact pathway evaluation: an approach for achieving and attributing impact in complex systems. *Agricultural Systems* 78: 243-265.
- Earl, S., Carden, F. and Smutylo, T. 2001. Building learning and reflection into development programs. International Development Research Center, Canada.
- Falconi, C.A. 1999. Methods for priority setting in agricultural biotechnology research. In: Cohen, J.I. (ed.) *Managing Agricultural Biotechnology-Addressing Research Program Needs and Policy Implications*
- Friedman, A. and Danis, M. 2011. Intransitivity and priority setting. *Journal of Philosophical research* 36:173-189.
- Gardiner, P., Hagmann, J. and Hahne, G. 2003. Planning in muddy waters-Orientation for strategic planning in CGIAR Centers, in Patricia Munro (ed.), WorldFish Center: 34 pp. http://www.cgiar.org/pdf/agm08/agm08_reform_proposal.pdf
- ICRA Learning Materials. Priority Setting – Approaches. http://www.icra-edu.org/objects/angolearn/Priority_Setting-Approaches.pdf
- Ingram J., Erickson, P. and Liverman, D. (eds.) 2010. Food security and global environmental change. Earthscan. London. Washington DC. 382 p.
- Lele, U., Pretty, J., Terry, E. and Trigo, E. 2010. Report for the Global Conference on Agricultural Research (GCARD). Draft 11.0
- Lynam, J. 2007. Research into development: Assessing CGIAR research priorities from the perspective of development challenges. Nov. 2007. Paper prepared for the Alliance of CGIAR Centers.
- Manicad, G. 1997. Priority setting in agricultural research. *Biotechnology and Development Monitor* No. 31. <http://www.biotech-monitor.nl/3102.htm>
- Martin, D., and Singer, P. 2000. Priority setting and health care technology assessment: beyond evidence-based medicine and cost-effectiveness analysis. In C. Ham, & A. Coulter (eds.), *The Global Challenge of Health Care Rationing* (pp. 135-145). Buckingham: Open University Press.
- Melamed, C., Scott, A., and Mitchell, T. 2012. Separated at birth, reunited in Rio? A roadmap to bring development and environment together. Background note. Overseas Development Institute. 8 p.

- Norton, G.W., Pardey, P.G. and Alston, J.M. 1992. Economic issues in agricultural research priority setting. *Am. J. Ag. Econ.* 74: 1089-1094.
- Peacock, S., Mitton, C., Bate, A., McCoy, B. and Donaldson, C. 2009. Overcoming barriers to priority setting using interdisciplinary methods. *Health Policy* 92:124-132.
- Raitzer, D.A. and Norton, G.W. (eds.) 2009. Prioritizing agricultural research for development. Experiences and lessons. CABI Wallingford, UK. (and references within)
- Ranson, M.K. and Bennett, S.C. 2009. Priority setting and health policy and systems research. *Health Research Policy and Systems* 7:27. 7p.
- Reece J.D. and Sumberg J. 2003. More clients, less resources: toward a new conceptual framework for agricultural research in marginal areas. *Technovation* 23: 409-421.
- Ryan, J. (2004). Agricultural research and poverty alleviation: Some international perspectives. ACIAR Working Paper No. 56. 31 p.
- Sandker, M., Campbell, B.M., Ruiz-Perez, M., Sayer, J.A., Cowling, R., Kassa, H. and Knight, A.T. 2010. The role of participatory modeling in landscape approaches to reconcile conservation and development. *Ecol. Soc.* 15:13. [online] URL: <http://www.ecologyandsociety.org/vol15/iss2/art13/>
- Saritas, O. 2006. Technology Foresight Training Program. Module 1. Technology Foresight for Organizers. University of Manchester. Science Council, 2004. Report on CGIAR priorities and strategies for 2005-2010.
- Sayer, J.A., Campbell, B., Petheram, L., Aldrich, M., Ruiz Perez, M., Endamana, D., Dongmo, Z-L.N., Defo, L., Mariki, S., Doggart, N., and Burgess, N. 2007. Assessing environmental and development outcomes in conservation landscapes. *Biodivers Conserv* 16: 2677-2694.
- Science Council, 2010. SC comments on the document: "Towards a Strategy and Results Framework", version of 21 October 2009.
- Shankar, B. 2012. Trends and policies in the agri-food sector and their impacts on diets/nutrition. Presentation at the 6th meeting of the Independent Science and Partnership Council of the CGIAR. http://www.sciencecouncil.cgiar.org/fileadmin/templates/ispc/documents/Meetings_and_events/ISPC_meetings/ISPC_5_INDIA/presentations/Bhavani.pdf
- Sibbald, S.L., Singer, P.A., Upshur, R. and Martin, D.K. 2009. Priority setting: what constitutes success? A conceptual framework for successful priority setting. *BMC Health Service Research* 9:43 doi:10.1186/1472-6963-9-43
- Smith, P. 2001. Priority setting in agricultural research: Beyond economic surplus methods. *Public Admin. Dev.* 21:419-428.
- Standing Panel on Priorities and Strategies. 2004. Report on CGIAR priorities and strategies for the period 2005-2010. Incomplete draft. Science Council.
- Stewart, J. Models of priority setting for public sector research. *Public policy* 24:115-126
- Technical Advisory Committee 2000. CGIAR priorities and strategies for resource allocation 1998-2000 and Center proposals and TAC recommendations. TAC Secretariat.
- Thomas, P.G. 2007. Why is performance-based accountability so popular in theory and difficult in practice? Paper presented to the World Summit on Public Governance: Improving the Performance of the Public Sector – Taipei City, May 1-3, 2007
- Wood, S., Erickson, P., Stewart, B., Thornton, P. and Anderson, M. 2010. Chapter 3 Lessons Learned from International Assessments. (in) Ingram J., Erickson, P. and Liverman, D. (eds.) Food security and global environmental change. Earthscan. London. Washington DC. 46-62.

Annex 1: CGIAR impact pathways and development of intermediate development outcomes

Annex 1 illustrate and expand on the demarcation of the CGIAR System at two levels considered for priority setting in the main report. The figures are indicative of how the interface between the SRF and the four SLOs and the CRPs could be developed by agreeing on intermediate development outcomes that reflect a prioritized results framework and which can be monitored.

