

CONSULTATIVE GROUP ON INTERNATIONAL AGRICULTURAL RESEARCH
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(Agenda Item 3)

**Report on CGIAR Priorities and Strategies
for the Period 2005-2010**

(Outcomes of the Consultative Process)

For Information

This report provides the outcomes of the Science Council-led Consultative Process on Priority Setting and has been revised subsequent to the Aleppo Meeting. It is provided as background information to the Summary Report on CGIAR Priorities and Strategies 2005-2010 and the subsequent steps taken by the Science Council on System Priorities.

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**REPORT ON
CGIAR PRIORITIES AND STRATEGIES
FOR THE PERIOD 2005-2010**

(Outcomes of the Consultative Process)

SCIENCE COUNCIL SECRETARIAT
FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

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ABSTRACT

The Science Council provides guidance to the CGIAR on the setting of System Priorities for research and strategies for meeting the CGIAR's mission and goals.

This report examines previous means of priority setting used by the CGIAR at the System-level, and describes the current and future context for agricultural research in developing countries. The priorities of other stakeholder institutions, as well as the current portfolio of research projects for the CGIAR (as reflected in the Centre Medium Term Plans for 2004-2006), are examined. The report describes a new process and the outcomes of a Science Council-led, consultative process for the establishment of potential new priority areas for research, conducted between 2002 and 2004.

The analysis and outcomes of the process described in this report provide the background for subsequent steps by the Science Council, Centres and members in the further development of overall System Priorities for the CGIAR.

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Note on Terminology

In this report, we follow terminology used in the CGIAR as follows:

1. Logframe outputs

- Germplasm improvement
- Germplasm collection, conservation, and characterization
- Sustainable production systems and natural resource management (NRM)
- Policy and socio-economic research
- Strengthening NARD and other rural institutions

These logframe categories were subsequently disaggregated into:

- Activities: Critical issues for research
- Sub-activities: Specific research programs and projects

2. Sectors

- Crops
- Cereals
- Rice
- Wheat
- Maize
- Other cereals
- Legumes
- Roots and tubers
- Banana/Plantain
- Livestock
- Forestry
- Fish

3. Undertakings

- Productivity
- Environment
- Biodiversity
- Policy
- NARS

4. Regions

- Sub-Saharan Africa
- Asia
- Latin America and the Caribbean (LAC)
- Central and West Asia and North Africa (CWANA)

CHAPTER 1 - INTRODUCTION

1.1 The Need for Priorities and Strategies at the System Level

The CGIAR is an association of 63 public and private members that support 15 international agricultural research Centres. The CGIAR's mission is "to achieve sustainable food security and reduce poverty in developing countries through scientific research and research-related activities in the fields of agriculture, forestry, fisheries, policy, and the environment"¹. Centres are autonomous institutions, each with its own governing board. To contribute to the CGIAR's mission, each Centre formulates its own medium and long term plans that specify research priorities and a strategy to implement them. While each Centre is specialized in particular domains of agricultural research, strong complementarities and synergies exist among Centres, giving great importance to coordination of efforts through the CGIAR as a System. The formulation of System-wide priorities and strategies is consequently needed to guide Centres in implementing the CGIAR's mission. Specifically, System-wide priorities and strategies are needed to:

- Help Centres set their own research priorities and strategies in a fashion that builds complementarities, achieves economies of scale, and reduces dispersion and redundancies. This will result in:
 - Improved coordination in research initiatives across Centres.
 - Collaborative research projects between Centres.
 - Systemwide programs (SWP).
- Help the CGIAR define Challenge Programs and Task Force initiatives that address, in a coordinated fashion among several Centres and their partners, major global and regional development objectives.
- Help partners and stakeholders participate to the process of priority setting by the CGIAR.
- Help the CGIAR organize and coordinate research with partners.
- Help donors allocate resources across Centres and to Systemwide programs, Task Force initiatives, and Challenge Programs.

In setting research priorities, careful attention needs be given to changes in the specific targets to be reached and in the constraints and opportunities to attain these targets. These are evolving rapidly and need careful analysis. Because of the time lags involved in research, these targets, constraints, and opportunities need to be forecast to allocate today's research budgets in terms of future research achievements. To do this, an analysis of the emerging context for priority setting is provided in Chapter 2 of the report.

¹ CGIAR. "Charting the CGIAR's Future: A New Vision for 2010". Washington D.C.: CGIAR Secretariat, July 2000. Note that, in this terminology, agriculture includes livestock.

1.2 The Need for an Expanded Approach to Priority Setting

Until the 1990s, CGIAR research was largely driven by the goal of increasing productivity in the production of major food crops. Discussions and decisions on relative priorities and resource allocation among commodities could be based on internal consultations with scientists to identify production constraints, backed by special thematic studies, and facilitated by congruence analysis based on the value of production. Congruence analysis, which was used by the Technical Advisory Committee for priority setting until 1997, consisted in:

- Making predictions of area, yields, and gross value of production for 19 crops plus livestock, forestry, and fisheries, disaggregated by five geographical regions.
- Calculating the share of each activity and region in the “total” value of agricultural production.
- Applying modifiers to these shares to account for considerations such as poverty, the participation of women, productivity gaps, sustainability outlooks, the strength of local institutions, new scientific opportunities, the IPG character of the innovation, alternative sources of supply, and the probability of success in raising yield. These shares would give the optimum overall budget allocation across commodities and regions.
- Congruence analysis consisted in comparing the optimum to the actual budget allocation, thus identifying discrepancies in investment. Deficits would provide signals to donors as to where additional funds were needed to achieve the Systems’ overall priorities. The World Bank would act as the “donor of last resort”, filling the remaining gaps, and allowing the congruence approach to be implemented as an overall plan.

Over the last fifteen years, this approach has become increasingly insufficient to define priorities for the CGIAR. This is due to the fact that the current goals and missions, defined by the seven strategic “planks” in the Vision and Strategy for 2010 adopted by members at the 2000 Mid-Term Meeting, have significantly broadened the objectives pursued by the CGIAR. The main dimension of complexity derives from pursuing with one instrument -- agricultural research -- the multidimensional goals of reducing poverty, hunger, and malnutrition by sustainably increasing productivity of resources in agriculture, forestry, and fisheries. In addition to this, the CGIAR needs to address increasingly complex unresolved problems, requiring it to go beyond the “blue print” approach followed by the Green Revolution, toward holistic/integral approaches that deal with (1) the multidimensionality of poverty, (2) the multiplicity of constraints, (3) the heterogeneity of local situations, and (4) global problems of extraordinary scope and complexity.

Clearly, allocating budgets based on production value does not work well when priorities increasingly address issues that do not involve production of goods and services valued in the market place - such as germplasm conservation, natural resource management, policy and socio-economics, and assistance to NARS. In addition, the approach works quantitatively within research categories that already exist, but does not help identify new categories that are missing in the investment portfolio. Finally, the World Bank’s decision to abandon its role of donor of last resort reduced considerably the System’s capacity to implement the planning and resource allocation implications of congruence analysis.

As a consequence, the Science Council has been experimenting with a new methodology for priority setting that combines eight complementary approaches that can be classified as follows (see Figure 1):

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 that can 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.
- 4) Use of IFPRI's supply and demand projections for 2020 and the FAO's 2030 predictions.

2. Historical approaches

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

3. Inductive approaches

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

Needless to say, setting research priorities for as vast and complex an institution as the CGIAR is a daunting task. No approach, however sophisticated and comprehensive, can be fully satisfactory. For this reason, the approach used here is to be seen as part of an institutional learning process that needs to be systematically pursued and improved. We discuss in Chapter 9 how the process of priority setting that has been initiated with this report could be institutionalized as a formalized procedure in the CGIAR.

1.3 CGIAR Vision and Strategy

The CGIAR Vision and Strategy for 2010, approved at MTM2000, proposes seven strategic planks as guidelines for the CGIAR in achieving its mission. These planks provide the basic rationales in selecting the current priorities and strategies. They are:

1. Sharply focusing System activities on the reduction of poverty, hunger, and malnutrition in developing countries.
2. Bringing modern science to bear on difficult productivity and institutional problems that have proven intractable in the past.
3. Giving highest priority to the research needs of South Asia and Sub-Saharan Africa, where poverty is concentrated and growing.
4. Adopting a regional approach to research planning in order to better address the heterogeneous nature of poverty.
5. Diversifying and closely integrating its partnerships.
6. Adopting, under certain circumstances, a task force approach to the organization and delivery of CGIAR products and services.
7. Serving as catalyst, organizer, coordinator, and integrator of global efforts on key opportunities and constraints in agriculture, forestry, and fisheries.

1.4 Pursuing System Priorities – a sequenced approach

The Future Harvest centres and the CGIAR were created to apply science to the solution of problems related to poverty, agriculture, natural resources, food and nutrition. While the overall goal of the System is to help alleviate poverty, hunger and malnutrition in a manner compatible with sustainable management of natural resources, each Centre was created to help solve a specific set of problems. It naturally followed that each centre would develop its own priorities and activities within its mandate. As more centres were created, the opportunities for gains from stronger collaboration among Centres became more obvious and efforts were initiated to assure that the impact of the System would be larger than the sum of the impacts of each centre. Such efforts include spontaneous collaboration among individual scientists and centres as well as more structured inter-centre programmes and, most recently, the Challenge Programmes. Some of these efforts were driven by programmatic needs as perceived by the Centres, scientists or donors, while others were brought about by stakeholders who, for reasons other than programmatic ones, wanted to see more collaboration among Centres and with institutions outside the System.

There is a clear indication that those inter-centre activities that succeeded in achieving their programmatic goals were those driven by programmatic needs, while those promoted for other reasons generally did poorly and ended when the funds earmarked for them dried up. The System's experience conforms to similar experience elsewhere. Efforts to make structural changes a goal, rather than a means to achieve programmatic goals usually fail. To be successful, form should follow function, not the other way round.

The evolution of molecular biology and the associated new science and technology opportunities, changes in the intellectual property regimes applied to agricultural science and technology, and the rapid increases in the investments in agricultural sciences by the private sector have very significant implications for the organization of national and international public sector agricultural research, including research by the System. Furthermore, as the research needs evolve, the way the CGIAR research is organized must adapt to maintain relevance and cost-effectiveness.

In the light of these changes, and the desire to pursue an overall System impact that exceeds the impact derived from the sum of the individual centre priorities, a movement towards closer integration of priorities in the form of a small number of system priorities, which together would provide a cohesive System program, might enhance the overall impact per dollar spent. Each system priority would be focused on the solution of a well-defined major problem requiring international agricultural science for its solution. Highest possible cost effectiveness will be the principal guide used in the selection of the problems.

Over the years, the CGIAR has spent a considerable amount of resources to identify priorities for its research. TAC, the iSC and, most recently, the Science Council have developed programme priorities periodically. Centres and donors have developed their own priorities. Thus the development of system priorities needs to take into account the approximately 200 projects the centres are currently undertaking, as well as identifying new research opportunities. The existing portfolio of projects represents, at least implicitly, current priorities by centres and donors. Proposals for further inter-centre programmes and Challenge Programmes have resulted

in a long list of potential priorities, and GFAR has developed a set of regional and global priorities in collaboration with national and regional institutions. A review of this material (see chapters 4 and 5) is a first step in the attempt to develop a list of system priorities for discussion. The overriding criteria for the selection of a problem as a system priority would be the expected impact of CGIAR research on the alleviation of poverty and hunger in a manner compatible with sustainable management of natural resources per dollar spent.

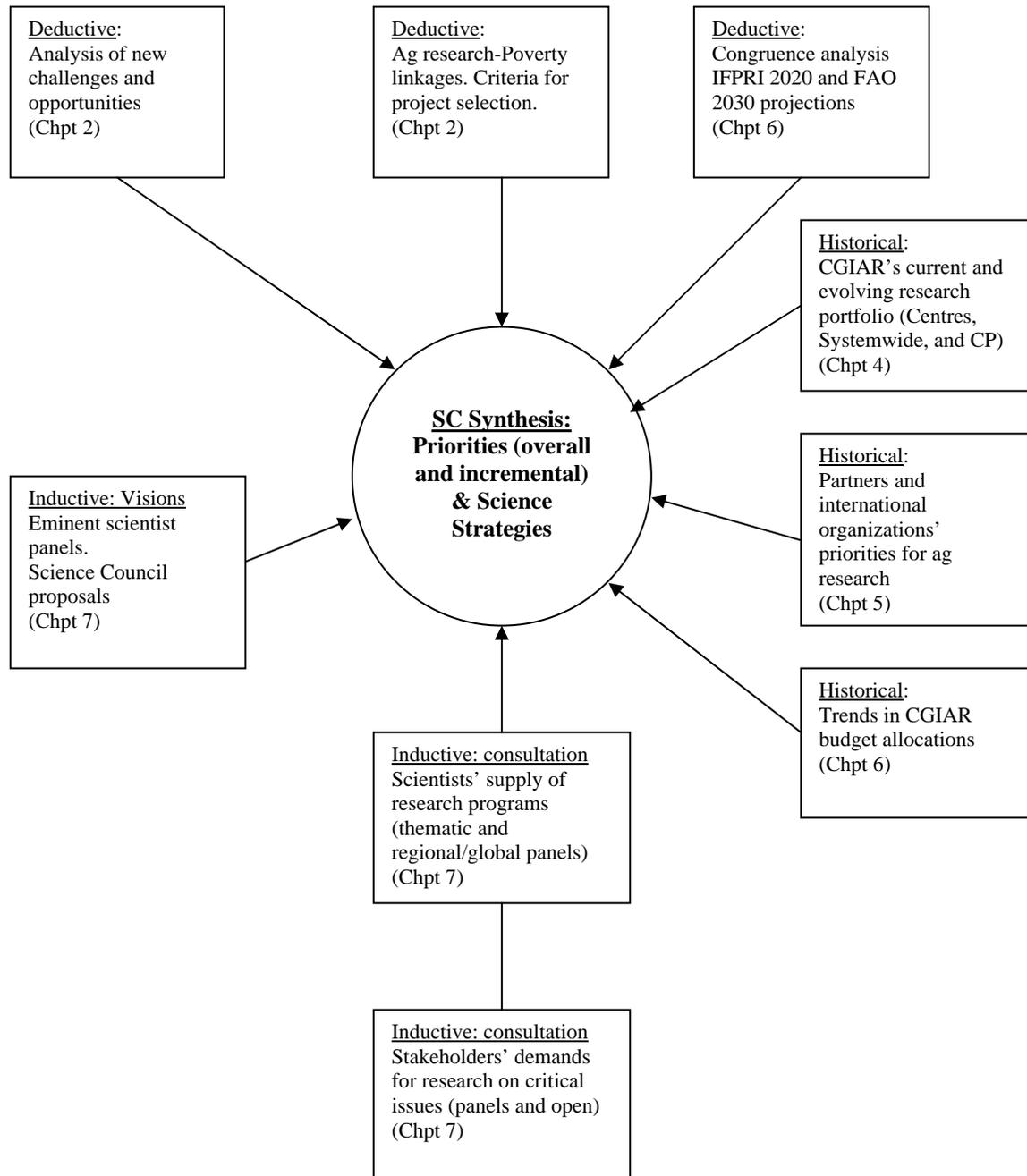
Since international agricultural research is only one component of the solution, judgments must be made as to the probability that the other components will materialize. Placing the Future Harvest Centres squarely in the middle of the research chain with close collaboration with advanced, up-stream research institutions as well as down stream research and implementation institutions, including NARS, NGOs and farmer organizations, will enhance the probability that the other components will be implemented. Judgments must also be made on the probability of success in achieving the research objectives and the time it would take. Again, collaboration with other research institutions will increase the probability of success. Thus each priority area should include not only the research by the Future Harvest Centres but also collaborative activities - as is done presently. The system priorities should be selected exclusively on the basis of expected impact.

1.5 Outline of the Report

The report responds to the various inputs and analytical steps identified in the priority setting process described in Figure 1. A review of the major trends, opportunities and challenges, which comprise the context for agricultural research in developing countries, is given in Chapter 2. The analytical basis for setting priorities is then considered (Chapter 3). The current CGIAR research agenda (composed of Centre projects and a range of inter-centre and system wide programmes, including Challenge Programmes), and which is indicative of the present System research priorities, is then described (Chapter 4). Examples of regional and global agricultural and development priorities set by other agencies and bodies are considered in Chapter 5, to help establish synergies, alternative sources of supply and the comparative advantage of the CGIAR in tackling new research. Previous CGIAR priorities were set, in part, using congruence analysis, and in Chapter 6 an updated congruence analysis for CGIAR priorities is provided for comparative purposes, as well as descriptions of the gaps in the provision of important agricultural and food commodities at points in the future - as developed by the projections of IFPRI and the FAO.