Figure A1 presents a generic impact pathway from the main research activities to the SLOs. It illustrates different kinds of deliverables and interventions in the main areas of research. It highlights:

1. The pathways from research activities that lead directly to development changes at the intermediate level that contribute to one or more SLOs. Research on commodities (crops, livestock and fisheries), natural resource management, agricultural systems and policy result in such changes. However, in most cases, an integrated approach is needed, which means combining commodity, resource management and policy interventions for the outcomes to be realized and for the benefits to accrue.
2. The pathways from natural resource management and social science research for more sustainable systems and for better targeting of research and addressing adoption and development constraints.
3. The pathways through systems research for better addressing specific adoption constraints, vulnerability and risk.
4. The pathways from research on genetic resources and biotechnology that lead to outcomes indirectly by increasing the efficiency and quality of commodity research, for example.
5. Other activities, such as capacity building, vitally important for the achievement of the results from research. Other such activities include advocacy and awareness raising (not shown in the Figure).

Multiple programs are likely to contribute to the same outcomes and many of the outcomes depend on cross-disciplinary and cross-sectoral interventions. The need for considerable capacity building, only some of which comes from the CGIAR, and additional investments on agricultural R&D—other than in the CRPs—is highlighted.

Figure A2 zooms in on the SLO-CRP interface presenting a set of potential intermediate development outcomes both at the aggregate and the CRP-specific levels. At the System level, these outcomes represent results in the aggregate and within the broad CGIAR target domains and at scales defined at the System level. The intermediate development outcomes at the System level reflect the key development challenges that can be addressed through agricultural research and the competencies, main assets and main areas of comparative advantage of the CGIAR. They are a prerequisite for the SLOs and logically linked to them

At the CRP level, the intermediate development outcomes are specified within the program context and adhere to the main program thrusts and specific target domains, such as choice of countries or agro-ecosystems. The intermediate development outcomes are designed to generate specific direct effects on the SLOs, but they very likely also have spill-over effects on other SLOs. Trade-off effects on competing goals are possible and need to be understood.

Figure A1. Generic impact pathways from main research activities to SLOs

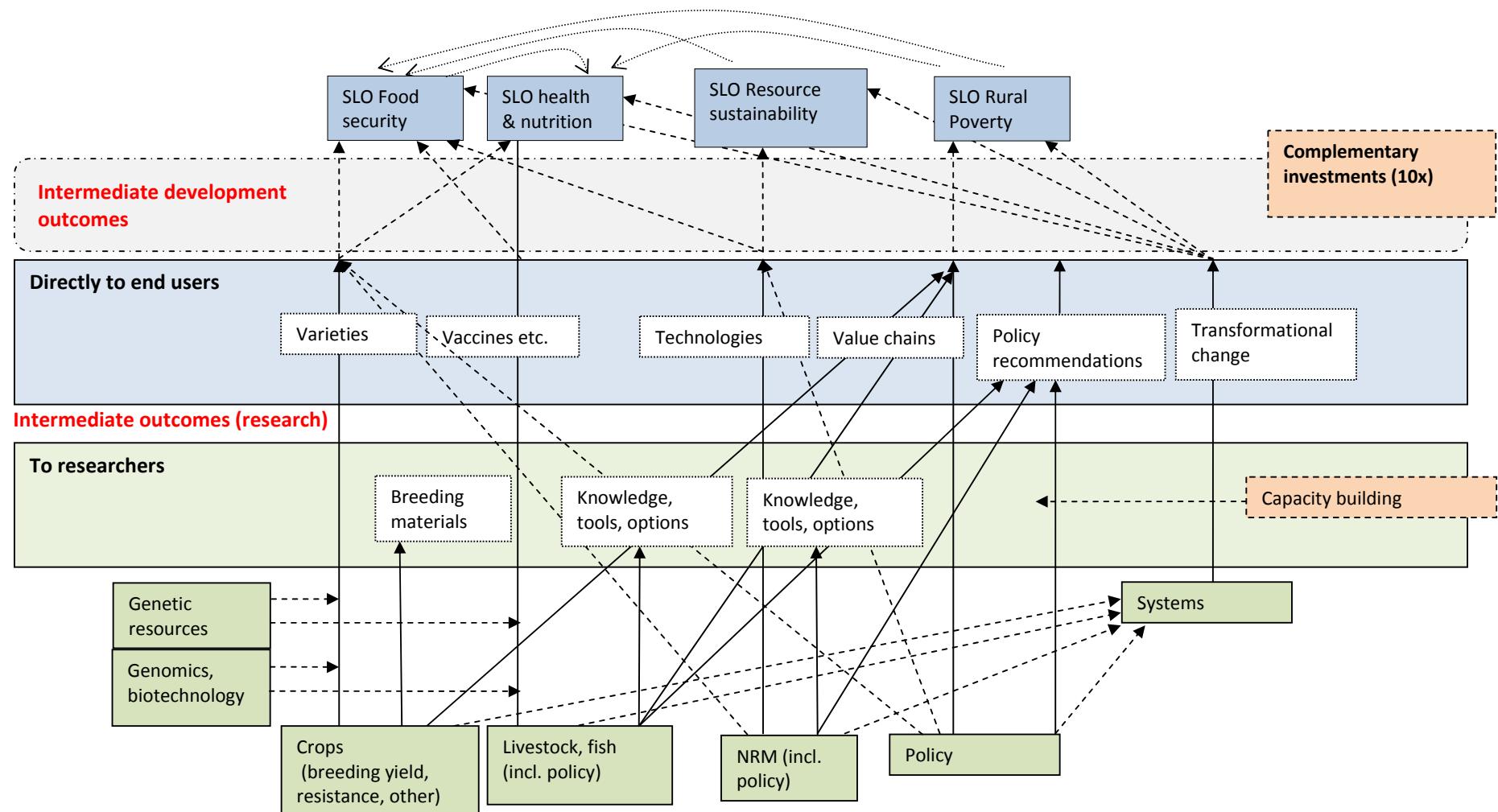


Figure A2. Intermediate development outcomes

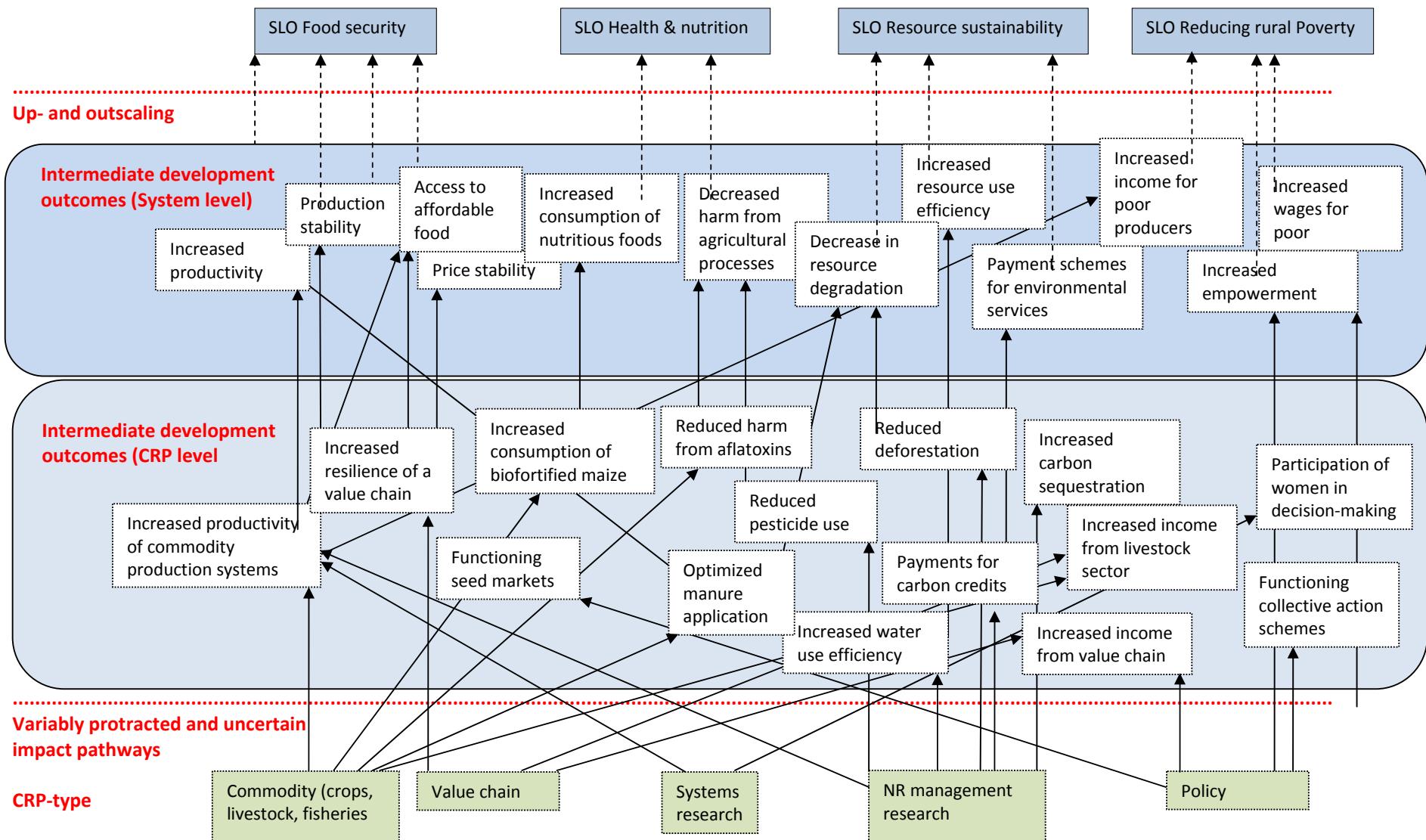


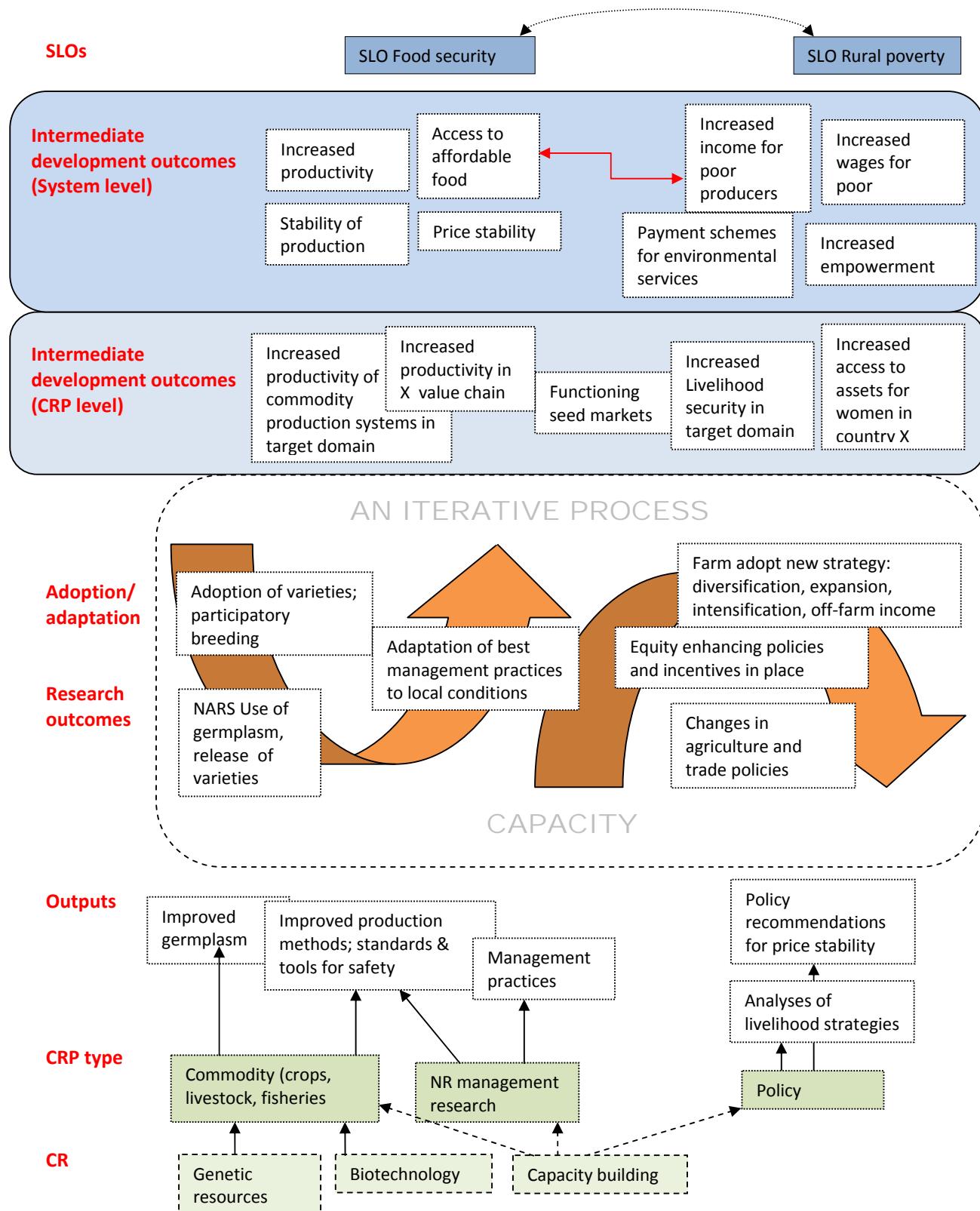
Figure A3 outlines two vertical pathways for different types of programs from research activities and outputs to the SLOs. The main idea is to illustrate the potential complexity and uncertainty between research outputs and intermediate development outcomes. For much of research, this involves several cycles of NARS research, testing, piloting, adjustment, further testing, working in partnerships with private sector, extension, advocacy agencies and farmer groups. It also includes involvement of other actors such as policy makers, marketing and distribution agents. Capacity, resources and policies regulating research are examples of the constraints of the applied and adaptive research phase. Subsequent adoption and up- and out-scaling depends on a multitude of conditions, including agro-ecological and climatic, capacity at end-user level, policies, infrastructure, extension and advisory services, input- and output markets, credit etc. The trade-offs between different objectives and different actors are also to be considered.