The outcomes and recommendations of the major Consultation process on identifying possible additional priorities for CGIAR research are given in Chapter 7, together with the rationales for advancing the priority areas of work. The strategic considerations for the CGIAR in selecting and implementing new potential priority areas is discussed in Chapter 8. The final chapter (Chapter 9) considers the lessons learned from this major new initiative in participatory setting of CGIAR priorities, the pros and cons of the approach and the means by which priority setting may be institutionalised in the future (so relating priority setting, to research, and the monitoring oversight and evaluation of impact functions of the Science Council on behalf of the Centres).

**Figure 1. Science Council's Approach to Setting CGIAR Priorities and Strategies:
Outline of the Report**



CHAPTER 2 - THE EMERGING CONTEXT FOR PRIORITY SETTING: CHALLENGES AND OPPORTUNITIES

2.1 Current Challenges in Setting Priorities

Prior to the establishment of the CGIAR the challenge of improving global food security seemed a daunting, yet relatively straightforward task of increasing food production and increasing access to food, predominantly for rural societies.

Within the last half a century the world has changed rapidly and so has the food security challenge². Urbanization and globalization are becoming pervasive, private sector involvement in agricultural research has been increasing at a very rapid pace around the world, and global concerns about the sustainable management of resources have been rising. The global food security challenge has over time become increasingly complex as well as more multi-dimensional. This complexity is mirrored in the means and levels at which the food security issue is to be addressed, and in the setting of priorities to meet these challenges.

Germplasm improvement of staple commodities has been successful in enhancing production and in precipitating the Green Revolution. Crop staples are a key component of nutrition and food security. But there are many other commodities and resources, utilized in farming or taken from nature, which ensure nutrition, productivity, incomes, and better livelihoods of farmers, fishers, forest dwellers and pastoralists in developing countries. The advances in production brought about by new technologies must be sustained and efforts made to share the benefits as equitably as possible. The absolute importance of sustaining production (including protecting natural production and biodiversity losses from decline) and extending benefits to the poor, enhance the complexity in developing the CGIAR's new agenda for agricultural research.

There are substantial differences between and within developing country and transitional regions in agro-ecologies, natural ecosystems and the capacity of local institutes to undertake agricultural research. There has been a rapid rise in the urban populations of the world creating two major classes of rural and urban poor. Overall emphases therefore have to encompass situational analysis and more tailored solutions. Development-centred research places people more centrally and requires increased understanding of social contexts and policy development. Globalization increasingly influences local opportunities and risks.

Finally, the previous relationships amongst stakeholders in agriculture have changed dramatically; there has been a marked rise in the contribution of the private sector in some aspects of research; and of the civil society sector in defining relevance of research and partnerships, and for delivering research. There are more and different providers of science, technology and extension services, and players seeking to influence markets and policy development. However, amongst potential partners, institutions developed against older, more linear, paradigms of technology-based research and development may require overhaul to be able to tackle the broader issues which are integral to sustainable development. New priorities for

² Pingali.P. (2003) Sustaining Food Security in the Developing World: An Agenda for Science and Technology.

agricultural research must be planned and delivered within these contexts in order to be relevant and to achieve objectives.

Considered globally, there are four major components to the challenges facing agriculture, forestry and fisheries: (i) provisioning the urban masses, especially the urban poor, with adequate amounts of food and nutrition; (ii) eliminating rural poverty and attacking the problem of chronic food insecurity; (iii) sustainably managing the natural resource base; and, (iv) repositioning developing country agriculture in the context of globalization. Seeking priority areas for international public goods research, which can be addressed through the comparative advantage of the CGIAR, has become more important. This Chapter reviews the relative complexity, which must be addressed in deciding upon choices, and means for research. In the face of complexity the issue becomes in setting priorities “what is the path to the optimal product?” and “what part should the CGIAR appropriately play to maximize its contribution?”

2.2 Evolving Structure and Causes of Poverty and Environmental Stress

In the last 50 years the world has changed fundamentally from one that was predominantly a rural based world to one where almost half the population is living in urban areas. Today approximately 3 billion people live in urban areas. The UN projections show that by the year 2030 5 billion people will be living in urban areas as opposed to roughly 3 billion in rural areas (UN 2000).

There have been however, rapid qualitative changes in the nature and determinants of poverty and the dynamics of agriculture. These include:

- Increased landlessness, or quasi-landlessness, and rising inequality in the concentration of land holdings.
- Continued uncertainty in property rights and weak enforcement.
- Profitability crisis of traditional agriculture for the rural poor.
- Tendency to diffusion of poverty in the high potential areas, leaving pockets of poverty in marginal (isolated, low potential, high risk) areas.
- “Ethnicisation” of poverty (through populations left behind within developing regions) and feminization of poverty (through migration of male labour).
- Increased connectivity of rural areas to cities and international markets.
- Increasing reliance on off-farm non-agricultural employment and multiple livelihood activities.
- Increasing role of migration and remittances in household incomes.
- Increased links to modern markets (supermarkets, product chains, agro-industry, agro-exports): potential opportunities are difficult to access for smallholders.
- Improved education opportunities for the young in some regions, in spite of household poverty.
- Additional adverse effects of epidemic human disease, civil war, and ideological polarization on poor and vulnerable communities.

Despite rapid gains in some areas and developing country regions, there is a persistence of inequality, which is reproduced in segmented land market (exacerbated by insecurity of property

rights), income-based social networks, and political and governance systems dominated by local elites. Inequality is a hurdle to the social incorporation of the poor.

The continuation of these presently observable trends is predicted to lead to the further marginalisation of the poor³:

- Most farms will be predominantly commercial, i.e. buying most inputs and selling most outputs.
- Farms (other than part-time subsistence or homestead plots) will be larger than at present, and getting larger.
- For those farms able to engage in the commercial economy, input and output marketing systems will be integrated, industrialised and sophisticated.
- As a result of the above, disparities between rural areas will increase.
- Agriculture's contribution to GDP will be no more than 10%.
- Agriculture's contribution to exports will also not be more than 10% (except perhaps in Latin America and sub-Saharan Africa).

Thus whilst the overall contribution of agriculture reduces with development, it remains a key means through which to assist the poor and marginalised within wider development strategies.

The challenge of urban poverty: Providing food to these expanding urban populations will pose a dual challenge. First, the size of the middle class populations is increasing very rapidly in urban areas, both in absolute as well as relative terms. As middleclass incomes grow, this community starts moving away from a traditional cereal-based diet to a diversified daily diet that demands meat, milk, fish, vegetables, fruit, etc. Supplying the needs of the diversified diet of the growing urban middle class populations is a major emerging food policy challenge facing developing country policy makers.

The locus of poverty is simultaneously changing, a trend that is likely to accelerate with time. The very poor, populations living under a dollar a day, are moving into urban areas, expanding the urban slum populations in cities like Bombay, Bangkok, Manila and Mexico City. Considerations of how to provision future urban Centres would necessarily require appropriate balance between trade and domestic production. Re-orienting domestic production towards growing urban demands will be a major force driving change in rural environments across the developing world. Urban demand for resources, such as land, labour, and water, will significantly affect access and relative prices of these resources for rural producers.

Poverty and food security issues persist in rural areas: About 1.2 billion people live on less than a dollar a day, 2.8 billion live on less than 2 dollars a day. Forty four per cent of the world's poorest of the poor (those under a dollar a day) live in Sub-Saharan Africa and 40% live in South Asia. Tremendous progress was made in reducing poverty in East Asia, Southeast Asia and in Latin America over the last three decades, but the recent financial crisis in East Asia and Latin America and the recent slow down in economies could lead to a reversal of those trends.

³ Ashley, C. and Maxwell, S. (2001) Rethinking Rural Development. Development Policy Review 19: 4

The poorest of the poor tend to be associated with marginal production environments in rural areas. They have very poor endowments of physical and human capital, they produce few marketable products and, for them, the transaction costs of reaching the markets are very high. Even if there is national economic development, there will still be hundreds of millions of people who are left behind. It should also be recognized that poor and marginal farmers have not yet been successful in accessing the technology that is already on the shelf today. Identifying small farmer constraints to technology adoption and use continues to be an issue for consideration and planning.

Managing the natural resource base: There are many signals of the exhaustion and degradation of natural resources. Population pressure and poor land and water use practices are at the heart of these declines. Yet meeting the nutritional and livelihood requirements of current and growing populations requires that there is improved and optimal utilisation of the resource base.

Degradation of natural systems: Globally, marine and capture fisheries are stagnant or in decline because of overfishing and population pressure. In South East Asia the biomass of bottom dwelling fish species is 10-15% of what it was in the 1940s. Deforestation occurred at the rate of 90,000 square kilometres per year in the nineties due to logging, fires, slash and burn agriculture and other types of encroachment. These natural resource sectors support large numbers of poor people in developing countries. Their patterns of resource use provide nutritional and livelihood benefits which are difficult to substitute from alternative sources.

Degradation of intensively cultivated lands: The intensively cultivated irrigated lowlands of Asia were the lands that were home to the green revolution. Productivity growth on the irrigated lowlands, that are under double or triple crops of rice per year, or under rice followed by wheat each year, was the primary reason for Asia achieving food self-sufficiency in the late 1970s and early 1980s. Over the last decade these areas have begun to exhibit signs of productivity decline due to very poor management of the water and the land resource base due to inappropriate intensification.

Exploitation and erosion of marginal lands: As populations grow, particularly in countries with stagnant or slow growing economies, agricultural production starts taking over very fragile landscapes. Without appropriate property rights and adequate investments in land management, intensification of marginal lands leads to high levels of erosion over time.

Water resource depletion: Population growth will threaten the capacity of existing water supplies, particularly in dry areas such as the WANA region. However, there are also widespread concerns over water resource depletion and degradation. Problems of groundwater depletion, salinization and other water quality problems are becoming widespread across the developing world, having potential knock-on effects for livestock keeping and aquaculture, as well as human health. Such issues are becoming common in areas with severe inter-sectoral competition.

Depletion of genetic diversity: Finally, agricultural modernization is leading to the erosion of local genetic resources across the developing world. Traditional cultivars that were uniquely suited to particular agro-ecological niches, especially in marginal environments, are being replaced by modern varieties that can be cultivated across several production environments.

Clearing of forests threatens forest diversity, and habitat loss and water quality issues threaten freshwater fish species.

Conclusions: The food security challenge has become a lot more complex today than it was in the 1940s and 1950s. Urbanization, globalization, private sector R&D, on the one hand, and the persistence of poverty and resource degradation on the other, have contributed to the growing complexity of the problem. The target population for food security policy is no longer predominantly the rural poor, it is increasingly urban based. Catering to the diversified demands of the populations that are becoming increasingly better off is adding to the challenge of meeting the food needs of the poorest of the poor. The challenges for science and technology are as great today, if not greater, than they were fifty years ago.

Food security is not just a problem of increasing production, in the present global context it requires acting swiftly to protect the resource base on which production depends. Environmental degradation is often fastest where the capacity to manage it is weakest. Rich countries can manage those stresses - their principal difficulty in doing so is the political argument about who should pay and when. The poor countries are often unable to manage those stresses for technical and institutional reasons, in addition to the income distribution reasons that afflict the wealthy. The challenge for research here is to understand the environmental costs of agricultural growth in the poor countries; to devise market solutions, where possible, for those costs; and to devise public solutions where market ones are too costly. In addition food security involves the dimensions of improving access, and equity in distribution. Improving opportunities for protecting and increasing incomes of the poorest of the poor may be as important to their food security as providing them with new productivity-enhancing technologies. A wide spectrum of actors needs to be involved in tackling these problems: local communities, researchers, governments, multinational corporations etc.

2.3 Globalization of Markets

The opening of the flow of agricultural and other commodities between countries and regions, has been facilitated through the steady liberalization of the conditions of trade and by technical changes in production, transportation, and information. People can now more quickly adapt to local factor prices by moving, by producing new or different goods, by adopting exogenous technologies unrelated to local primary factor prices, or by receiving new types of external investments. These increased opportunities for international market access, trade and earnings are also likely to have some adverse consequences on the agricultural sector in developing countries. The impacts of globalization⁴ will be seen principally in three major areas:

- (i) Impacts on agrarian and resource-dependent societies

As a result of these rapid changes many agrarian societies, and societies dependent on forests and fisheries, are likely to become unstable. There is already erosion of traditional authority in poor areas. Economic liberalization and urbanization also lead to the rise in rural labour costs as labour moves out of the agriculture sector. Rising labour and input costs and

⁴ McIntyre, J. (2003) Major developments in and future potential of social and policy research: implications for agricultural, forestry and fisheries R&D in developing countries.

falling output prices lead to declining terms of trade of domestic food crop production relative to imports. As the terms of trade for food crops change, producers tend to look for areas of competitive advantage for allocating their resources and for increasing their income through farm production.

As a consequence, three classes of producers in agriculture, forestry and fisheries in the tropics are likely to emerge:

- First are commercial producers of enough scale and technology to earn competitive returns, acquire information, generate or adapt technologies, and fund lobbies.
- Second are the farmers who do not earn competitive returns because their farms or other available resources (livestock, fishery, forest holding) are too small and unproductive. These producers either cannot produce enough food for their own consumption, or are at the margin of doing so, nor can they generate enough income in other goods to buy enough food. They will depend on public charity and private remittances;
- Third are intermediate groups of varying size dependent upon their farming or resource systems and constrained by climate and the biophysical and local economic parameters of their production (e.g. costs of irrigation).

(ii) Impacts on growth and income distribution

Integration of developing country economies into the global system, especially for agriculture, leads to changing terms of trade and competitiveness of domestic agricultural products such as food grain production. Given that global food prices are low, and are expected to continue to decline, domestic competitiveness of cereal crop production will also decline. This decline creates a persistent disparity of world income distribution away from producers to consumers.

Farmers in richer countries create lobbies to defend their interests. Those lobbies use market power to harvest subsidies, with indirect and negative effects on the terms of trade of rural people in the poor nations. This creates imbalances in both income distribution and market stability.

Within a particular country the adjustment costs to a more globalized system are going to be highest for people who are displaced from the less competitive sectors and those people who are left out of the market. Lack of physical and human capital, as well as institutional constraints, prevent the very poor from making a smooth transition to a globalized world. Across countries the least developed countries would have very significant adjustment costs in the move towards a globalized society.

Without building specific social alliances, the interactions between rural and urban people within and across rich and poor countries will widen. Market interactions leading to competition between populations for scarce factors (e.g., water conflicts between rural and urban users in every arid region of the world; land conflicts in the humid tropics between cities and forests or farms) may become more common.

- (iii) Conflict between *economic efficiency* versus *multiple use* approaches for natural resources.

In response to the pressures of global economic forces and the integration of markets, there is a tendency towards specialized, single uses of natural resources, such as very high yielding single clone plantations to meet industrial timber needs. Economic efficiency favours the aggregation of management units - as is apparent in the consolidation of the global pulp and paper industry, or the intensive aquaculture and feed industries. In direct contrast, the thrust of inter-governmental processes is in general to favour integrated, multiple-use approaches for the management of natural resources such as forests, coastal areas and watersheds. These divergent scenarios have different implications for the poor in developing countries. Although the opportunity of employment in the economically efficient segregated industry may meet the needs of some, others will not make the transition for a long time. Balancing development goals and the rates and types of exploitation of natural resources will be necessary for sustainability of both the resources and dependent communities in the longer term.

2.3.1 Repositioning Developing Country Agriculture in the Context of Globalization

The science and technology agenda: An area in which science and technology can play a crucial role is through enhancing competitiveness through technological change, particularly for food crops. Quality and food safety are important dimensions of competitiveness for agricultural products. The focus should be on substantially reducing the unit costs of production, either through a shift in the yield frontier or through improved input use efficiencies. Reducing transactions costs associated with market access could also help enhance the competitiveness of small farmers.

Globalization, on the other hand, has dramatically increased the transactions costs associated with technology access by developing countries due to the growing importance of proprietary biotechnology investments in agricultural research. Private sector investments in genomics and genetic engineering could be potentially very useful for addressing the problems faced by poor farmers, particularly those in the marginal environments. The requirement is to create incentives (and licensing agreements) for public/private sector partnerships that allow the public sector to use and adapt technologies, developed by the private sector, for the problems faced by the poor.