The timeframes from start of research to reaching benefits is generally long and the feasibility to attribute the benefits to CRP interventions varies. There are multiple constraints along the impact pathways that will differ substantially between different types of research and different CRPs and CRP components. The scientific advances (knowledge, technologies and system innovations) themselves are uncertain as is their passage to impacts. Several iterative steps requiring enhanced human capacity, adaptation, adoption, policy changes, institutional incentives, and up- and out-scaling will have to take place for eventual impacts to accrue that often are fully realized several decades after the research was done.³⁴ Countries and regions that are constrained regarding infrastructure and institutions and have high levels of rural poverty tend to be the primary targets of CGIAR research. This makes it even more important that the constraints to uptake (i.e. the context in which the research results will be applied) be taken into account in priority setting, impact pathway development and monitoring of progress. Insurmountable constraints that cannot be addressed by research, capacity building or partner strategies may render certain activities a low priority.

A factor, essential for outcomes and impact, not shown the Figures, is the increasing contribution from partners occurring at three stages: directly participating in the CRPs; contributing to the CRPs through their own complementary projects and investments; and contributing to the outcomes through involvement in subsequent innovation, adaptation, and additional research and development. Thus their role is important both in impact pathways design and priority setting.

³⁴ Lynam, 2007

Figure A3. Examples of impact pathways for two SLOs



Annex 2. Methods and tools used in agricultural priority setting

Methods

Congruency analysis - The method has been used in the past for commodity programs for allocating resources to a commodity on the basis of an indicator, such as the value of a single measure of productivity or area sown. The method is considered simple, transparent and cheap. The negative aspects are its poor logic as the single measure is only weakly associated with impact of research; the difficulty to compare different research areas; its inadequacy with the growing diversity of research activities and the need to prioritize issues with no market value; its inability to address complex situations due to the single criterion, limited scope for stakeholder participation and inability to prioritize new areas of research. In the CGIAR poverty weighted congruency analysis was used until 1997.

Economic surplus method (ESM) – A group of formal economic methods apply a variant of the EMS. EMS attempts to capture aggregate benefits from a change affecting production and consumption on the basis of a set of assumptions. Cost/benefit analysis is usually associated with EMS. Priority setting is based on greatest economic benefits comparing the value of increased production/benefits accrued and the cost of research. Advantages are that ESM calculates benefits to both consumers and producers; it incorporates other changes in the system, such as population, income, area, policy etc., and has a strong theoretical logic. Given the uncertainty associated with economic models, a sensitivity analysis allows assessment of the impacts of changes in certain parameters that influence the conclusions. That may help determining in which parameters are the key drivers of the results. ESM is best suited for research on commodities with transparent markets and for research with a single objective. Application may include highly complex assumptions and demanding mathematical specifications. EMS is neither simple, nor cheap and has limitations with ill-structured problems.³⁵ It excludes areas that have no direct monetary value and has difficulties with fuzzy variables. Due to its dependency on elaborate data and high level skills in economics, and reliance on many assumptions, it is not transparent to non-economists. It offers little scope for participation of stakeholders. *Econometric approaches* used for statistically estimating aggregate impacts of past research investments, and *Mathematical programming*, a highly sophisticated method for implementing the EMS, require time, skills and high quality data.

Scoring methods - Scores are used when there are multiple objectives for research and they usually combine criteria on benefits and cost, such as prospective economic impact, scientific merit, feasibility, compliance with policy, and indicators for those criteria. Weights reflect the relative importance of the criteria as determined by the decision-makers. Scores for each potential activity are added or combined to get values (for instance a weighted composite index) that can be ranked. The advantages of scoring methods are: versatility as it is applicable to research choices at all levels; it is possible without the high-quality data required in ESM and can deal with non-quantitative issues; it is relatively transparent and cheap and allows participation of non-specialists. The negative aspects are that the weights are often highly subjective and furthermore the results can, despite plausible assumptions, be odd (due to inconsistency in the ranking orders). The method can lack analytical rigour, which can be corrected for, although this may reduce the transparency.

³⁵ “Ill-structured problems mirror real world problems where data are conflicting or inconclusive, where disputants disagree about appropriate assumptions or theories, or where values are in conflict.” Carlton College, 2010.

Analytical hierarchy procedure - AHP has a comprehensive logical framework to analyze the issues in light of both quantitative and qualitative information. In this procedure, a complex problem is reduced to simple pair-wise comparisons. A hierarchy is constructed of goals, criteria and the options. The process involves weighing criteria (and sub-criteria) and scoring the options by criterion using qualitative scales. AHP has its use in complex decision-making. It is supported by a commercial software “Expert choice” and is common in commercial decision-making. The advantages are that it accommodates multiple criteria and is simple and intuitive while having mathematical rigour. Unlike with scoring, AHP offers a process for correcting inconsistency in results. AHP can facilitate participation, learning, debate and revision. The disadvantages relate to the length of the process which increases with the number of levels and number of pair-wise decisions. Its dependency on the commercial software may be a limitation.