The public policy agenda: The main public policy challenge is to assist the second farming class - the poor farmers (foresters or fishers) with low and variable income and with little capacity to invest in knowledge generation. It requires investment support, and an extended form of social protection, if this agrarian class is not to fall irretrievably behind the rest of the world.

The main challenges for research are to address the imbalances caused by the macroeconomic effects of lower commodity prices and the market power of the farm lobbies in the rich countries.

Nations will require assistance to establish enabling environments for developing country goods to be competitive in international markets - for instance, to meet the growing food safety,

and product and environmental health certification requirements, associated with trade in agricultural products (particularly including livestock, fish and tree products).

2.3.2 Long term trends in commodity prices and the profitability crisis in staple cereals

World market prices for wheat, maize and rice, adjusted for inflation, are the lowest they have been in the last century. More dramatically still, commodity prices for pulses have dropped to only about half of what they were in 1989/90. In comparison, over the last decade, there have been simultaneous price increases for commodities such as milk, fish, potatoes (including sweet potatoes and yams) and plantains (see Chapter 6).

In the case of maize and wheat, after a spike in prices in 1995/6 led to an increased area planted to these crops, higher levels of production, particularly from high yielding agriculture in North America, have led to yield exceeding demand and depressed prices. The stabilization or reduction of global prices in staple commodities is advantageous for less well off consumers, including the urban poor, who spend a larger proportion of their income in obtaining basic food requirements. Food policies in some less developed countries turn the terms of trade against agriculture to keep urban food prices low. However, depressed world market prices reduce returns to poor farmers increasing their poverty, acting as a disincentive for technological improvement, and slowing agricultural and national economic growth. Low prices can act as a stimulus, for those with the means to do so, to diversify agricultural practices and products (although farmers' attempts to diversify can sometimes come into conflict with government policy protecting land planted to staple crops).

A second dimension of the profitability crisis in cereals (and in several cash crops important for developing countries, like sugar and cotton) is that it results from commodity subsidies in high-income countries and the dumping of excess production on world markets. Protectionist import policies and export subsidies further distort what might profitably be produced in particular countries. For agriculture-led development to be effective in poverty reduction, particularly in a globalizing world, high-income countries must move rapidly towards the elimination of agricultural commodity subsidies. Similarly, developing country policies (especially in those countries where agriculture contributes substantially to GDP) should be redirected towards the stimulus of agricultural production and the provision of equitable opportunities for diversification of products.

Potential and challenges of the "new agriculture": If, measured globally, the required supply of staples can be met and maintained through technological improvements and efficiency in production, the challenges are to make supplies available to the poor and for developing countries to embark on additional opportunities to take advantage of the new scenario for the future of agriculture. This will include moves away from the production of traditional staples, to high value products (including, for example, fruits, vegetables, fish, livestock products, horticulture etc). There will be greater focus on post-harvest improvements to increase cost efficiencies, or to increase the value added to products. Such market-oriented adjustments require greater consideration of product quality, and emphasis on production to market food chains, labelling (for product and human health, and environmental safety), and on managing and paying

for environmental services. Organization of small farmers will be required to ensure their access to these supply chains and markets.

2.4 The Changing Composition of NARS and Partnership Opportunities

National agricultural research systems (NARS) consist not just of public organizations, but also of all organizations, including farmers and farmer organizations, that contribute to agriculture-related knowledge and information⁵. Well over 100,000 agricultural scientists (full-time equivalents) are working in the public sector NARS of the developing world (compared with about 60,000 in industrialized countries). NARS account for over 95% of agricultural R&D investments in the developing world, and this investment in turn accounts for a substantial share of the unprecedented rate of agricultural productivity growth seen over the past three decades. However, in general, the number of scientists has expanded faster than budgets, resulting in a squeeze in operating budgets and reduced real salaries. A variety of new funding mechanisms, such as commercialization of research products and services, levies paid by farmers, and environmental funds, are being utilized to supplement public funding.

Diversity in NARS: NARS and the circumstances in which they operate are highly diverse, ranging from large federal-state systems with considerable capacity in strategic research, to many small systems with a handful of research stations, carrying out mostly adaptive research. China and India, for instance, have the largest research systems in the world, with tens of thousands of scientists, and account for over one-half of developing country research capacity. Roughly three quarters of NARS in developing countries employ fewer than 200 researchers. Small countries face special problems of small market size, a limited pool of scientists, and lack of economies of size in research execution. Regional research initiatives, lead by regional agricultural research associations (RARAs), are especially important in sharing the cost of research in regions with many small countries. The challenge is how to set priorities among small NARS in a region, and effectively share research products and services.

The evolution of the National Agricultural Research System concept: In the 1990s, emphasis shifted from almost exclusive attention on national agricultural *research organizations* (NAROs) to a broader focus on national *research systems*, defined to include the NARO, universities and the private sector (both for profit and non-profit). The aim has been to increase the scope and capacity of the system, seek additional funding support and to exploit complementarities among various research providers at the national and international levels. Despite the continued centrality of NAROs, other organizations (within the agricultural sector or in other sectors) are playing a greater role in contributing certain types of research.

With this increased pluralism, NARS are now being viewed within a wider innovation system. Some countries are promoting greater integration among *research, extension and education organizations* - the so-called *agricultural knowledge and information system* (AKIS). Others expand this concept further into *national agricultural innovation systems* (NAIS) that recognize wider sources of innovation (including farmers and foreign suppliers), and a non-linear pattern of interaction and feedback between research, development, and uptake of technology.

⁵ Byerlee, D. and Alex, G. (2003) National Agricultural Research Systems: Recent Developments and Key Changes

However, many NAROs have planning or activities dominated by supply-led criteria resulting from poor links to clients. Consequently, many NAROs are attempting to streamline research priorities, reform management and incentive systems, and involve a broader range of actors, including farmers, in the research process. An additional challenge in a more decentralized and stakeholder-driven environment is to combine priority setting driven by national strategies in terms of commodities, regions, and types of technology, with bottom up participatory processes of setting the research agenda. The rates of change to the new paradigm have been very variable. However, successful implementation of a strategy of decentralization and empowerment can lead to shifts in the flows of funding, with funding increasingly passing to users, who then contract needed research services.

Meeting new priorities: In a changing world, and confronted by the same externalities as the CGIAR, the NARS too are confronting new priorities. There are an increased number of actors and linkages in national systems, compared with early concepts of NARS. The speed of institutional change is unprecedented, induced by market liberalization, scientific discovery, democratization and empowerment. The particular challenges to the NARS include:

Competitiveness of agriculture: Investment in science and technology is now seen as a key element in establishing a country's competitive advantage. This applies to traditional and non-traditional exports and to niche products, which are also growing rapidly (e.g., horticultural exports). New endeavours require substantial research, an entirely new base of knowledge and skills, and a capacity to increase efficiency along the entire commodity chain.

Accessing and applying new science: Biotechnology and information and communications technologies are providing new tools to address agricultural constraints. However, most developing countries are not sharing in the benefits from these advances, creating "molecular" and "digital" divides. Biotechnology strategies will vary with national science capacity and level of commercialization of agriculture, but all are being challenged to strengthen their policy and regulatory frameworks for IPRs, biosafety, trade in genetically modified products, food safety, and strategies for accessing the new technologies. This links national agricultural concerns with the wider requirements of Science and Technology policy. Developing country NARS must enter into new partnerships or contractual arrangements to obtain use of proprietary scientific knowledge on favourable terms for markets that are not of interest to the private sector. Patenting the products of public research demands new legal, negotiation, and business skills. Accessing or acquiring germplasm requires NARS to find new ways of sharing genetic resources according to international criteria.

Defining uptake pathways: Agricultural extension systems are becoming much more pluralistic, and farmers themselves are becoming better organized to contract and provide advisory and information services. R&D organizations must therefore explore a variety of potential uptake pathways for their products.

Precision agriculture: This approach requires application of new knowledge in the form of information and management practices that use existing land and water resources more efficiently and sustainably.

Natural resources and the environment: Natural resource degradation, and public concern over environmental issues, is shifting research priorities and funding to sustainable land and water management, forests, and biodiversity; pesticide safety and residue minimization; livestock waste management; water quality preservation, and watershed protection. There are also increasing opportunities for agriculture to provide environmental services through carbon farming and conservation of biodiversity.

Defining public and private roles: With liberalized trade, promotion of private investment regimes, and protection of intellectual property, investment in R&D by both the local private sector and multinationals is growing in most countries. As a result, the public sector is being challenged to more clearly define the public good component of research. With the private sector increasingly serving the commercial farming sector, public funding is being challenged to focus more sharply on the poor.

Developing partnerships and alliances: Partnerships (with CGIAR or other partners) present new challenges in term of capacity and skills for public-private collaboration, and the forging of regional and international alliances.

Conclusion: Given the central role of NARS in the agricultural development of their countries, the public goods nature of much of their goals, links to government policy formulation and the wider number of stakeholders in delivery, the strengthening of NARS to meet these emerging needs is central to the success of the CGIAR. This point has been recognized and identified as a priority in the CGIAR consultations with stakeholders and scientists.

2.5 New Scientific Opportunities: Biotechnology and ICT

2.5.1 Biotechnology

A large proportion of the historical mandate of the CGIAR has been on the improvement of the germplasm of the major plant crop staples of importance to developing countries. Recent years have witnessed an unprecedented increase in the power and range of biotechnologies, particularly genetic technologies, available to amplify and extend investigations across plant and animal species and to address the organisms, disease agents and abiotic stresses of most concern to developing country agriculture. A parallel explosion in computing and informatics has augmented data acquisition and storage, synthesis and transfer. Modelling, and the ability to combine data from different sources, can not only inform germplasm studies and the search for new genes and functions, but also promise to revolutionise understandings of processes affecting the management of natural resources. The strategic accumulation of data, tools and modelling resources can be expected to develop in the coming decade a more predictive approach to agriculture, the evolution of land and seascapes and the effects of climate, so providing insights for the development of long term agricultural and environmental policy.

Gene discovery research: Advances (in technical capability and speed) in the sequencing of whole genomes, and the mapping of key genes for adaptation carried out by the private and public sectors, provide the basic material for the identification of gene function and the more directed incorporation of useful genes into plants, animals or micro-organisms important to agriculture. The genome sequencing of rice has been completed and a major international

experiment on *Arabidopsis*, which will evaluate gene function in this model plant, is well advanced. Various genomics technologies are used to identify the function (the product and the role) of genes discovered as anonymous ‘expressed sequence tags’ (ESTs) or ‘gene predictor’ programs working on raw genomic DNA sequence. The recent discovery that gene order and gene content can be largely conserved over evolutionary time (synteny) allows information on gene function discovered in one species to be transferred to other, often quite distantly related, crop species. Gene expression (the extent to which individual genes are switched on at different times and in different tissues, together with effects on other genes) can be examined using microarrays and expression profiling. Genes of likely interest to CGIAR research would include those contributing to yield improvement (e.g. through modified plant architecture, maturity, delayed ripening, pest and disease resistance), use of marginal environments (drought and salinity tolerance), or improved nutrition (e.g. enhancement of protein or vitamins), or alternative uses (e.g. production of vaccines or antibiotics). Genes and beneficial versions (alleles) of individual genes, once identified, can be transferred to suitable lines by breeding or introgression and the recipient lines tested for character expression (see Figure 2).

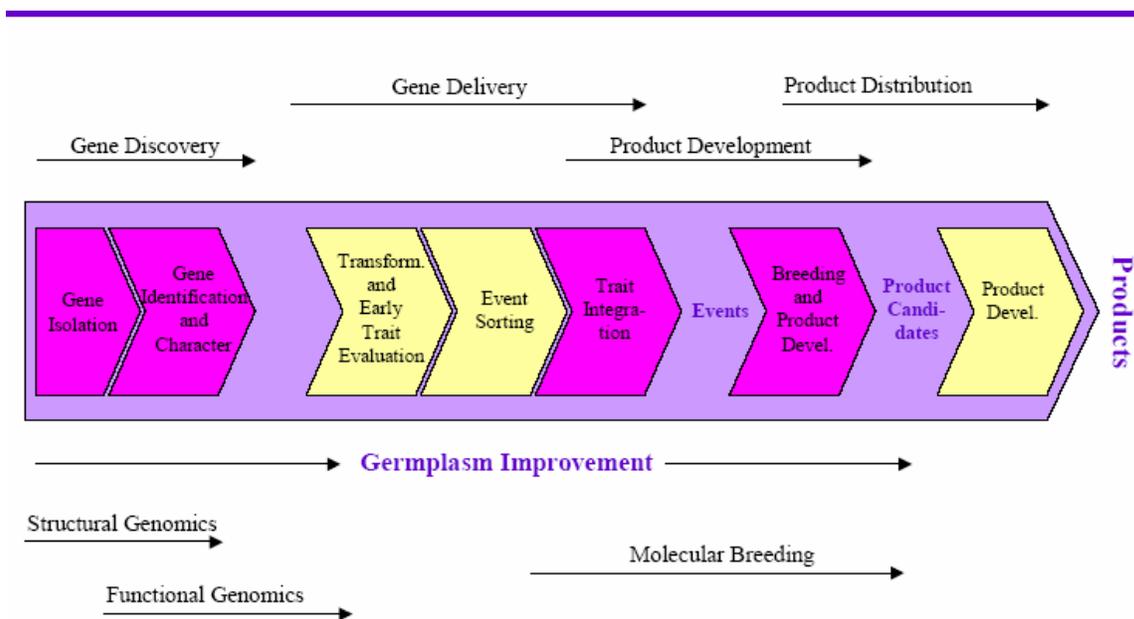


Figure 2. Technology supply chain for the delivery of new products will require integration of different technologies that include transgenic and non-transgenic approaches. Source, Powell, W. (2003)

A major advantage in functional analysis is the ability to compare the functions and products of target genes with similar genes found in the wild relatives of the plants or animals under study. The CGIAR is particularly well placed in this respect as there has been considerable study of the crop plants of interest and wild relatives of some species are already CGIAR genebank accessions (see Table 1a). The further collection and phenotypic characterization of land races and a greater array of plants would augment research. Through similar rates of advances in human medical science and in work on developmental model systems, it is equally feasible to extend analogous approaches to livestock, including fish species for aquaculture, and

to potentially useful micro-organisms - or even, potentially, to insect and other pests (see Table 1b). There is therefore an opportunity to link biotechnology to whole organismal biology and breeding of resource families, and targeted at the natural resource constraints of developing country farmers.

Such approaches will be augmented by the ability to collect and characterise wild relatives of the target species for enhancement, as these are likely to harbour genes which confer resistance to biotic and abiotic stresses in different localities. Indeed, these strategies form part of the new Challenge Programme that will hope to identify major genes which contribute to drought tolerance in plants. The necessary steps must also be taken therefore to conserve wild relatives, particularly at their centres of origin, to ensure their future contribution to the enhancement of production. In the future, there is also the opportunity to develop a 'horizontal genomics' programme that focuses on non-crop plants that harbour completely novel genes that could have utility in agriculture and biotechnology. Gene flow occurs between cultivated and wild species in nature. Knowledge of this phenomenon requires further study since its extent for any target species or group of species will inform improvement strategies and govern biosafety protocols for the introduction of improved varieties, using traditional or GM technologies.

Possible constraints: The availability of these powerful technologies, including gene transfer, is still relatively recent, and the state of knowledge of the genetics of some of the key plants or animals is very uneven. For instance, more than 415,000 ESTs have been developed for wheat by all research, but only 45 have been developed in cassava. More is known about certain fish and tree species (providing the basis for rapid investigations in these groups) but more work is also required on many of the 'orphan' crops of most relevance to the poor. Secondly, the scale of major initiatives to improve particular crops is expensive in resources and funds, and a CGIAR portfolio of genetic improvement should be developed in the knowledge that it will be able to lead relatively few such initiatives (but could advance research on many fronts with adequate partner arrangements).

Secondly, part of the reason for the rapid rate of progress in these fields, particularly for the staples, has been because of the high rate of investment by private companies in agricultural research. Seventy per cent of the patents on proprietary biotechnologies reside with the private sector, sometimes putting new public research in both developed and developing countries at a disadvantage. Private-public partnerships in biotechnology (promoted within the CGIAR, and by agencies such as the Rockefeller Foundation) are considered the best means to allow the specific use of priority procedures and technologies for the benefit of crops or farming systems improvement for the poor of developing countries.