Delphi technique – Delphi, originally developed as a forecasting tool, can be used in scoring and other approaches above including the ESM. It is an intensive and specialized group problem-solving method to harness and reconcile the knowledge and judgment of several experts. It involves a systematic elicitation and synthesis of opinions and judgments through successive rounds of questionnaires, information summaries and feedback. It is often done anonymously and thus eliminates excessive influence of senior or dominating individuals that might occur in face-to-face discussions. During the process, as participants revise their answers in light of the replies of others, the range of answers decreases and there is convergence towards consensus. Delphi can help facilitate difficult and complex decisions. It can suffer from the absence of interaction and be influenced by how the process is framed and conducted. Methods relying on *Expert Panels* can also facilitate structured thinking towards consensus but are again dependent upon choice of panel members, and skills in leadership and facilitation.

Participatory research program formulation - There are many variations of participatory processes (for instance Participatory Impact Pathway Analysis, PIPA, used by CPWF in the CGIAR) and for instance AHP and Delphi include participation. A participatory process has multiple steps combining the skills and knowledge of many different people and disciplines incorporating creative and analytical thinking. There is usually less emphasis on quantitative measurement approaches. The rigor of the approach is not in the methodological depth but on the systematic step-wise consideration from problem identification to selection of options. The limitations are vulnerability to the composition of the group involved, considerable requirement of data to support judgment and high demand on time.

Use of different priority setting tools and methods at CGIAR Centers

CGIAR Centers have used a variety of approaches to research prioritization for informing decision making on strategies, research directions and resource allocation. Economic surplus analyses have been used in Centers with commodity programs, often combined with scoring to capture expert judgment on criteria such as probability of research success, and sometimes as a component to develop composite scores for ranking investment options. Economic approaches have often had a commodity focus and prioritized among alternative research objectives, such as a large number of potentially important biotic and abiotic stresses in crop production. The formal methods that Centers have used have been based on estimates of product value and consumer and producer benefits.

There are several examples of formal priority setting approaches that Centers have developed for their specific situations. CIP’s most recent and sophisticated approach included economic

surplus measures, qualitative scoring models, disability-adjusted life years methods and modeling of poverty impacts in order to include a better coverage of the multiple objectives. The Center used *ex post* impact assessment to confirm the relevance of some longer-term research areas and subsequently used the prioritization results to de-emphasize certain technologies. IITA's Priority Assessment Exercise combined economic surplus analysis with expert opinion, but was conducted in one country only for prioritizing commodity research programs. ICRISAT developed a multidimensional composite index based ranking for its 1994-98 planning. The approach combined economic surplus analysis for economic efficiency consideration with assessing other criteria (equity, internationality and sustainability) through clearly defined data, indices and weights and drawing from expert judgment. ILRI in 1999 engaged in a comprehensive process, involving a broad range of research and partners. The approach consisted of economic surplus and standard cost/benefit analyses, indices for estimating contribution to poverty, environmental impact and internationality, and scoring to support judgment of some of the criteria and trade-offs among them. A landmark in CIMMYT's priority setting was development of the Research Allocation Tool (RAT), which involved development of a database on key parameters, surveys, indices for poverty, relevant of CIMMYT's commodities and strength of partnerships, and sensitivity analyses.

Natural resource management research often aims at improving the performance of the system that produces a variety of goods and services, between which there may be trade-offs. In a policy-oriented context each specific output has many potential user groups and impact pathways. The benefits may accrue through system stability and its ability to produce benefits into the future and both for local and global beneficiaries. Thus total benefit estimates cannot be based on single commodity or single time period performance. Advanced economic systems simulation models are an example of priority setting method in environmental research, which also typically uses participatory approaches. Landscape approaches are commonly used when the aim is to improve both local livelihoods and generating environmental benefits.³⁶ CIFOR has used a Research Application Area Framework process, which is based on semi-quantitative estimates of impact potential and feasibility and additional set of criteria, and informed by back-ground analysis on trends and status and regional needs assessments. The Center has also used a qualitative approaches based on the Delphi method and structured scoring. Commodity research also needs to define resource management priorities to support sustainable production. In the ILRI example, for instance, environmental criteria, and considering both direct and indirect effects, were given a strong emphasis.

Participatory processes involving stakeholders have been used widely. For instance, the processes at IITA, WARDA, ICARDA and ICRISAT have relied strongly on regional and national priority setting and consultation with stakeholders, primarily because the regional constituency for these Centers is particularly strong.

Over the years, most Centers have introduced different approaches to priority setting alternating between formal, supply driven and informal approached. The formal methods have been complemented with consultative processes particularly to gauge partners and stakeholders perspectives and needs. The results from these exercises have been an input to management decision making where other factors, such as donor preferences have also weighed considerably. The Center experiences are discussed further in Annex 3.

³⁶ Sayer et al, 2007

The tools available for priority assessment have evolved considerably over the last decade or two. The CGIAR is involved and leading initiatives that have produced widely used maps, models, tools and data. Examples are: IFPRI's IMPACT model used by several CRP in their initial analyses of supply and demand effects; Harvest Choice that produces data, scenario analyses, different tools and maps for geographic target domains with the ability to over-lay many kinds of data with increasing granularity; the CGIAR's Consortium for Spatial Information operating across CGIAR and other organizations for development of geospatial global public goods. Several Centers have developed geo-information applications such as poverty maps for their specific contexts (e.g. CIMMYT's interactive poverty maps using poverty and agro-climatic data for Mexico, spatial poverty databases used by the Rice-Wheat Consortium, ILRI's meta-data services on livestock, poverty assessment in Sudan by ICARDA).

There are also participatory tools that help priority setting (including decision and performance trees) and are geared towards impact pathway analysis and monitoring (such as the Participatory Impact Pathway Analysis project management approach³⁷ used by the Water and Food Challenge Program, and outcome mapping for progress measurement³⁸ used particularly by ILRI). For landscape level research and natural resource systems analysis, there are, for instance, economic systems simulation models and participatory modeling methods³⁹ that can be used for priority setting and trade-off analyses and have been experimented with by some of the CRPs. The software "Expert choice" for AHP is an example of a decision-support tool.

³⁷ Douthwaite et al, 2003

³⁸ Earl et al. 2001

³⁹ Sandker et al. 2010

Annex 3: Past experiences in the CGIAR on priority setting

Over its history, the CGIAR has used or tried out different approaches to priority setting at the System level. Most Centers have also developed their approaches to priority setting and their experiences have been documented recently.⁴⁰ In the following, four experiences are briefly discussed for the System: priority setting by the Technical Advisory Committee (TAC); two approaches to develop System Priorities and experiences from the Strategy and Results Framework process. The Center experiences are also discussed.