**Table 1a - Future Harvest Genebank Collections
held in-trust for the world community based on agreement with FAO (2002)**

Centre	Crop	Number of Accessions
CIAT	Cassava Forages Bean	851 1399
CIMMYT	Maize Wheat	200,799 415,642
CIP	Andean roots & tuber Sweet potato Potato	4,153 94,423
ICARDA	Barley Chickpea Faba Bean Wheat Forages Lentil	314,884 469 1 415,642 9
ICRAF	<i>Sesbania</i>	
ICRISAT	Chickpea Groundnut Pearl millet Pigeon pea Sorghum Minor millets	469 105 93 23 84,712
IITA	Bambara groundnut Cassava Cowpea Soybean Wild <i>Vigna</i> Yam	851 45 308,564 17 7
ILRI	Forages	
IPGRI	<i>Musa</i>	437
IRRI	Rice	130,812
WARDA	Rice	

Source: Powell⁶

⁶ Powell, W. (2003) "Think Piece" - The BioSciences Opportunity.

Table 1b - ESTs for selected livestock, fish and tree Species

Species	Number of dbEST
<i>Danio rerio</i> (zebrafish)	294,479
<i>Bos taurus</i> (cattle)	265,998
<i>Sus scrofa</i> (pig)	116,668
<i>Oryzias latipes</i> (Japanese medaka)	103,098
<i>Pinus taeda</i> (loblolly pine)	60,226
<i>Populus tremula</i> & <i>P. tremuloides</i>	56,013

Source: Powell (2003) ibid.

Requirements: The quantitative nature of modern biology demands closer collaboration between biologists, bioinformatics experts and service technologies. Converting the vast amount of information into knowledge represents a major opportunity. A collaborative approach is needed to capture emerging opportunities but also to gain access to large-scale expensive resources.

Seeds or propagules provide the delivery system and the means through which innovation in biotechnology can be captured and transferred to the major beneficiaries. Capturing the value from genomics requires the maintenance of strong competency in plant and animal breeding and whole organism biology. Opportunities therefore exist for the integration of genomics with breeding to create technology platforms for the conversion of traits to products.

Programmatic requirements for CGIAR and partner involvement in gene discovery and the development of new products for the poor would include:

- The secure handling and maintenance of mass data volumes for global distribution
- Integrated bioinformatics platforms to link genomic and agronomic data (e.g. yield trials, other phenotypes, genotypes and pedigrees)
- Facile platforms for segregation and population based trait (major gene or QTL) mapping
- High throughput DNA marker (microsatellite and/or SNP) services to support breeding programmes for trait introgression, backed by user accessible laboratory information management systems (LIMS)
- Proteomics and metabolomics service technologies
- Training of NARS scientists in the application of these services

And underpinning research across all CGIAR species:

- Enhanced understanding of the significance of intra and inter-specific DNA sequence diversity and its relationship with agronomic traits
- Haplotype-based disequilibrium genetics (association genetics) analysis

Conclusion: Two new Challenge Programmes build on Centre and partner research to exploit genetic technologies to; a) search for genes for drought tolerance and other characteristics of potential use to farmers in marginal environments, and, b) to enhance the nutritional quality of grains. Resources may limit the number of major projects of this type. However, there is a wide array of other possible applications (particularly to augment animal or fish breeding, identification of species in conservation biology, or the identification or modification of soil

micro-organisms responsible for enhancing soil fertility and plant performance). Genetic methodologies provide the tools for the CGIAR to accelerate the rate of research and the production of plant and animal types of importance to its work in augmenting the productivity of developing country agriculture. Additional work on enabling policies and private-public partnerships to facilitate freedom of action and to address key issues is also required.

2.5.2 Information and Communication Technology

Modern information and communication technologies (ICT) have been seen as an integral part of the effective acquisition and exchange of information and knowledge in the CGIAR. The challenges are not just concerned with infrastructure and connectivity, but rather comprise a multi-faceted problem of effective knowledge exchange and information management⁷. There are particular opportunities to augment human resources and institutional capacity through the use of these technologies.

ICT as a component of research: New information technologies already play an important part in the storage, retrieval and sharing of information amongst the CGIAR Centres and their partners. They will continue to contribute to multi-partner efforts in such fields as genetic sequence storage, gene bank management, enhanced resource and trend monitoring for natural resources. Web-based resources allow Centres to distribute centre outputs widely, such as biological encyclopaedia, keys, guidelines, analytical software and publications. Intranets allow increased cohesion in geographically dispersed activities and increase the efficiency of common scientific recording and administrative functions.

Spatial data, mapping and policy/decision support: Following the considerable investment in Geographic Information Systems (GIS) by the CGIAR, a critical mass of data and expertise has been accumulated. Measuring and monitoring natural resources provides essential data that can underpin decision support models and tools that can in turn guide policymaking. Expanded allocation of resources to building such models and tools would increase the System's integration of approaches and increase research visibility at all levels. The CGIAR should consider system-wide approaches to promoting the utility of such data and the adoption of internationally accepted standards for spatial data (being developed by the UN Geographic Information Working Group). The System Wide Initiative on Spatial Information includes the use of GIS for poverty mapping, and refinement of this capability, in concert with other international initiatives and data sources, can greatly enhance the targeting and monitoring of the CGIAR's pro-poor research initiatives.

Sensors: Advances in design have meant that sensors can detect ever-smaller changes in their environment (e.g. temperature, chemical levels), but more importantly some can now report their data remotely using wireless data communications. This has many implications for biological, and specifically agricultural research, e.g. for working remotely from sites in smallholder agriculture. Refined monitoring of this type also allows the design of precision agriculture approaches.

⁷ Rudgard, S., Katz, S. and Mangstl, A. (2003) Recent developments in information and communication technology: Implications for agricultural, forestry and fisheries R&D in developing countries.

A greater capacity in photo and video image processing: With the increasing power of desktop computers, new photo and image technologies can be the means of managing several types of data/information: images of scientific samples; integration of aerial, satellite, and ground-based images for characterization of a local setting; e-learning training materials; presentations; and promotional media.

Emerging Opportunities to Improve Access and Management of Information across the CGIAR using ICT

Information standards and vocabularies: The rapid growth of information available on the World Wide Web in general, and from the CGIAR Centres, has increased the difficulty of locating specific information and knowledge, which is scattered across widely distributed sources and archives, and in different domains. The efficiency of “resource discovery” depends on the structure, type and content of the information resources being searched, and on the diverse interests of the owners of the information. Systems which can recognise and analyse intended meaning (semantic analysis) of vocabularies will allow automated information processing, allowing machine-assisted indexing and text annotation, classification, and semantic clustering of information in a dynamic way with possibility for cross-domain links.

International initiatives for operationalizing such standard nomenclatures include the Agricultural Metadata Standards Initiative (launched in November 2000). In support of this initiative the FAO has produced the Agricultural Ontology Service (AOS) as a co-ordinated collaborative approach to develop a multilingual and multidisciplinary vocabulary system in relation to promoting food security and sustainable development.

Sharing informational assets in agriculture: To help diminish the knowledge divide between developing and developed countries, the emphasis for ICT approaches will be to enhance links and efficiencies between sources of agriculture-related information sources, for instance, there have been strong recent efforts by FAO and partners in the international agricultural research community to strengthen the AGRIS initiative. AGRIS has adopted a decentralized approach, which seeks to serve the increased plurality of actors involved in agriculture research.

Outreach and Capacity Building - Strengthening research-extension linkages: Digital ICT provides a potentially powerful tool for improving communication between research, extension and even farmers, by establishing and/or strengthening linkages among and within the human and institutional elements of agricultural research and extension systems. The Internet's multi-media capabilities facilitate the development, sharing, storage, retrieval and dissemination of a range of information and support communication in many forms (e.g. e-mail, discussion lists, chat forums)⁸. The aim should be improving linkages between both the human component and the technological components within and between agricultural research and extension institutions.

⁸ The FAO have developed a conceptual model for a Virtual Extension Research Communication Network (VERCON) of potential utility.

Electronic Distance Learning: Distance education and learning are potentially powerful ways for organizations such as the CGIAR Centres to communicate with, and impart knowledge to, their stakeholders. Modern ICT provide means of communication and presentation of materials to the target beneficiaries/learners that are available, reliable and affordable. Considerations of the choice of technologies for developing and delivering learning content should be based on the pedagogic and operational considerations.

Conclusions: “The Future of Information Activities in the CGIAR: A System-Wide Strategy” prepared in 1994 set the following three goals: (a) to enhance the quality and relevance of research and decision making of CGIAR staff, their clients and partners; (b) to disseminate effectively the results of IARC and partner research; and (c) to contribute to the development of an efficient and effective global information system on agricultural research. The Organizational Change Programme (OCP) of the CGIAR has focused on the theme of “knowledge management” or “knowledge sharing” in its efforts to develop innovative ways of managing collaborative alliances and improving knowledge management between Centres. Development of this theme has been seen as a key factor in improving individual and organizational performance. The appointment of a Chief Information Officer was made recognizing the need for a more integrated system-wide approach to information. There are continuing opportunities to strengthen standard ICT technologies to enhance the coherence, interactions and delivery capacities of the CGIAR system as a whole. The recommendations of the SC (in this document) relating to the development and sharing of global context and trend indicators, to enhance mutual planning and impact assessment capacities, are a case in point.

2.6 Changing Donor Support

The CGIAR System as a whole, and each of its Centres (and now new major undertakings such as Challenge Programmes), is funded by a consortium of independent donors. Traditionally, and still in large part, the donor nations, agencies and development Banks provided support to agricultural research as part of assistance to international development. Stable core funding for Centres led to the development of longer-term research projects and programmes. In the last decade, the following trends have been noticeable:

- A reduction in unrestricted support to Centres.
- A stabilization or relative reduction in the funding of the work from public sector sources.
- An increase in the number of new “non-traditional” donors through the inclusion of Foundations for the environment and other science agencies, collaborative research funds from the private sector, private philanthropy and the commissioning of research by developing country NARS.
- A tendency amongst Centres to seek support from these non-CGIAR member donors to cover research activities. These new opportunities can bring new constraints on flexibility, and complexity to the path of delivery.
- An increasing “projectization” of the work of the Centres.
- Decreased flexibility for Centre-funded and Centre-level (sector, commodity) planning and pilot experiment type research (unless projectized).

- Greater involvement of individual donors in collaborative project development and a trend for donors to utilize Centre's analytical and project management expertise in developing countries to enhance donor activities or goals.
- A greater emphasis from donors on poverty alleviation and development-level impacts.
- Increases in support to policy and natural resources management research and a reduction to technology-based research, particularly germplasm enhancement type research in Centre heartland research.
- More varied and individual donor preferences for inter-Centre and system - wide initiatives, some of which have been under-funded after initiation.
- Competition between traditional activities and new activities for support given donor budgetary ceilings.
- Differences of opinions over the potential efficacy and scale of the move to Challenge Programmes (see for example the OED meta evaluation of the CGIAR in Chapter 3).

Donors respond with different enthusiasm and commitment to the range of research topics being undertaken across the system, required in order to address the broader aspects of agricultural research. In many cases, the donors are not unified in outlook, regional interests or funding capacity and so Centre portfolios of research are subject to piecemeal funding. The recent trends to increasing policy support from donors have made some areas of required technological research difficult to accomplish. The donors are subject to their own national structures and political considerations, which can interrupt, redirect or temporarily constrain funding to agriculture and development issues.

Recently, there is increasing evidence of coordination amongst donors in many of the individual aspects of the CGIAR portfolio (including some Challenge Programmes) and particularly for support of NARS-led priority setting. However, means of enlisting support for overall CGIAR System level planning and priorities is required, through the consultative process and beyond. It will be hard for donors to judge (in anything but a piecemeal fashion) the support that may be given to additional elements of the CGIAR priorities without prior assessment of research activities currently being carried out across the system. Such an assessment will also require identification of strategies for accomplishing priority research - including which research efforts will be addressed through Centre-based research, inter-Centre initiatives, or Challenge Programmes. Attempts to implement gap-filling strategies by donors for completion of the CGIAR agenda have not met with success. From the standpoint of the implementation of Centre and system-level plans and priorities, vagues in donor support can lead to distortion of the intended portfolio or mission creep. However, through their support, the donors and investors in the CGIAR essentially catalyze the implementation of the plans made at System and Centre levels. Donor inputs into the System-wide CGIAR planning may therefore be a key element determining the ultimate success of the plan and its implementation.

2.7 Role for Agricultural Research in Poverty Reduction through Sustainable Productivity Enhancement

Earlier in this chapter the major challenges for poverty reduction and sustainability enhancement were identified as (i) provisioning the urban masses especially the urban poor with adequate amounts of food and nutrition; (ii) eliminating rural poverty and attacking the problem

of chronic food insecurity; (iii) sustainably managing the natural resource base; and, (iv) repositioning developing country agriculture in the context of globalization. This section considers the role for research in meeting these challenges⁹.

The science and technology agenda for provisioning the urban masses: Much of the food policy discussion and policy making in the developing world is centred on increasing cereal crop productivity in predominantly subsistence production systems. Urbanization and the associated diet diversification induce increased commercialization and diversification of agricultural production. Identification of the technologies and policies that allow for the least cost transition to a diversified agricultural system (including meat, milk, fish, fruit and vegetables) would be crucial. The demands on the research system still include the maintenance of cereal supplies and price stability, but the emphasis for all commodities changes from quantity to product quality (both in nutritional and safety aspects). Production priorities will therefore be more specifically on post-harvest processing, agro-industrialization, and producer to market food chains. The rapid absorption of resources out of the rural sector places a great demand on the agricultural research and development sector to generate technologies that are less demanding of the primary factors of production, particularly land, labour, and water. Quality and safety considerations require the agricultural science community to generate and promote technologies that significantly reduce the dependence of the farming sector on chemical inputs, particularly fertilizers, pesticides, antibiotics etc.

Reaching the rural poor: Improving the productivity of agriculture in the marginal environments, and in disseminating that information to the people who need it the most will be paramount. Significant progress has been made in the development of drought tolerant crops, high temperature tolerant crops, etc, but this remains an avenue for future research. Similar attention should be paid to assessing the technical feasibility and economic viability of producing nutrient-enhanced grain (e.g. Vitamin A rice, and Quality Protein Maize). The CGIAR has a role to play in catalyzing the application of new biotechnology to these issues so augmenting conventional breeding methods. Increased understanding and acceptance of the benefits of modified crops, following discussions with participating farmers and national authorities, could help target research outputs to particular environmental and socioeconomic niches. The exploitation of marginal environments requires the development and promotion of technologies that are both productivity enhancing while at the same time risk reducing and resource conserving. Diversification of systems and research on agro-ecological (production ecology) methods are required to these ends. Identifying small farmer constraints to technology adoption and use continues to be an issue for research.

Policies that ensure that the poor maintain access to land, water and other productive capital is required to ensure that the situation of the poor can be improved through agriculture. High levels of investments in education and infrastructure improvements targeted towards marginalized people will facilitate their integration into the market. A third requirement would be means to reduce transactions costs in accessing markets for these households - both accessing output markets, but also input markets, reducing transactions costs involved in acquiring information on technologies, on markets, and on institutions, can help them improve their lives and livelihoods. Finally, targeted policy interventions for marginalized people need to assess and

⁹ Pingali, P (2003) op cit.

focus the role of research and technology development specifically for the less favourable environments.

Research and policy for the sustainable management of the natural resource base: The highest priority for sustainable resource management is to create better incentives for judicious resource use. Improved property rights, and input and output price policies are required for long-term sustainability of resources. Price policy reforms would require adjustments in both macroeconomic as well as agriculture sector-specific policies. In many situations, market failures for environmental services need to be corrected by the setting up of markets (e.g., for carbon capture) or of schemes of payments for environmental services (e.g., for watershed management and *in-situ* conservation of biodiversity). Particular attention should be paid to potential trade-offs between food security goals relative to resource conservation.

Devolution of governance authority and the development of institutional arrangements that foster sustainable local management are required for primary natural resources like forests, fisheries and rangelands. At the farm and landscape levels it is necessary to target research and development specifically towards technologies that both enhance productivity while at the same time conserve resources. Multiple water use and integrated pest management (IPM) are examples of the approach. Similar technologies are needed for nutrient, land, and water management across a wide range of environments and farming systems. The problem of disseminating such knowledge-intensive technologies to subsistence farmers needs particular attention - and the correct incentives.

Science and technology for developing countries facing a global food market Clearly here, the focus will be on enhancing competitiveness through technological change. For commodities such as cereals, in order for the cost per ton of output to drop faster than the price the farmers face, sharp increases in output per unit of input will be required. This can be addressed either through a shift in the yield frontier (as a result of strain improvement) or through improved input use efficiencies. Similar arguments apply to livestock systems and fish from aquaculture. Reducing transactions costs associated with market access could also help enhance the competitiveness of small farmers.

Globalization, on the other hand, is likely to increase the transactions costs associated with accessing technology by developing countries. Public/private sector partnerships will need to be evaluated for their capacity to provide technologies appropriate to the poor, including how such new tools may be licensed for use

Food security is not just a problem of increasing production, it is a problem of improving access, it is a problem of equitable distribution, and it is also a problem of enhancing effective demand of the poorest of the poor for food. Improving opportunities for increasing incomes of the poorest of the poor may be as important to their food security as providing them with new productivity enhancing technologies.

Solution of the food security issues involves multiple actors and the CGIAR must enter into extensive partnerships to maintain its knowledge of the context, and to provide and catalyze solutions to these challenges where it has capacity to assist.

2.7.1 Beyond Blueprints: Towards Localized Integral Approaches to Attack Resilient Problems, and Towards Attacks on Global Problems

The foregoing sections suggest that agricultural development, or certainly the state of development of agricultural research, is in a state of transition. The Green revolution produced substantial yield gains in cereal crops in productive environments. It put off major scares of food scarcity and famine. It was produced by quite a linear model of technology development (in this case, breeding of lines with high growth potential), testing and extension with national partners. Faced with still growing human populations, predominantly in developing countries, and likely to be heavily clustered in urban situations, there is still a requirement to increase the efficiency of food production to meet the needs of these agriculturally unproductive city dwellers.

But in many cases yield ceilings have been reached. The natural resources that support production are degraded (land and water quality) or are in increasingly short supply (fresh water, cultivable land). The straightforward requirement for increased production changes to encompass a priority for sustaining production and making it more efficient per unit of land. There is also the need to focus on the sustainability and demand aspects of supply. This includes extending the range of technologies to meet the needs of the poor where they exist, in unfavourable agro-ecosystems, or exploiting resource systems that are under stress from poor management or over use. The poor tend not to be directly involved in monocropping systems (unless as hired labour). They approach risk through diversification of enterprises with low input use. Assisting the poor requires knowledge of where they are, how they put together livelihoods and the constraints on system improvement. It requires delivery of technologies appropriate for their circumstances.

However, given the complexity of existing local farming systems (in relation to the huge variability and diversity in agro-ecological and socio-economic/ cultural conditions) the simple provision of technological packages or project-based interventions will not be sufficient¹⁰. Research (international and national) and development/extension systems must be prepared to face changes in the paradigms for strategic and operational governance. The key players are the NARES of developing countries, the Regional bodies for agricultural research and the international agricultural research centres. It must be recognised that no single actor, operating alone, can hope to resolve the situation in a sustainable way. Most importantly, all of the major actors must confront the implications of the diversity and variability required for their respective intervention strategies. The introduction of an intensified, sustainable agriculture requires the creation of an “enabling policy environment” by international and national policymakers, that would enhance the development of professional research and extension services, as well as a competitive private sector. Governments therefore have a role to play in the:

- stimulation of the private sector for trade and transport, enhancing the creation of efficient and equitable markets for both inputs and outputs,
- an allocation from the national budget to the agricultural research and extension institutions to achieve a minimal degree of continuity in their field operations, and

¹⁰ Stoop, W.A. (2002). A study about the causes for low adoption rates of agricultural research results in West and Central Africa: possible solutions leading to greater future impacts. The Mali and Guinea case studies. (A study commissioned by TAC, TAC/the Syngenta Foundation for Sustainable Development).

- institutional changes at local levels, stimulating the creation of effective farmer organisations.

Each of these components will require fundamental and strategic adjustments to ensure their respective implementation. Moreover, their human and financial management should be aimed at achieving continuity and flexibility in the implementation process.

Natural systems like fisheries and forests are suffering similarly from unsustainable practices, principally overexploitation or exogenous environmental threats. It is clear that to meet the needs of the poor - whether in marginal lands, raising livestock in small holdings or pastures, in forests, in coastal or inland water fisheries - that their socio-economic and resource endowments will be critical to solutions. The loss of natural fisheries, for instance, would not be readily replaced with other protein sources. Poor forest dwellers are often associated with forest patches in forest-agriculture mosaics. The systems require to be sustained and institutions developed for management. The units of analysis are both the local (the immediate household or community) and at the level of landscape or coastal region. These facts raise questions not about what are the priorities for research, but how the research is carried out. To assist poor farmers and the resource dependent poor, particular focus must be placed on the nature of the partnership arrangements with NARS, and the nature of the relationship with research users¹¹.

Governance arrangements are changing globally. In forests (and similarly with fisheries), under the old paradigm most resources were managed primarily by the state for the national interest with some use-rights given to local people. Under the new paradigm most forests are to be managed primarily by private individuals or communities with some regulatory provision or incentives to ensure the maintenance of the public goods values of the forests. The term co-management is commonly used to describe the latter situations.

The desirability of devolving much more management responsibility to local communities is now running ahead of the ability of governments to put into place land tenure and resource access rights arrangements. There are many examples of compromise or transitional situations where local people are given responsibilities but not the rights to exercise them, or where the complexity and overlapping nature of local rights results in uncertainty and power vacuums. Many countries are suffering from serious depletion of forest and fisheries resources as a result of these difficult periods of transition.

The effects of the devolution of forest and fisheries management is a general tendency towards smaller management units, less uniformity of management, greater degrees of change over time and from place to place in the objectives of management, and a larger number of multiple objectives for any single management unit.

Globalization may have the opposite effect: the integration of markets will produce a tendency towards specialized production units of high value produce. Natural resource systems may follow the way of the management of major commodity crops with industrial corporations taking the lead in research and development. In which case, is the smallholder subsistence farmer

¹¹ Sayer, J. (2003) Forest Research and Poverty: Emerging Issues for the CGIAR

with his diverse cropping system and his patches of woodland may be destined to be absorbed into the global economic system, or to remain marginalized and in need of public assistance?

Although these scenarios are increasingly complicated, such assessments provide indicators of the sorts of research that will be required:

Diversification and yield improvements from fragile lands: how to manage inputs more effectively and present knowledge-intensive technologies to poor and small-scale farmers to ensure technology uptake.

Multi-functionality: how to manage small land or water endowments, or the same piece of forest, for a mix of local production functions plus environmental service functions at various scales - local to global. How to measure and cost the production of this product and service mix?

Institutional transformation in resource management: the need to build new governance arrangements in the move away from state or centralized control to a wide range of corporate, local, co- and community management situations.

Requirements for policy solutions to resource management: natural resources research has often ignored the critical component of policies in effecting the necessary changes to sustainability. Research needs to generate knowledge, how knowledge is used to effect policy and the application of knowledge and policies through effective institutional arrangements.

Integrated landscapes: Devising optimal solutions for farm and resource use at the landscape/watershed level whilst minimizing the opportunity costs for other users of the land.

Restoration: There is a need to invest in more integrated, multi-functional approaches to restoration of natural resources to ensure future production.

2.7.2 Achieving Durable, Multidisciplinary, Multi-Agency Relations Involving the CGIAR, NARS and Resource Management Agencies

The CGIAR could act as a convener and facilitator of teams and could help to bridge the gaps between users of research and researchers. The CGIAR could lead a transformation of research culture (a paradigm shift) towards real-life-scale participatory, action research. Its key role is to improve linkages, promote synergies and accelerate the spread of innovations (in science methods). The CGIAR has a distinguished history of action research at the level of the farm. What is now needed is action research at a much larger scale and involving a greater diversity of actors. It is action research at the landscape level. CGIAR scientists can only support this kind of work to a very limited extent but they can play a significant role in helping the NARS to fill this niche. New sorts of integrative institutions for multidisciplinary, science-based management of landscapes are required to replace sectoral institutions.

Flexibility: Research, development or extension services require to address this situational complexity, adoption of the new agriculture, and the transition in NARS capacity through flexibility in their approaches, e.g. by following a “process approach”, that emphasizes facilitation and participatory learning (rather than instruction and the mechanical transfer of blue-print solutions), thereby strengthening the “self-help” and local organisational capacity of

farming communities. Adaptive management requires measures of system performance and participatory processes for tracking these indicators and adapting management accordingly. This will require multi-disciplinary approaches bringing together management scientists, social scientists and biophysical scientists. There will also be the need to respond more rapidly to the effects of transitions in governance and markets that we are now witnessing.

2.8 Towards Greater System Coordination and Coherence

The CGIAR Centres have developed with their partners many of the disciplinary skills and infrastructure to address the issues that have been raised. As conveners and facilitators of programmes and projects, CGIAR scientists are also able to draw on additional expertise e.g. legal expertise, market analysis, which could contribute to wider collaborative projects. Multidisciplinary approaches are already relatively wide spread across the System, and can be applied with the assistance of the NARS, simultaneously building different capacities in the latter. The issue is rather one of scale and the number of activities around which the CGIAR should focus its research so as to bring the relevant research to bear in iterative and flexible ways. Chapter 7 discusses potential subject matter for new research and initiatives to assist NARS deal with the institutional and policy issues which confront modern agricultural science. Research on agro-ecological approaches to farming in marginal areas, coupled with the introduction of research on drought tolerance for similar environments, may also form a focus for the CGIAR's engagement in a more concerted way with all the research elements discussed above. Linking the development of globally relevant technology to simultaneous research on the context and delivery pathways in the major ecoregions will serve to integrate the work of the system, as well as bringing support to NARS in a changing environment. The CGIAR System is now programmatically structured to deliver relevant high quality research through Centre-based core programmes, inter-Centre or Systemwide Programmes and Challenge Programmes.

2.9. What do we know of the link between Agricultural Research and Poverty Reduction?

The CGIAR's mission, as stated in the 2000 Vision and Strategy, is to reduce poverty in a sustainable fashion through the use of agricultural research. Agricultural research is itself a multidimensional instrument for this purpose, with work being pursued on the CGIAR's five logframe outputs: germplasm conservation, germplasm enhancement, farming systems and NRM, policy and socio-economic research, and enhancing NARS and other rural institutions. How agricultural research, through these outputs, bears on poverty is complex and still only partially understood. It involves both direct effects on the adopting poor smallholders, and indirect effects on others than adopters of the innovation via employment, wages, inter-regional migration opportunities, the price of food, the quality of diet, and growth of the non-farm economy both rural and national. Case studies done for SPIA12, and country-level studies¹³, have shown that indirect effects can be very large, even though the tendency is often to narrow down thinking about the research-poverty relation to direct effects on smallholders. Maintaining a focus on the

¹² Meinzen-Dick, R., Adato, M., Haddad, L., and Hazell, P. 2003. "Impacts of Agricultural research on Poverty: Findings of an Integrated Economic and Social Analysis". IFPRI Discussion Paper BRIEFS.

¹³ de Janvry, A, and Sadoulet, E. 2002. "World Poverty and the Role of Agricultural Technology: Direct and Indirect Effects". *Journal of Development Studies*, 38(4): 1-26.

role of indirect effects, and hence on agricultural growth and employment creation in agriculture, is thus important. What we currently know of this complex relation provides us with guidelines as to how to select future research proposals for CPs, SWPs, or other initiatives.

To help the CGIAR develop research priorities, TAC commissioned a study to develop priority areas for a pro-poor agricultural research agenda.¹⁴ This complemented the results obtained in the SPIA case studies. The definition of poverty used in these studies goes beyond income to include food security, reducing vulnerability, satisfaction of basic needs in health, nutrition, and education, environmental sustainability, and empowerment. The priorities they propose provide the criteria to screen proposals effective for poverty reduction. Specifically, the authors propose the following seven priorities for a pro-poor research agenda:

1. Increasing the production of staple foods in countries where food price effects are still important and/or that have a comparative advantage in growing these crops.
2. Increasing agricultural productivity in many less-favoured lands, especially heavily populated low-potential areas.
3. Reducing risks in agriculture, in particular in high-value market-oriented production, and the vulnerability of rural households to shocks of both idiosyncratic and covariate nature.
4. Helping smallholder farms across the board diversify into higher value products, including livestock products, especially in countries with rapidly growing markets for such products and/or access to suitable export markets.
5. Increasing employment and income-earning opportunities for landless and near-landless workers in surplus labour regions.
6. Developing more nutritious and safer foods to enhance the diets of poor people.
7. Undertaking agricultural research in ways that are more empowering of the poor, in particular by helping them acquire the capacity to tailor technology to their specific livelihood strategies, with particular attention to women farmers and excluded groups.

2.10 Conclusions

The purpose of the present Priorities and Strategies exercise for the CGIAR is not to re-examine the vision and mission of the CGIAR, but rather to identify the major new and emerging areas for agricultural research that will help the CGIAR and its partners achieve the Vision: a food secure world for all¹⁵.

The Goal is: to reduce poverty, hunger and malnutrition by sustainably increasing the productivity of resources in agriculture, forestry and fisheries.

The Mission of the CGIAR is: to achieve sustainable food security and reduce poverty in developing countries through scientific research and research-related activities in the fields of agriculture, livestock, forestry, fisheries, policy and natural resources management.

¹⁴ Hazell, P. and Haddad, L. 2001. "Agricultural Research and Poverty Reduction". Washington D.C.: IFPRI.

¹⁵ TAC (2000). A Food Secure World for All: Toward a New Vision and Strategy for the CGIAR. SDR/TAC:IAR/001/14.1/Rev. 2.

From the foregoing review of the current context and future projections for agriculture in developing countries, it is possible to identify major areas for research which must be addressed in order to meet the goals and mission of the system.

There should continue to be a two-pronged approach in support of research and research-related activities to contribute both to the reduction of poverty and to improving food security. This will entail research to maintain the primary food supply against yield declines, reducing land areas or short falls caused by market or climatic shocks. The nutritional quality of foods should be enhanced to safeguard human health and development. This may be achieved through the nutritional enhancement of staples, increasing the availability of a diversified diet, or through attention to food quality.

Research is required on agriculture and natural resources to address the needs of the poor in the more favoured environments, to ensure food security and prevent future poverty, while at the same time tackling the more complex problems of the poverty which remains in the marginal and hard areas.

There are new opportunities for the enhancement of the CGIAR commodities for both favoured and marginal environments through biotechnical improvements in genomics and genetics, and these tools will have wide applicability to the work of the CGIAR in the future e.g. in nutritional enhancement of grains, or improving productivity in areas of lower water availability. Freedom to apply such technologies for the benefit of the poor will require attention to both the intellectual property rights that relate to these technologies, and the biological processes governing gene flows (for instance between cultivated varieties and wild relatives). Work in marginal lands will require the adoption of new agricultural systems research, as well as better understanding of the socio-economic conditions of farmers, foresters and fishers which lead to poverty, marginalization and vulnerability.

Maintaining the productivity of natural resources (such as forestry and fisheries and pastures, particularly those on which the poor depend) is urgently required. This will require innovative landscape level and devolved governance approaches. The conservation of biodiversity of cultivated and related species, which contribute to agricultural productivity, continues to be a key area for research and to secure the basis for agriculture to keep pace with demand in the future.

Improving the availability and productive use of water is of increasing urgency to maintain current levels of production in some regions in the face of competing uses. Indeed the general issues of environmental sustainability – particularly the increasing environmental loading of agricultural and natural resources in countries with rapidly growing populations - will be central to the maintenance of productivity in the future. Integrated natural resource management approaches to sustaining productivity should be addressed at both farm and landscape levels, including the coasts of lakes and seas. Effective changes in practices will require concomitant changes in policies and governance of natural resources.

Special research and development emphasis must be placed on sub-Saharan Africa. Each of the developing country regions has particular challenges – human population density threatening the natural resource base in Asia, looming water shortages in WANA, inequality in

development within and between countries in LAC etc, but meeting the Millennium Development Goals, and the vision of the CGIAR, will be most difficult in Africa. Sub-Saharan Africa is characterized by widespread poverty, the high relative dependence of populations upon agriculture or the extraction of natural resources, the low performance of agriculture at the aggregate level, poor infrastructure, and additional challenges from human disease, climatic instability and civil unrest which serve to increase the vulnerability of large numbers of people. There is the opportunity to join in consolidated partnership approaches for the enhancement of African agriculture laid out by regional priority setting and the New Economic Programme for African Development (NEPAD).