Experiences at System level

TAC priority setting

During the earlier decades, up until about the mid 1990s, CGIAR Centers received primarily unrestricted core funding. TAC had the responsibility to determine optimum resource allocation. It did that for the sectors and commodities and it also recommended the allocations that should be made to Centers. TAC reviewed the Center Medium-term plans and recommended allocation shares. The Donors provided funding according to the TAC-approved MTPs. Within the sector and commodity allocation frameworks and their mandates, Centers were relatively free to design their research activities and approaches.

TAC used a poverty-weighted congruency analysis method. The optimum budget allocations were determined on the basis of the share of the activity in the "total" value of agricultural production and modified by poverty indicators (at two levels according to country poverty). The priority setting process also included the outcomes of strategic studies. In its deliberations, following a Delphi method, TAC used three efficiency criteria: international public goods, alternative suppliers, and probability of success. Regional allocations emerged from the primary allocations, but TAC did not give specific recommendations regarding regions. Additional modifiers, such as opportunities for women and rural vs. urban comparisons were discussed but not actually used. Although TAC considered that health of the environment was closely linked to CGIAR's activities, it did not use any modifiers related to soil or water. In the congruency analysis, TAC identified gaps between the optimal and actual allocations recommending donor action to correct these deviances.

Up until 1993/4 the World Bank acted as the donor of "last resort" that could fill gaps in funding identified in TAC's analysis. The change by the World Bank to a matching grants model affected research focus, because, rather than funding areas that were assessed to be underfunded, the Bank amplified investments in areas that individual donors favored. Thus the attention to optimizing the research agenda at the System's level diminished. With this change, the System accepted both core and non-core funded research as part of its "agreed research agenda". 1997 was the final year of TAC's recommendation. However, the shift of funding from core to restricted funding⁴¹ meant moving further away from a prioritization and funding allocation mechanism at the System level. It did not necessarily mean that Centers weren't successful in securing funding for activities that were internally prioritized.

In summary, the TAC approach was transparent and simple, and its results could be implemented as long as the power regarding fund allocation was centralized. However, it became increasingly ill-suited to the CGIAR as the research agenda expanded to other areas

⁴⁰ Raitzer, D.A. and Norton, G.W. (Eds) 2009. Prioritizing agricultural research for development. Experiences and lessons. CAB International.

⁴¹ The proportion of restricted funding changed from 83% in 1990 to 51% in 2000 to 34% in 2009.

than (crop) productivity focused research and was rendered meaningless when individual donor interests started driving the research agendas.

Interim Science Council 2003-4

At the end of 2002, the interim Science Council launched an exercise to set System Priorities. An expanded approach to priority setting was considered necessary for the CGIAR because of the broadening of the objectives of the System and consequently a pursuit of multiple goals (reducing poverty, hunger and malnutrition by sustainably increasing productivity of resources in agriculture, forestry and fisheries). Rather than pursuing a quantitative evaluation of different research options, a multi-pronged approach was chosen, which included information gathering and analysis coupled with broad consultation with stakeholders.

The exercise included eight approaches:

1. Deductive approaches

- 1) A broad analysis of new challenges and opportunities.
- 2) Development of a set of criteria to achieve poverty reduction through agricultural research to be used to screen future proposals.
- 3) An updated congruence analysis to establish the future relative importance to be given in the overall budget to commodities (15 crops) and sectors (crops, livestock, forestry, and fish) by regions.

2. Historical approaches

- 4) Analysis of the current and evolving research portfolios for Centres and the CGIAR.
- 5) Analysis of the current and evolving research portfolios for other research institutions and for international organizations.
- 6) Analysis of long run trends in the CGIAR's budget allocation across outputs, crops, sectors, undertakings, regions, and Centres.

3. Inductive approaches

- 7) A broadly consultative approach inviting the formulation of demand for incremental research by stakeholders and of potential supply of research by scientists.
- 8) A consultative approach with eminent scientists and members of the Science Council.

As part of the process, the congruency analysis was updated to consider total investment shares by regions, sectors and commodities under different weight schemes. Sensitivity analyses revealed large variations in the results depending on how modifiers were used. The results were analyzed for deviations from actual investments but no recommendations were made. It was left open how results from this type of analysis could be factored into a consultation-based priority setting process.

The consultative process focused on priority setting for incremental investments. The five principle output categories of CGIAR research were confirmed: germplasm improvement, germplasm collection, sustainable production, policy and enhancing NARS.⁴² The first

⁴² Up till 1991, CGIAR research was divided in four categories: Research, Strengthening NARS, Research support, and Management research. The subsequent classification system that in 2003 was replaced by a classification of outputs, involved five areas of activities (or "undertakings") with sub-categories: Increasing

round of consultation among stakeholders was aimed at drawing a list of critical issues for research in each output category. Consultation was also used to get a sense of stakeholders' perception of the relative importance of the different output categories.

A second round of consultations was among scientists of both regional and global panels. It was aimed at determining relative allocations across the output categories, identifying major themes across regions and highlighting region-specific areas of emphasis. Despite variability across different groups there was general call for increasing investment on germplasm conservation and research on sustainable systems and integrated NRM (INRM). Regarding research themes, twenty themes, under the output categories, were identified as dominating across regions. Five of them were under germplasm conservation and eight on strengthening NARS. The results from the exercise included also regional priorities important for the regional panels.

The third round of consultations was among senior scientists and Science Council members. It was intended to confirm themes of importance of the on-going Challenge Programs, confirm choices made during the second round and suggest additional themes that had not been raised. In conclusion, recommendations were made for seven research topics to be addressed if incremental resources were available.⁴³ The recommendation was to address these topics either through a systemwide program, a coordinated program or task force or as a complement to on-going research. The exercise did not make recommendations regarding the funding although notional budgets were used to guide the thematic scoring process.

In summary, the interim Science Council's multi-approach process, despite its different components, did not yield substantial results for system priority setting. The system's core agenda was assessed only through a congruence analysis method that had already earlier proven unsatisfactory. The background analyses were not linked to the consultative process or reflected on the eventual thematic recommendations. The focus on identifying themes on incremental funding reduced the potential utility of the exercise. This work was received by the incoming Science Council, which did not follow all the recommendations for incremental additions but continued on the exercise to define System Priorities for the entire agenda. Thus this work was subsumed by a new approach on the priority setting challenge by the new Science Council.