The effects of the globalisation of trade in agricultural commodities must be analysed and understood from the stand-point of the opportunities and potential impacts on the poor and less-developed countries. Increased trade also brings opportunities for the diversification of production and securing increased value-added from agricultural products. There are clear opportunities to enhance the incomes and livelihoods of small-holders through such means. However, small-holders must be able to access new markets for them to benefit. These developments demand increased attention to food quality and food safety through production to consumption food chains and on post-harvest issues. Research will be required to support such diversification, particularly for fruits, high-value food crops, tree products, fish, and livestock. Increased trade brings with it issues of the movement of organisms and agricultural produce, and the need to evaluate appropriate and equitable SPS and environmental regulations.

Climate change and instability are projected to become increasingly apparent through the next decades. Developing nations will require assistance to orient agriculture and agricultural practices into less vulnerable choices and pathways.

The increasing uniformity in vision and approaches of the major development agencies and international undertakings around a pro-poor agenda means that there are enhanced opportunities to address these high priority areas through scientific and development partnerships, including with the private sector, civil society and with national and local stakeholders in agriculture. Enhancing the capacity of NARS to undertake integrated research approaches will enhance the front on which the attack on poverty can be carried forward. There will be increased demands for knowledge management to enhance the workings of these communities of practice and research consortia, and there are major opportunities to capitalize on the new ICTs in carrying out this collaborative mission.

CHAPTER 3 - THE ANALYTICAL FRAMEWORK FOR PRIORITY SETTING

At the request of the Group at AGM 2002, the iSC commenced an update of the System's priorities with a 5 to 10 years time horizon. This request was in part motivated by the need for a strategic framework that could be used in selecting additional Challenge Programmes to the three currently in progress:

Water and Food

Biofortification

Unlocking Genetic Diversity in Crops for the Resource-poor

A fourth one on Africa is at an advanced stage of formulation.

Priorities are, however, not only directed at helping select future Challenge Programmes. It is appropriate to scan the global and regional changes and rate of progress occurring in agriculture, forestry and fisheries from time to time to confirm or adjust the CGIAR's general points of leverage in conducting research. The priorities determined by such processes can then be implemented, as appropriate, through the mechanisms of Systemwide programmes and through the normal research agenda of Centres. The latter are strategic choices regarding the system's way of working, which are discussed in Chapter 8. This chapter reviews the different types of approaches to setting research priorities, and describes how the process chosen by the SC for the current evaluation of incremental priorities for the system has been applied.

3.1 Approaches to Priority Setting

Priority setting helps to define a future research portfolio in line with the mission of the organization, in this case the CGIAR. Since priority setting is about future research plans and future impacts, it must be based on information and perspectives on the future. The importance of certain research topics at this moment should be combined with an assessment of how the importance will change, and how quickly. Because of this forward-looking nature, priority setting is often a very strategic activity. Also in order to grasp the new opportunities of the future, priority setting can normally not rely on current evidence only. There must be a creative element. And thirdly, the priorities that will be obtained in the process must have broad enough acceptance to be implemented. Otherwise the priority setting exercise just leads to more paper on the shelf.

For all of these reasons, priority setting is best seen as a management process, and not only as an analytical comparison, even though the analysis is an essential component and has received a lot of attention in the literature. In this respect it is important to point out that for such a complex, multi-faceted process it is normally very difficult to establish an "objectively best" outcome. There are too many uncertainties, and even when those would be removed, there will be so many elements of judgment in a priority setting exercise that what is obtained in the best case is a well described and well explained view of future research that carries internal logic and makes sense against the available evidence, and that is respected and accepted by the key stakeholders and decision makers.

Here we will describe the essential elements of a priority setting process and then analyze how different approaches compare with respect to this process. We will conclude with a

comparison of these approaches on a series of criteria that were first formulated by Janssen (1995).

3.1.1 The Priority Setting Process

A priority-setting exercise should combine the following four steps. It is not needed that these steps are undertaken in the sequence described below, but it is essential that all of these elements receive attention somewhere in the process.

Step 1: Choosing the right people

Building the right core team is the first requirement for effective priority setting. The priority setting exercise has to be led by a small group of people that are able and willing to dedicate a significant share of their time to the exercise.

Choosing the right participants is a key decision in any priority setting process. Priority setting builds on the knowledge, opinions and judgments of many other people besides the core team. The core team needs to assemble a group of participants which is large enough to represent the most important interests and which represents knowledge of the research domain, and is small enough to allow effective interaction and communication.

Step 2: Defining objectives and options

An analysis of the research domain, and what is at stake is an essential prerequisite for a solid priority setting exercise. The analysis helps to identify new issues, to understand how things have changed, and facilitates the sharing of knowledge with the participants. The analysis of the research domain puts the different participants on a (more or less) equal footing in the remainder of the process.

Defining the research objectives is equally essential since it will strongly influence how alternative research options can be compared. In the case of the CGIAR it is increasingly clear that its research should contribute to sustainable and equitable agricultural development. This is often translated into four categories of objectives: food security, poverty alleviation, income generation and improved natural resource management.

Research alternatives must be defined before priorities can be set. Priority setting is also about defining the alternatives among which the choices are to be made. This is the most neglected element of most priority setting exercises, and the most underestimated part. Defining research alternatives is a creative process, which builds on the capacity to bring together an understanding of problems and an understanding of scientific opportunities. Research alternatives may be defined as a listing of possible subjects (e.g., all the crops planted in a country), but are better identified by analyzing constraints and opportunities.

Priority setting criteria must be defined to assess and compare research alternatives. These criteria normally correspond with measurable indicators for the research objectives that were selected earlier. The final selection of evaluation criteria is best made after the research

alternatives have been defined. When there are several criteria, weighting of criteria may be required.

Step 3: Choosing and evaluating

Choosing and applying a measurement method. Research should clearly be undertaken on those alternatives that contribute most to the research objectives. One should therefore estimate how the research alternatives are expected to perform on the criteria defined above. This requires a measurement method. There is a wide range of methods available, ranging from simple qualitative methods to complex quantitative approaches. The art is to choose the right method for the decision problem at hand. The measurement activity results in the establishment of a rank order of research alternatives, from highest to lowest priority.

Often the initial rank order is submitted to sensitivity analysis, e.g., by means of a group analysis and discussion, or by means of more rigorous mathematical procedures in which the measurement methods or the criteria weights are modified to examine the effect of such changes. This may lead to well-reasoned changes in the priority rank order.

Step 4: Preparing for implementation

Link with implementation. Priorities are set in order to be implemented. However, many priority-setting exercises do not lead automatically to an implementation scheme. The priorities thus need to be transformed into a resource allocation plan. The resource allocation plan considers what the priorities should imply for the funding of each research alternative, and how the current resource allocation can be modified.

Stakeholder validation. While all participants in the exercise may agree with the results, it is still important to obtain further feedback. The process followed and the results obtained should be submitted to wider stakeholder validation. This may take the form of one or several meetings with more participants, or may be done by sharing the outcomes widely and asking for feedback.

Institutional learning. A priority setting exercise may also influence the institutional directions in other ways than through resource allocation. Researchers may change their perspectives, may become sensitized to conditions that they have not considered as yet, may start looking for external funds for new types of work, may develop new types of partnerships, or may change their ways of working. These effects of a priority setting exercise may in the end be larger than the formal change in resource allocation, and may be more lasting.

3.1.2 Analytical or Consultative Priority Setting Approaches

Priority setting for agricultural research has been an important topic since the mid 1980s. Initially the question was very much about knowing which of two activities was more important, often in economic terms. There was a lot of attention to measurement issues and to understanding who would receive the benefits. Over time the focus in priority setting has shifted towards satisfying - in the best possible way - the objectives of the research programme. The problem was increasingly seen as multidimensional, and of a political nature that requires the consultation with

stakeholders instead of, or in addition to, the measurement-based approaches. Here two analytical and two consultative approaches will be described.

Analytical approach 1: Congruence analysis

In congruence analysis, research alternatives are compared according to the value of a single measure. The most common measure for commodity research is value of production. However other measures, for example total population or number of poor who benefit from the anticipated research outcomes, can also be used as a 'first-cut' in order to reduce the number of research alternatives to be examined by more rigorous methods.

A simple example may explain congruence analysis: In a certain country maize may be grown in four regions, I, II, III and IV. The value of maize production in these four regions is 400.000; 300.000; 200.000; and 100.000, respectively. The value of maize consumption in these four regions, in the same order, is 200.000; 500.000; 160.000; and 140.000. The priority ranking for maize research amongst the four regions based on these two different measures differs. Region I receives the highest priority for maize research based on the value of production; second priority goes to region II; third to Region III and fourth to Region IV. When ranked by the value of maize consumption, however, Region II received the highest priority, followed by I, III and IV, in this order.

The choice of measure is of paramount importance in the congruence method. An appropriate measure should be logically derived from defined research objectives and criteria. Value of production and other commonly used measures are often only weakly associated with research impact, and are usually heavily biased towards historically important commodities. On the other hand, the congruency method is simple to apply and very transparent. The method is often used as a 'first-cut' in order to reduce the number of research alternatives examined by more rigorous methods. The Science Council and its predecessors (TAC, iSC) have often used congruence approaches.

An essential problem of congruence analysis is that it only allows the comparison of relatively similar research alternatives. Rice research may be compared with wheat research, but it is very difficult to compare rice research with policy analysis or ecoregional research.

The information required for congruence analysis will depend on the measure chosen. Measures like value of production require national or local price and production data. Population and poverty measures require population census and household welfare survey data, respectively, as well as a good understanding of the geographic domain of research alternatives.

The approach used by the Technical Advisory Committee to set priorities consisted in a congruence analysis with an optimum budget allocation derived from application of a normative formula embodying a number of criteria meant to achieve CGIAR objectives. Optimum resource allocation was established across commodities, sectors, and regions for:

- 19 crops plus livestock, forestry, and fisheries.
- Five geographical regions.

Optimum budget allocations were determined on the basis of:

- The share of the activity and region in the “total” value of agricultural production.
- Modifiers to these shares to account for considerations such as poverty, the participation of women, productivity gaps, sustainability outlooks, the strength of local institutions, new scientific opportunities, the IPG character of the innovation, alternative sources of supply, and the probability of success in raising yield.

Congruence analysis then consisted in comparing the optimum to the actual budget allocation, thus identifying gaps in investment. These gaps would then signal donors where additional funds were needed to achieve the System’s overall priorities.

Over time, this approach has become increasingly incomplete due to the growing diversity of activities in the CGIAR, such as basic science, natural resource management, research on ecosystems, water, policy and socio-economics, research management, training, etc. Clearly, allocating budget based on production value does not work well when priorities increasingly address issues that do not involve production of goods and services valued in the market place.

The approach followed for the 2003 priority setting exercise complements the traditional congruence analysis with a broad consultation on priorities with stakeholders and scientists. We describe this process in what follows.

Analytical approach 2: Economic Surplus Method

The economic surplus method measures the economic (efficiency) benefits associated with research alternatives. The approach takes account of the market changes that will occur if research is successful and that will affect the expected benefits and their distribution among producers and consumers. Economic surplus analysis can be used to show how economic policy interventions, such as commodity price ceilings, over-valued exchange rates, and/or subsidies and taxes, distort or even eliminate the welfare gains that might otherwise have been obtained from research. The logic involved in the economic surplus benefit/cost model requires some knowledge of economic theory, and application is hampered by difficulties in obtaining the necessary data.

A major advantage of the economic surplus method is its ability to incorporate other concurrent changes in the commodity system into the evaluation framework (e.g. population growth, income changes, area expansion, research spill-overs from other regions, and changes in external and internal trade policies). However, economic surplus concepts often lack transparency to non-economists. There is often a tendency on the part of individuals participating in the research decision-making process to attribute results to the model and not to the data and assumptions on technology generation and adoption underlying the model.

Economic surplus models are best suited to evaluate research aimed at productivity increases in commodities with transparent markets. For research with other aims (e.g. natural

resource management research, genetic conservation, quality enhancing research) economic surplus methods are less straightforward and may require complex assumptions.

Economic surplus methods require large amounts of information on commodity production and consumption. Knowledge of producer and consumer responses to price changes (elasticities) is also needed.

Consultative approach 1: Participatory Research Programme Formulation

The participatory research programme formulation approach developed by Collion and Kissi (1994) and Janssen and Kissi (1997) tries to combine the skills and knowledge of many different people and disciplines in order to formulate agricultural research programmes. The approach puts less emphasis on the quantitative measurement approach but emphasizes the development of a stepwise procedure which gains from the perspectives of users, scientists and other stakeholders. The following steps are considered:

- Step 1: Establishing a committee for priority setting
- Step 2: Review of the research domain
- Step 3: Constraints analysis
- Step 4: Evaluation of existing results
- Step 5: Defining research objectives
- Step 6: Defining research projects
- Step 7: Choosing the best research projects
- Step 8: Gap analysis
- Step 9: Preparing for implementation

In each step, new information is incorporated into the process. The balance between creative and analytical thinking changes from step to step. In some steps skill in economics is the key to furthering the procedure; in other steps technical skills from, say, agronomy or animal sciences are essential. The priority setting procedure is organized through two workshops plus preparatory and follow-up work.

The approach obtains its rigor not from the methodological depth in any single step, but from the combination of steps that go from problem identification to the selection of research projects in a systematic manner. On the downside, the approach is vulnerable to the composition of the group that is involved in the process. Data requirements for the approach are still very large, especially if an effort is made to compare productivity and natural resource management topics. The time involvement of the participants is high, and bringing them together in workshops for a total of five days may be a deterrent to the most needed participants, whose time tends to be in high demand.

Consultative approach 2: E-mail-based Consultative Priority Setting

The approach that was piloted by the interim Science Council for CGIAR priority setting in 2003 is a consultative approach that has several elements that are comparable with the consultative approach described above, but that builds increasingly on electronic conferencing rather than physical workshops. In the process managed by the Science Council the research

domain was reviewed in two ways: a set of some 20 position papers were written by experts on the key issues in agricultural development and research and were shared with the other participants to the priority setting exercise and the public at large; constraints were then further identified in open ended discussions in a series of regional panels and a global panel, made up of some 20 experts with different disciplinary and organizational background, to elaborate on the issues that came out of the position papers. Through these panels an initial set of large research themes was obtained. The panel members rated the importance of the themes and the combined outcomes were afterwards validated by an electronic consultation in which more than 800 people participated.

In the second round of the exercise, the results of the first round were used to identify more precise research projects in thematic panels of up to fifty subject matter experts. A large number of possible research projects (over 150) were identified. These were then prioritized by new regional (and global) panels made up of the same experts but now organized by their regional expertise. Panel members now did not rate the research projects, but composed research portfolios under a budget constraint. The projects that were included by most panel members in their research portfolio entered in the priority list for the region (or for the global research programme). The aggregated lists for the different regions, plus the priorities defined by the global panel, would now represent the future priorities for the CGIAR. The results are being validated through several means: opinions of a series of top scientists have been asked; a workshop among the panel leaders is considered; the compatibility with a congruency analysis that was undertaken at the same time in the Science Council is explored. The exercise was undertaken on the understanding that new money would be available to implement these priorities, but in the absence of new funds it is hard to imagine that the newly defined priorities would fade away.

The approach was not data intensive for the coordinators of the process, but relied explicitly and implicitly on the knowledge available with the participants in the process, through their position papers and through their contributions to the discussions. Whereas the analytical approach of the second round appears simple (counting votes), there was an interesting innovation by asking participants to compose portfolios under a budget constraint. The attention to the objectives of the CGIAR research was more evident in the beginning of the exercise, when the position papers were shared and in the open ended discussions in the regional panels, than in the final selection of the best research projects. The large participation of recognized experts, the wide generation of new ideas and the room for discussion before coming to results are important advantages that could only be realized by working through the e-mail. The rigor of the process now originates in the massive participation and interaction of the experts. Large-scale participation and “grounded” subjectivity provide a certain rigor and relevance at the same time.

3.1.3 Comparing Approaches to Priority Setting

Table 3.1 provides an assessment of the four different approaches on the required process characteristics of priority setting. In addition, six criteria have been added that ISNAR has often used to assess the quality of decision-making process (see the ISNAR website and Janssen, 1995). These are:

1. Transparency. Is it clear to the outsider how the results have been reached?
2. Participatory nature. Does the approach allow the stakeholders to engage themselves in the decision-making?
3. Simplicity. Is the approach easy to understand and to replicate?
4. Discriminating potential. Does the approach allow clear distinction between which alternatives should be considered and which ones should be discarded?
5. Cheap to apply. Is the approach attractive in terms of the resources required to make it work.
6. Versatility. Can the approach be used to set priorities among very different types of research alternatives?