Science Council, 2005: System priorities

Although the work of the Science Council in 2004-2005 was presented as part of the process initiated in 2003, there was a clear departure from the previous data (congruency analysis on sectors, regions and commodities) and conclusions (on five output categories and recommendations for new research themes). The SC abandoned the research output categorization previously used in the planning and logframes. It replaced them with a set of System Priorities (SP) intended to represent a cohesive and focused research program across the System of Centers and programs. Other objectives of this overhaul of organizing the

productivity, Protecting the environment, Saving biodiversity, Improving policies, Strengthening National Research Programs

⁴³ Collection, conservation, and characterization of germplasm for crop wild relatives and orphan food crops; Understanding and optimizing gene flows; Genomics for high value crops, especially vegetable and perennial crops, and for fisheries and livestock; Agricultural systems research from an agroecology, INRM, and sustainable livelihoods perspective, particularly for unfavorable environments; The rural poor: Access to assets, links to markets and institutions, and pathways out of poverty, with a special emphasis on gender; Strengthening NARS and developing new partnerships; Strengthening farmers' organizations and participatory processes.

CGIAR's research agenda were to avoid the dispersion of effort; mobilizing capacity across the system; enhancing opportunities for cooperation and coordination and defining the scope of the priority research for better accountability. These objectives were very similar to those emphasized in the current reform.

The process was characterized by discussion and building consensus through a set of consultative meetings. Building on the earlier assessments and through a review of the CGIAR's total research portfolio, the SC outlined descriptions of research within ten areas, initially. Each meeting focused on one priority area. Three pre-set criteria were provided to guide the final discussions: (i) expected impact of the research on the major CGIAR goals; (ii) production of international public goods; and (iii) alternative sources of supply and CGIAR comparative advantage to conduct the research. Following the consultations, 20 SPs were specified and for each research rationale, generic and specific goals and scope of research were described.

The CGIAR endorsed the 20 system priorities at the AGM05. The implementation of the priorities depended on development of Framework plans for each SP by the Centers with their partners. In parallel, the donors were discussing ways of changing the funding mechanism from short-term restricted grants towards longer term support of the priority research areas. However, framework planning did not proceed beyond a draft one for Genetic Resources⁴⁴ and the reform agreed at AGM08 effectively cancelled the process.

In conclusion, the SC initiative was triggered by the same analysis that drove the current reform related to better coherence, coordination, efficiency and effectiveness. However, the SPs were seen as representing areas of competence. The prioritization was dependent upon development of framework plans for which the system did not provide sufficient incentives.

Development of Strategy and Results Framework (first version in 2009)

The process to develop the Strategy and Results Framework involved three stages with three different groups in charge of the drafting. As their point of departure, the first two drafting groups used three Strategic Objectives agreed at an earlier stage of the reform (Food for people, Policies for people and Environment for people). The first version (2009) made an effort to describe and prioritize (in terms of resource allocation), through a step-wise process, seven Mega Programs to address those objectives. (The subsequent version dropped allocation suggestions and focused on portfolio description, increasing the number of operating units)

The development of the proposed program portfolio and funding recommendations involved several steps. In predictive modeling, the IFPRI IMPACT model was used to analyze several alternative research and investment scenarios that assumed different combinations of investment on agricultural R&D. For each scenario, changes in yield, total production (crops and livestock), world prices, trade, and child malnutrition were presented for 2025. The comprehensive scenario combining increased agricultural research investment with more efficient research, expanded irrigation infrastructure, improved natural resources management, and enhanced market efficiency showed largest benefits for the parameters included, and was considered to point toward the type and scale of investments needed, and the type of research needed for alleviation of poverty and hunger. The team then agreed on

⁴⁴ The Genetic Resources Framework plan was peer reviewed and could be useful in developing further the System's thinking on genetic resources research.

three system level results criteria: (i) increased productivity and reduced poverty; (ii) reduction of hunger and improved nutrition; and (iii) sustainability and resource efficiency.

For deciding on the set of Programs to achieve these results, the Team followed a step-wise process

1. Three system-level results criteria (with gender and capacity building indicators to be factored in) as point of departure:

- Lift productivity and reduce poverty;
- Contribute to reduction of hunger and improve nutrition;
- Contribute to sustainability and resource efficiency

2. Three key considerations:

Evidence that integrating research on productivity, natural resources management and institutional and policy change can lead to the greatest impact;

Results of mapping on populations, poverty and agricultural growth potential to learn about how to reduce poverty and hunger in a sustainable manner, reaching the greatest number of people, over the shortest period;

The reality that the global food system is dominated by a set of commodities.

3. Two foci for program selection:

- to identify research on agricultural productivity, sustainability, and policy that would deliver specific outcomes in the form of international public goods that contribute to the three system-level outcomes; and
- to focus research on agricultural systems, regions, and domains where research interventions could achieve the greatest impact on poverty and hunger.

In order to decide at a specific set of Programs, the team followed an iterative process synthesizing quantitative and qualitative information and examining a large number of potential programs before deciding on a set of 7. The team used Analytical Hierarchy Procedure and the “Expert Choice” decision-making support software to arrive at different weights for different Programs. The rating was at two levels: from system-level criteria to the vision goals, and from Programs to the system-level criteria. The team also included a large-scale scientist survey of key opportunities for international agricultural research, a workshop involving leading scientists, and a workshop on poverty. The SRF included preliminary description of the seven programs and a preliminary estimate of a funding range for each program.

Lessons from past experiences – System level

The CGIAR’s previous attempts (since 1990s) to set priorities at the system level for activities at the Center level have not led to agreement on the prioritized areas and topics and have not been followed in funding allocation. The power structure of the System has been such that deciding on the research agenda and its funding through a top-down process has not been possible. The difficulties related to priority setting have been acknowledged at each stage of the CGIAR’s evolution. TAC (1988) recognized agricultural research as an especially difficult arena for convincing priority setting. The SC (2004) concluded that “setting research priorities for as vast and complex an institution as the CGIAR is a daunting task. No approach, however complex and multidimensional, can be fully satisfactory.” It further considered that priority setting is best seen as a management process and that “for such complex, multi-faceted process it is normally very difficult to establish an ‘objectively best’ outcome”. The 1st version of the SRF (2009) was criticized for lack of transparency in deriving and defining the set of Programs, and for lacking a level of Program outcomes and

successes which would be used as valid basis for prioritizing investments (Science Council, 2010). The current SRF, while recognizing the importance of priority setting notes the lack of priority setting frameworks when the overall objective is sustainable agricultural development and the task is to meet multiple objectives. An effort to determined prioritized linkages from high level objectives to ground level activities does not seem desirable.