The table makes it very clear that the different approaches have their advantages and disadvantages. Congruence analysis is cheap, straightforward, but oversimplifies. Economic surplus analysis provides a lot of sophistication, is based on good understanding of market conditions, but is hard to understand for the non-economists and may overemphasize economic objectives. Participatory programme formulation integrates more people, recognizes the creative nature of the priority setting process, has a lot of procedural rigor, but is expensive. The newly developed approach of the Science Council relies on the choice of the participants and the quality of the facilitation process to arrive at credible outcomes. Because it is not based on a particular measurement method, the approach is very versatile and can be applied in almost any context. In addition the approach is cheap.

The versatility and the low cost provide an interesting opportunity: a reduced version of the 2003 approach can be used whenever the Science Council would like to obtain in-depth understanding of the feasibility of new research topics and the possible research alternatives in a new topic. By replacing the “expert” by the “expert panel” the Science Council can most probably obtain assessments of more depth than one single individual could write. In addition the Science Council could develop a “continuous institutional learning platform” by undertaking an average of two of such reduced exercises per year, for example in the initial steps of the design of new Challenge Programmes.

Table 3.1: A Comparison of Four Priority Setting Approaches				
	Scoring Methods	Economic Surplus Analysis	Participatory Programme Formulation	E-mail-based Consultative Priority Setting
Choosing the right people				
- Core team	Economists and agronomists	Agricultural economists	Workshop facilitators	E-mail facilitators
- Participants	Not required	Not required	Balance between researchers and stakeholders, limited by workshop size	Balance between researchers and stakeholders, few constraints to group size
Defining objectives and options				
- Analysis of the research domain	Statistics on the indicator	Production-consumption parameters	Normally one analytical paper	Position papers, open discussions
- Defining objectives	Congruence indicator must reflect objective	Centred around economic growth	Formal step in workshop discussions	Somewhat implicit, not much debate
- Defining research alternatives	Difficult	Cost-benefit profiles	Project development based on constraint analysis	Through discussion and free contributions
- Defining criteria	Not required	Weighting schemes for different benefits	Weighting schemes based on workshop discussion	Limited attention
Choosing and evaluating				
- Measurement method	Simple and robust	Sophisticated and robust	Simplified, but less robust	Highly intuitive
- Sensitivity analysis	By changing indicator values	By changing model parameters	By changing model parameters	By counting votes
Preparing for implementation				
- Link with implementation	unclear	Clear if analysis is done on projects	Clear	Clear, but additionality condition may prove difficult
- Stakeholder validation	To assess methodological correctness	To assess methodological correctness	To assess assumptions of participants	To assess if the outcome is sufficiently balanced
- Institutional learning	Not clear	Not clear	Through workshop participants	Through panel participants
Methodological comparison				
Transparency	***	*	**	**
Participatory nature	*	*	**	***
Simplicity	***	**	**	**
Discriminating potential	**	***	**	**
Cheap to apply	**	**	*	***
Versatility	*	**	**	***

Note: *** = good; ** = intermediate; * = poor

3.2 Dimensions of CGIAR Priority Setting

The CGIAR's priorities are guided by the Vision and Strategy that was adopted at the 2000 Stakeholders' Mid-Term Meeting in Dresden. This document identified seven planks that set broad guidelines for priority setting. Important guidelines established by these planks are:

- Priority given to poverty and hunger reduction, both rural and urban.
- Adopting a regional approach to research planning and implementation.
- Pursuing partnerships in implementing its mandate.
- Focus on Africa
- Taskforce approach (CPs)

The selected priorities must correspond to the CGIAR's five logframe outputs:

- Output 1: Germplasm collection, conservation, and characterization.
- Output 2: Germplasm improvement.
- Output 3: Sustainable production systems through integrated natural resource management (INRM).
- Output 4: Socio-economics and policy research.
- Output 5: Strengthening NARS and rural institutions.

The priorities chosen need to reflect what the CGIAR can do best based on its comparative advantages, including through extensive partnerships, and on efficiency criteria in reaching objectives. This raises the question of the "other 96%" of the global budget spent on agricultural research worldwide and how the CGIAR's priorities should be defined in relation to this.

Most importantly, the methodology and processes utilized in the most recent exercise, as well as the priority research outcomes, form a component of the TAC/iSC/SC's role in setting Priorities and Strategies for the System. The approach followed here is to look first at content (priorities) before going on to form (strategies for implementation). While the two are not separable, they can be developed iteratively. The current effort can then be seen as a first iteration where priorities are explored, to be followed by an analysis of strategies.

The present effort is but one contribution to a complex process of priority setting. The consultative approach that is being followed will hopefully provide important outcomes, which can be augmented by other efforts following different methodologies. We propose a set of complementary actions at the end of this report.

3.3 The Process Followed

The assumption behind the approach followed here is that information to set research priorities is not available centrally. This is in contrast to the presumption on which congruence analysis is based. Information is asymmetrical: information on research needs exists among CGIAR stakeholders and information about research opportunities exists among scientists. This information consequently needs to be revealed by engaging in a dialogue with these agents. Because there are competing demands for a limited research budget, demand and supply need to

be confronted, and collective agreement needs to be reached in deciding ranking among options, thus establishing priorities. The process of dialogue and choice is in itself a process of discovery about needs and possibilities. It also increases ownership of the priorities which are identified amongst participants.

The principles of the approach that has been followed consist in eliciting (from participants to a consultation) information on research priorities from both the demand side (stakeholders), and the supply side (scientists), of research. On the demand side, stakeholders are asked to identify critical issues in need of research. This is done by engaging selected regional panels of stakeholders in a dialogue on issues related to the role of agricultural research in sustainable poverty reduction (Step 1A). Members of these panels are asked to produce, as an outcome of this dialogue, a list of issues deserving attention. These issues correspond to activities within each of the CGIAR's five output categories.

To broaden the consultation, and seek majority opinions, the list of activities is offered to a maximum number of stakeholders in an open electronic forum. Respondents are asked to assign scores to the entries on the list (Step 1B).

On the supply side, thematic panels of scientists are asked to translate priorities into researchable activities (Step 2A). These panels propose researchable themes (sub-activities) within each of the categories of activities identified in Step 1A. Priorities are then established by regions. To do this, regional panels of scientists are asked to allocate incremental resources to the researchable sub-activities identified by the thematic panels (Step 2B).

Because regional panels allocating regional budgets on the basis of majority opinions may not have recognized research ideas that are truly innovative and unusual, selected visionaries and innovators are asked to provide their own perspectives on emerging research priorities. The consultation thus ranges from stakeholders (farmers and grassroots organizations, NGOs, private sector, donors), to scientists, and to visionaries.

Finally, the SC and research administrators are asked to meet face-to-face to take stock of the results of consultations and reconcile eventually conflicting information gathered from different sources into a consistent set of priorities (Step 3).

The approach was implemented using the following steps, which are summarized in Figure 1:

(1) Preparatory phase

As background information for participants to the consultation, the following materials were posted on the iSC webpage:

- An updated and expanded data base for congruence analysis, including new FAO projections for 2020 and initial availability of poverty maps.
- Regional priorities established by GFAR and by regional and sub-regional organizations.

- Priorities established for the Millenium Development Goals and for international conventions and agreements.
- 35 position papers prepared by experts on poverty, natural resources, policy, science, regions, and Centre programmes at the request of iSC.

(2) Identification of critical issues by stakeholders

Step 1A: Stakeholder panels consultation (April-May 2003)

- Five stakeholder panels were organized for Global, Sub-Saharan-Africa, Asia, CWANA, and Latin American regions, each led by a coordinator with recognized expertise in the area.
- Panel membership consisted in over 20 members per panel, selected in consultation with GFAR, Centres, CGIAR leadership, and stakeholders.
- Panels included representatives of NARI, government ministries, universities, Centres, NGOs, producers' organizations, private sector firms, regional agricultural research organizations, international development organizations, regional development banks, foundations, and donors.
- Electronic consultations by these panels were managed by RIMISP, a Chilean NGO.
- The desired outcome of Step 1A was establishment of a list of critical issues and knowledge gaps to be addressed via research by the CGIAR and its partners. Results from Step 1A are available under the form of five panel reports, including an attempt at ranking each panel's recommendations by order of "criticality" (see RIMISP website).

Step 1B: Stakeholders open consultation (May-June 2003)

- For Step 1B, the lists of critical issues prepared by the panels of stakeholders in Step 1A were clarified, completed, and unified into a single list of activities by output (see Appendix 1). These lists were posted on the Internet for an open consultation managed by RIMISP. Calls for participation reached more than 8,000 people and organizations including all CGIAR scientists, as many NARI scientists as possible, NGOs and GROs, the private sector, international donors, etc. Thanks to RIMISP's extensive worldwide contacts with NGOs and farmers organizations, 20% of participants were members of these types of organizations.
- Interested stakeholders were invited to prioritize the list of issues and add to it as seen fit. Six hundred and twenty-eight complete answers were received during the period May 26-June 13, 2003. A complete analysis of the data is available on the iSC website.

(3) Identification of projects and resource allocation by scientists

Step 2A: Thematic panels of scientists (last week of September 2003)

Three thematic panels of scientists were appointed, each with over 70 members, as follows:

Thematic panel 1: Germplasm conservation and improvement (Outputs 1 and 2).

Thematic panel 2: Farming systems and INRM (Output 3).

Thematic panel 3: Socio-economics, policy, and institutional strengthening (Outputs 4 and 5).

The panels were composed of 40% CGIAR scientists and 60% scientists from NARS and the North. A distinguished non-CGIAR scientist and a CGIAR scientist working as a team, with the non-CGIAR scientist as chair, led each panel. Panel members were carefully selected to give a broad representation of disciplines and institutions.

The task of thematic panels was to:

- (1) Receive the list of activities established by stakeholder consultations in Step 1A (same as the list that was submitted to the open consultation in Step 1B).
- (2) Establish a list of sub-activities (titles) within each activity representing new research projects or research projects in need of significant expansion (doubling as a benchmark).
- (3) Identify the expected output from investing in a sub-activity.
- (4) Provide an estimated annual cost to conduct the proposed project over a 5-10 years horizon. Costs were arrived at on the basis of counting the number of full time equivalent internationally recruited scientists (FTE) needed to implement the project. FTEs were fully budgeted (salary, benefits, equipment, and local supporting team) and categorized into three types as follows:
 FTE1 = scientist with computer equipment (e.g., social scientist) = \$250,000/year.
 FTE2 = scientist with dry laboratory (e.g., agronomist, NRM scientist) = \$350,000/year.
 FTE3 = scientist with wet laboratory (e.g., geneticists, breeders) = \$450,000/year.
 Costs were based on CGIAR accounting data.

This list of sub-activities by outputs is given in the Appendix.

Step 2B: Regional panels of scientists (first week of October 2003)

The same scientists that worked in the thematic panels were redistributed into five regional panels (Global, Asia, CWANA, SS-Africa, and Latin America). The task of the regional panels was to:

- (1) Receive the list of sub-activities identified by the regional panels: titles, expected outputs, and estimated annual costs.
- (2) Allocate a given incremental annual budget for the region across sub-activities.

The given budgets were as follows:

SS-Africa	\$45 million
Asia	\$30 million
CWANA	\$30 million
Latin America	\$30 million
Global	\$25 million

Relatively high figures were meant to account for the fact that regions may in fact not have to absorb the full cost of research undertakings as they can be shared with other regions if they deliver international public goods. In any case, the budget figure is only used to induce option making among competing projects.

- (3) Arrive, through successive voting rounds, at a selection of projects for the region, not exceeding the allocated budget.

Step 2C: Consultation with Senior Scientists

Broad consultations with assignment of scores may fail to reveal original ideas that are ahead of their time, and consequently not supported by a majority of participants. To help capture such ideas that may give new directions for research, a selected number of visionaries were asked to make suggestions. SC members and observers to the Science Council meeting in Aleppo, Syria were also invited to add additional ideas to this list.

Step 2D. Review and Synthesis

The SC then reviewed the outcomes of the consultation, together with other sources of information and the priorities of others (some of which are described in chapters 4, 5 and 6), to start to identify additional areas that may be considered for additional CGIAR research priorities (as described in Chapter 7).

CHAPTER 4 - THE CGIAR'S CURRENT RESEARCH AGENDA

4.1 The Overall Agenda by Outputs, Regions, and Sectors/Commodities

Under the log frame structure adopted by the CGIAR system in 2000, the research agenda of the CGIAR is a composite of the agreed research and research-related projects of the (previously) 16 Centres committed to the mission of the CGIAR. Centre projects are classified by CGIAR logframe outputs. Projects may contribute to more than one output, and so costs may be allocated also to more than one CGIAR output. Currently, there are about 200 projects in the CGIAR portfolio, the proposed budget for all activities in 2004 is US\$ 408 million.

The five categories of CGIAR outputs (with, in brackets, the percentage share of the total investment for 2004¹⁶) are:

- Germplasm Improvement (16 per cent),
- Germplasm Collection (12 per cent),
- Sustainable Production (34 per cent),
- Policy (17 per cent),
- Enhancing NARS (21 per cent).

Over the 2004 - 2006 period the shares of outputs is anticipated to remain virtually stable, except for Sustainable Production which declines by 1 percent to 33 percent.

The Centres address issues relevant to the world's developing regions, which are grouped for convenience into Asia, Latin America and the Caribbean (LAC), Sub-Saharan Africa (SSA) and West-Asia-North Africa (WANA). Recently the newly independent states of central Asia and the Caucasus (CAC) have been joined with WANA to form the enlarged C-WANA region. The CGIAR Secretariat proposed investment for the total research agenda (of US\$ 408 million in 2004) would result in an increase in the share of CGIAR investment dedicated to SSA. Compared with 2002, the share in 2004 will increase to 46 percent from 43 percent, due mainly to shifts from Latin America and Caribbean (LAC - from 15 to 13 percent) and Asia (from 33 to 32 percent). During the same period the share of Central, West Asia and North Africa (CWANA) remains stable at 9 percent. Over the plan period (2004 - 2006), the regional shares remain stable at the level of the 2004 proposal.

The System tracks and evaluates its investments in commodity specific research. These commodities include cereals, roots and tubers, food and forage legumes, banana/plantain, trees, livestock, and fish (for a complete discussion see Chapter 6). The Centres address commodities or natural resource sectors (fisheries, forestry), and farming systems research (including policy) based in the major agroecologies of developing country regions.

Centre or system priorities? Formerly, the research portfolios of the Centres were aligned with planning for the System as a whole through congruence analysis (developed by TAC) - the

¹⁶ These figures are estimates made by the CGIAR Secretariat. Science Council data suggests that trends for 2002/3 are 18% of expenditures ascribed to germplasm improvement and 10% to germplasm conservation.

matching of proposed Centre activities against commodity, sector or regional portfolios. This approach was further secured by the matching of resources to portfolios with donors providing often unrestricted or “core” support for Centre activities under the TAC approved plans. This modus operandi was assisted by the World Bank providing matching funds and acting as “donor of last resort”.

Subsequently, Centres have been free to seek resources to support a set of research activities addressing their particular mandate. Lists of Centre projects are given in section 4.2¹⁷. System level oversight over the priorities is formally exercised through SC’s review of the Centre’s annually updated Medium Term Plans (MTPs). Evaluation also considers the plans’ concordance with the vision and strategies of the CGIAR, periodic Centre-commissioned impact reviews of aspects of their programmes, and the External Programme and Management Reviews conducted by TAC/SC. Donors have increasingly qualified their assistance to Centres by earmarking funds for particular activities within the research and research-related portfolio of Centres described in the MTPs, or restricting grant funds for particular time bound project proposals allotted to Centres in competition. This has led to the Centres being able to implement parts of their Centre research plans more easily than others. The World Bank has also changed its methods of allotting financial support and is assessing more incentive-based, rather than matching approaches. In reaction to the broader goals of the CGIAR, the portfolios of Centre research have also become broader in scope, encompassing in general more natural resources management and policy research than formerly. There is greater responsiveness to the guidelines provided by international conventions in fields such as biodiversity. There is greater interaction between Centres in emerging research, research-related and common administrative matters. There is extensive interaction between Centres, and between Centres and NARS (and the emerging Regional Organizations) and increasingly with other stakeholders (NGOs, the private sector), and the tendency to work more directly with individual donors in project development. The development of MTPs is usually conducted in participatory ways with stakeholders at three to five year intervals; plans are updated for activities and new initiatives in relation to the commodity, sector or area mandate of the Centre and are submitted annually to SC for review. The system’s priority activities were thus an aggregate of the Centre-defined activities within a framework given by the CGIAR vision and goals. As the recent consultation on priorities was expressly to consider new and marginal additions to the System’s priority research, the adoption of new priorities do not immediately affect the individual Centre portfolios of research as described in the MTPs. Some of the research areas are being addressed in part by individual Centres, but are not given the global or System-level emphasis that has now been suggested, e.g. the *ex-situ* conservation of crop wild relatives. To incorporate new priorities into System activities in the future, the intention should be to determine *relative* priorities amongst research areas. This would then help direct funding support for new rather than established activities, and System level priority setting will have the effect of altering Centre research portfolios gradually or in a step-wise fashion as outmoded projects are completed.