Lessons from past experiences - Centers

Descriptions and analysis of experiences from eight CGIAR Centers and one Challenge Program have been recently documented (Raitzer and Norton, 2009). Most of the Centers that contributed to the book do research on commodities (crops and livestock) and the only non-commodity Center is CIFOR. The Centers have used variable approaches to priority setting and many of them have gone through very different processes over the years. For instance, ICRISAT moved from an initial approach of consultations with NARS to a participatory but formal approach using composite indices to an approach involving extensive discussions with partners and scoring to an approach based on analyses of trends (Semi-Arid Tropics futures approach) and finally to a precedence model conforming with the System Priorities agreed in 2005.

Several Centers have included a formal economic surplus and cost/benefit analysis in the priority setting, often as just one component of a more comprehensive approach. They have expanded the formal approaches to include other objectives than productivity increase and adopted difference indices and scoring methods to capture objectives such as poverty reduction and environmental sustainability, and criteria such as equity, sustainability and internationalism. The experiences from Centers suggest that the economic approaches have been used mainly with commodity research. For instance, CIP's formal analysis focused on components of the commodity research agenda that produce outputs directly for use and have well-defined impact targets.

While most Centers conclude that quantitative approaches have been useful to promote understanding among researchers and stakeholders about the trade-offs between choices and to stimulate discussion on the pay-off from different research components, they have also acknowledged issues of cost, transparency and suitability to all research areas. Using more complex models for differentiating, for instance, poverty and health impacts adds to loss of transparency (CIP). Centers also commented on the variability of the results depending on estimates of the parameters. ILRI reported that its composite index-based ranking resulted in clusters of themes due to the counter-balancing effects of the component indices. While clear winners were identified, differentiation among other themes, where screening would have been important, was not sufficient. The process thus supported a portfolio approach rather than selection of “winning” themes that would score high on all indices.

An aspect commonly raised was the cost, skills and availability of data demanded by formal approaches. CIP highlighted the need for modeling capacity and data. IITA concluded that considerable resources (human, financial, methodological and time) would have been needed for successfully completing the Priority Assessment Exercise. Also at CIFOR time, was considered a constraint for completing a quantitative analysis of prospective impacts and for debating the assumptions underpinning priority assessments. Yet, in CIFOR's experience, the consultative processes paid little attention to the impact potential of research. ICRISAT applied a comprehensive formal approach only once due to the costs involved. For CIMMYT, the time frame and available resources have been key determinates of the choice

of priority assessment methods; low-cost approaches have become prominent because of cost and data constraints.

In some Centers *ex post* studies were used to confirm some of the strategic choices made. CIP conducted *ex post* impact assessment in tandem with *ex ante* impact assessment for estimating economic benefits. ICRISAT stressed the utility of *ex post* studies for providing a basis for reasonable estimates of parameters such as levels and speed of adoption and reasons for non-adoption; farmer perceptions of desirable traits; in-farm gains due to alleviation of constraints; and infrastructural, institutional and policy constraints to technology exchange. Also at CIMMYT *ex post* studies have produced a valuable knowledge base about returns to past investments, although past performance was considered an imperfect mirror of potential future outcomes.

The ability to compile data and information needed for priority setting is improving. However, there are still shortcomings even regarding production data in many developing countries, and Centers in their priority setting reported difficulties regarding the availability and accuracy of data and information. Many saw the lack of high quality data as a bottleneck to priority setting in general, and particularly for economic assessments and modeling. ILRI reported that basic system's data for livestock-based production activities, for instance on poverty and production systems, is highly aggregated and of doubtful quality and the understanding of site-specific environmental effects is still limited. ICRISAT reported that the availability and accuracy of information was a major challenge for conducting the formal Priority Assessment Exercise. Expert information also poses challenges regarding responsiveness, reliability of the information and potential bias. ILRI listed a few challenges: ability to identify and value spill-over effects; ability to characterise risk beyond the control of the research institute associated with adaptation and delivery; and defining roughly comparable research themes in terms of spatial and temporal scales; and inclusion of certain social issues. CIMMYT reported that the choice of priority setting method was highly constrained by the availability of data, particularly on migration demographics, farming systems, production and value chain constraints, target group profiles and cost of different research options. In general, there are shortcomings particularly regarding environmental data needed for judging cause and effect relations.⁴⁵

Centers noted a number of challenges that influence priority setting. The shift to multiple goals and objectives and from focus on yield to focus on nutritional, equity and sustainability benefits makes it challenging to articulate and predict economic returns. It is not clear how equity and environment feature in the economic calculations. The trade-offs between productivity and environmental impacts are acknowledged. Not all research will have direct effects on the desired goals but, for instance, natural management and policy research and capacity strengthening are often aimed to have an accelerator effect, the nature of which is not well understood (ILRI). CIMMYT highlighted the shift from considering impact primarily at producer level to considering impact along the value chains, and the use of livelihoods assets approach to complement monetary approaches in poverty assessment. According to CIMMYT the following are unresolved issues: optimal scale for priority assessment; identification of multiple criteria and weights; critical lack of resources

⁴⁵ Wood et al. (2010) identify a gap in data, knowledge and tools for analyzing interactions in environmental drivers of change and food systems. They propose that lack of balanced assessments may lead to over-emphasis in boosting production potential *per se* at cost of, for instance, designing production systems more resilient to water shortages and pest and disease stresses, or generation of technologies to reduce post harvest storage and processing losses, waste and loss of nutrients.

earmarked for priority setting; need for multidisciplinary team involvement; poor quality and coverage of available data; engagement of donors in priority assessment processes.

In their discussion of the utility of these exercises, Centers often emphasize the benefits from the process for instance in highlighting the trade-offs among strategies for decision making and promoting understanding among staff and stakeholders. Consultative processes helped in making realistic plans with partners in complex environments. According to the experiences, the use of the results depended on the institutional commitment of managers (IITA), their confidence in the approach and other factors weighing on decision making. For instance, at CIFOR, the experience was that management considered the Research Application Area Framework overly mechanistic and rigid. ICRISAT highlighted management desire for simplicity and transparency. ILRI considered that priority setting provide one among several inputs and considerations that influence decision making. ILRI's comprehensive process resulted in some low priority areas being reduced in focus, but occasionally donor interest in such an area brought it back. Some other areas were left for institutions that were considered better placed for addressing them. New strategic directions emerged as a consequence including, for instance, efforts to map poverty for better understanding the target domains. Other benefits included reduction in research themes and more coherent definition of outputs. ILRI concluded that irrespective of the results, the priority assessment process itself and the conceptual framework used were helpful to alert teams focus on where, what and how. CIMMYT considered that a major benefit of the formal exercise was to allow better-informed dialogue and debate with donors.