¹⁷ Further current information can be obtained on individual Centre MTPs and projects at <http://krusty.ciat.cgiar.org:8090/cgiar/cgiar.home>

4.2 Centre Core Programmes

The major contributions of the CGIAR come from the long term research programmes and research-related activities of the Centres. Each of the Centres is charged in the first instance with responsibility for a particular commodity, natural resource, discipline or service to agricultural research, and its work applied to particular agro-ecologies or developing country regions. The Centres conduct research with a large number of partners appropriate to the research for development issues being tackled. Any discussion of new or additional priorities therefore must take full cognizance of the range of work already being conducted through the Centres' programmes. This section can only highlight general areas and trends and should be read in conjunction with the overall project portfolio and section 4.5, which looks at the likely future developments of these portfolios at the Centre level. Although Systemwide and Challenge Programmes are treated in separate sections of this chapter, they of course form integral parts of the research approaches of individual Centres and are referred to below as appropriate. The potential vehicle of Challenge Programmes has also raised potential new priority areas for research by Centres, consortia of Centres, or the system as a whole.

4.2.1 CIAT

CIAT's conducts research with a major commodity focus on beans, cassava, rice, livestock and tropical fruits (in order of anticipated expenditure by 2006). Work on livestock particularly relates to tropical forages. Work on beans, cassava and tropical forages has a global reach (beans particularly in Latin America and Africa; cassava in Latin America and Asia - and in collaboration with IITA in sub-Saharan Africa - and tropical forages in Latin America and SE Asia). Work on rice and tropical fruits targets Latin America and the Caribbean. In 2006 the Centre anticipates investing around 47 per cent of its budget for research applicable to LAC, 36 per cent to SSA and 14 per cent to Asia.

Target agroecosystems are the hillsides, forest margins and savannas of Latin America, or comparable tropical agroecosystems in other developing country regions. The products, particularly beans, are relevant to the mid-altitude regions of eastern, southern and central Africa. Research is focused on plant genetics and agrobiodiversity, ecology and management of pests, soil ecology and improvement (strengthened recently by full programme integration with TBSF the Tropical Board for Soil Fertility), analysis of spatial information and socioeconomic analysis of farming systems.

CIAT, with IFPRI, is a lead Centre for the Biofortification Challenge Programme, which is now operational. CIAT will conduct research to improve the vitamin A content of cassava and iron content of beans. The BCP is now incorporated as a new project in CIAT's portfolio.

CIAT is also contributing to (i) the Challenge Programme on Water and Food, with the Andean basin system as CIAT's likely geographical focus (this contributes to CIAT's Project on "Land Use"); (ii) the Challenge Programme on Genetic Resources (with the possibility of contributing to all four species groups, namely cereals, roots and tubers, legumes, and forages with emphasis on drought, and (iii) the Challenge Programme for Sub-Saharan Africa, which is under development.

Table 4.1 – CIAT: Centre Projects		Centre designation
1	Conservation and Use of Tropical Genetic Resources	SB-2
2	Bean Improvement for the Tropics	IP-1
3	Improve Cassava for the Developing World	IP-3
4	Improved Rice for Latin America and the Caribbean	IP- 4
5	Tropical Grasses and Legumes	IP- 5
6	Tropical Fruits	IP- 6
7	Integrated Pest and Disease Management	PE-1
8	TSBF/Overcoming Soil Degradation	PE-2
9	Communities and Watersheds	PE-3
10	Land Use in Latin America	PE-4
11	Confronting Global Climate Change	PE-6
12	Rural Agro-enterprises Development	SN-1
13	Participatory Research	SN-3
14	Information and Communication in Rural Communities	SN-4
15	Impact Assessment	BP-1
16	Soil, Water, and Nutrient Management	SW-2: SWNM
17	Participatory Research and Gender Analysis	SW-3:PRGA
18	Biofortified Global Challenge Programme	CP-1:BCP

Three projects have been developed as new priorities in 2002, *Tropical Fruits*, *Confronting Climate Change in Tropical Agriculture*, and *Information and Communication for Rural Communities*, and were recently added to CIAT's portfolio. The *Ecoregional Programme for Tropical Latin America* has been eliminated.

4.2.2 CIFOR

CIFOR's goal is maintain and enhance the benefits from forests to improve the well-being of people in tropical developing countries. The Centre's programme seeks to improve management and utilisation of forest-based natural resources, improve natural resource management-related research capacity, and to improve policy and governance of forests.

CIFOR addresses its mandate through research under 8 projects (see table 4.2). These contribute to three interrelating programmes: Environmental Services and Sustainable Use Programme (projects 1-4), Forests and Livelihoods Programme (projects 5 and 6), and a Forests and Governance Programme (projects 7 and 8). CIFOR continues to serve a sector where a longer-term vision is a necessary complement to medium-term planning, and where key international analyses, dialogues and processes concerning forests continue to shape that vision. As the Centre is re-evaluating its strategy for implementing the three programme areas, the MTP for 2004-2006 provides interim priorities for future research which are expected to be developed further (albeit around the same priority themes) in the coming year. The strong priority is to continue developing a livelihoods/poverty-oriented agenda, with increased focus on ecosystems that support large numbers of people. Increased attention to dry forests and woodlands is anticipated. As well as research, considerable emphasis is given to the interaction with, and

positively influencing, international fora on forests to enhance the impacts of forest policy and governance at the global level.

Table 4.2 – CIFOR: Centre Projects		Centre designation
1	Forests Society and People	FSP
2	Sustainable Forest Management	SFM
3	Adaptive Collaborative Management of Forests	ACM
4	Plantation Forestry on Degraded or Low Potential Sites	PLT
5	Biodiversity and Managed Forests	BIO
6	Forest Products and People	FPP
7	Research Impacts, Priorities and Capacity Evaluation	IAP
8	Policies, Technologies and Global Changes	GLC

Of the three approved ‘Pilot’ Challenge Programmes, only the Water and Food CP has a research focus that overlaps with CIFOR’s agreed research agenda. CIFOR is currently preparing a proposal with research elements from all of its three programmes that focuses on forest management, land use and water issues in upper catchments. The CP on sub-Saharan Africa is using INRM approaches in its development espoused and publicized by CIFOR. In addition CIFOR is monitoring progress of the Climate Change CP and the Coastal Zones CP as the proposed research foci have aspects that fall within CIFOR’s research agenda.

Rainforest Challenge Programme: Although not yet approved as a formal challenge programme, CIFOR has been a partner (with ICRAF, IUCN and WWF) in the development of the Rainforest Challenge. The research process emphasizes action research, with linkages to CIFOR’s approach promoted through the Adaptive Collaborative Management project. To the extent that current resources allow, the research proposed in the CP proposal is being actively pursued. Priority issues to be addressed in a fully funded CP include; payments for environmental services, tenure issues, and developing markets for forest products. The bulk of the work will be conducted at 6-12 sites (large landscape units) in the humid tropics including Bulungan Indonesia, Cameroon and Brazil. Attempts to secure restricted financial resources to support the CP’s proposed research agenda are continuing.

4.2.3 CIMMYT

CIMMYT has a global mandate for the improvement of maize and wheat and makes roughly similar investments in the two cereals (46.6 per cent in maize and 53.4 per cent in wheat in 2002). Research in maize and wheat undertaken by the Centre contributes to all five of the CGIAR outputs, with approximately 36 per cent of budget being spent on increasing productivity, 25 per cent in strengthening NARS and smaller amounts in the other output categories. However, these sums do not fully include additional resources for Challenge Programmes (see below) which may alter these ratios. CIMMYT has recently rationalized its project structure, describing its work under seven new projects (rather than 21 previously). Research is predominantly geared to the use of these cereals for the production of food grains. However, project 5 also encompasses sustainable production (particularly of maize) to meet livestock feed needs and opportunities for income generation for the poor.

1	Maize and wheat genetic diversity for humanity
2	Livelihoods and risk in rainfed, stress-prone, food grain systems
3	Food security, markets, and livelihoods in Africa
4	Ensuring world food security through sustainable intensification in densely inhabited areas
5	Improving livelihoods and conserving natural resources in tropical agro-ecosystems
6	Policies and institutions that maximize research impact
7	Sharing and managing knowledge

Due to the recent strategic revision of the CIMMYT portfolio, projected estimates of investment by region are not available as they are for other Centres for 2006. However, in 2002, actual CIMMYT investments (out of an overall budget of US\$ 36.545) were distributed as follows: Eastern and Southern Africa (33 per cent); South Asia (22 per cent); Central America/Caribbean (15 per cent); South America (10 per cent); WANA (10 per cent); East and SE Asia (6 per cent); Central and West Africa (4 per cent).

CIMMYT is a convening Centre, with IRRI and IPGRI, for the Challenge Programme on Unlocking Genetic Diversity in Crops for the Resource-Poor. The intention, using a concerted effort to generate, manage, and apply genomic information derived from comparative studies, is to enhance the use of genetic resources available in the public sector, especially from the CGIAR Centres and their partner organizations in developing countries, to identify traits of importance in poverty reduction. The Programme will assemble partners from other CGIAR Centres, national research systems, advanced research institutes, and the private sector to create a unique public research platform for accessing and developing genetic resources to reduce poverty. The Programme will give immediate priority to building partnerships with national research programmes, and the private sector, including the development of statements on IP policy and genetic resource stewardship that are consistent with CGIAR guidelines.

CIMMYT is a partner in the Challenge Programme on Biofortified Crops for Improved Human Nutrition. The Programme grew out of a pilot project in which several CGIAR Centres, including CIMMYT for maize and wheat, assessed the feasibility of breeding biofortified crops.

CIMMYT also participates in the Challenge Programme on Water and Food. The Centre's contribution stems from CIMMYT and its partners' success in improving farm-level water productivity through new maize and wheat system technology. Examples include the continuing "zero tillage" approach being applied in the Indo-Gangetic Plains, and new maize and wheat varieties that are more drought tolerant and water use efficient than alternatives. CIMMYT's focus will be in five river basins: the Indus-Ganges, Kharkheh, Limpopo, Nile, and Yellow River basins, addressing food and water dimensions of the Challenge Programme, as opposed to water issues alone.

4.2.4 CIP

CIP continues to emphasize research on its mandate crops: potato, sweetpotato and other Andean root and tuber crops (ARTC). CIP is the CGIAR Centre preserving in-trust germplasm

for these crops. Over the past decade CIP's research has expanded to include integrated natural resources management, with specific attention being given to highland or mountain environments (particularly through CONDESAN in the Andean region). High levels of poverty characterize these areas, and the well-being of the human populations of these areas depends on the sustainable development of several of CIP's mandate commodities.

Priority attention has been given to restoring staff capabilities in the African and Asian regions. In 2006, it is estimated that of a projected total of US\$ 22.91 million CIP will invest approximately 41 per cent in SSA (Eastern and Southern Africa), 35 per cent in East and SE Asia and the Pacific, 12.5 per cent in South Asia and 11.5 per cent in LAC. Revenues from involvement in Challenge Programmes are not included in this total.

In 2002 the Centre undertook the "CIP-Vision" exercise that resulted in the prioritization of seven development challenges. These were based on the selection of those Millennium Development Targets that could be addressed through the Centre's research and development programme over the next two decades. The resulting Challenges were broadly characterized as: reducing poverty and hunger; improving human health; developing sustainable rural and urban systems; and improving the availability of new technologies. CIP's impact assessment studies have documented improvements in potato and sweetpotato production systems through CIP-related technologies that have resulted in significant gains to farm productivity, especially in China, India, Eastern Africa, and the Andean highlands. The objective for the future is to increase impact across a broader array of challenges, in the context of the Millennium Development Goals and Targets. This has led to a strategic realignment of the CIP project portfolio (see Table 4.4). Within this structure, research and development activities are organized into two constellations: Research Projects and Partnership Projects. The programme will target absolute poverty and hunger, and broaden in scope to address more of the development challenges faced by these people.

1	Impact enhancement
2	Genetic resources conservation and characterization
3	Germplasm enhancement and crop improvement
4	Integrated crop management
5	Natural resource management
6	Health and agriculture
7	Vitamin A for Africa (VITAA)
8	Global Mountain Programme (GMP)
9	Urban harvest
10	Consortium for the sustainable development of the Andean ecoregion -CONDESAN
11	Global Initiative on Late Blight (GILB)
12	Country and regional network projects

Project 12 includes donor funded technical assistance to countries in hunger crises (e.g. Afghanistan, North Korea) as well as capacity building through established networks.

CIP is a partner in Systemwide, ecoregional and Challenge Programmes. The latter include the Challenge Programme on Food and Water. In 2002, CONDESAN was selected as Coordinator of the Andean System of Basins for the CGIAR Challenge Programme on Water and Food. CIP also contributes to the Challenge Programmes on Biofortification (including the work carried out on sweetpotato under Project 7) and Unlocking Genetic Diversity (through its mandate crops).

4.2.5 ICARDA

ICARDA has a major responsibility for agricultural research in the dry areas of West Asia and North Africa. This traditional region has been extended by the incorporation of the Central Asian republics of the former USSR into the CWANA region. The Centre's major commodity focus (in terms of anticipated investment in 2006) is on wheat, livestock, barley, chickpea and lentils. The Centre anticipates allotting approximately 70 per cent of its budget for research and research-related activities for WANA, 15 per cent for SSA, 12 per cent for Asia and 3 per cent in LAC.

The Research Project Portfolio for 2004-2006 is presented in Table 4.5. As noted for CIP (above) and with other Centres, ICARDA's research portfolio has previously been augmented by rapid-response development initiatives - such as the Future Harvest Consortium to Rebuild Agriculture in Afghanistan in 2002/3. Although there will be less emphasis on this topic in the future it highlights how the CGIAR Centres can respond to development assistance priorities.

1	Barley Improvement
2	Durum Wheat Improvement
3	Spring Bread Wheat Improvement
4	Facultative Bread Wheat Improvement
5	Food Legume Improvement
6	Forage Legume Improvement
7	Integrated Pest Management
8	Agronomic Management
9	Sown Pasture and Forage Production
10	Native Pasture and Rangeland Management
11	Small Ruminant Production
12	Water Resource Management
13	Land Management and Soil Conservation
14	Biodiversity Conservation
15	Agroecological Characterization
16	Socioeconomics of NRM
18	Policy and Public Management Research
19	Strengthening of National Seed Systems

The portfolio shows a continuation of earlier thrusts but a closer research focus at ICARDA on the determinants of poverty. Although the portfolio has not changed there are shifts in emphasis or scale within projects including:

- Expansion in research on water management in dry areas, as a key limiting natural resource
- Expansion of research on mitigation and adaptation to the anticipated effects of climate change
- Increased support for socioeconomic research overall.
- Greater funding for small ruminant research
- Expansion of research on germplasm enhancement of barley and food legumes - ICARDA's world mandate commodities.

CWANA: ICARDA together with AARINENA, and the CAC NARS Forum undertook a priority setting process for agricultural research in the CWANA region. There is growing ICARDA engagement the Central Asia and the Caucasus (CAC) region of CWANA. A project on 'Germplasm conservation, adaptation, and enhancement for diversification and intensification of agricultural production' on barley, forage legumes, food legumes including groundnuts with ICRISAT, winter wheat with CIMMYT and plant genetic resources with IPGRI was conducted within the CGIAR Programme. In CAC projects on 'On-farm Water and Soil, 'Integrated Feed and Livestock Production in the Steppes of Central Asia' funded by IFAD to expand livestock productivity research in Central Asia. A major focus has been on agro biodiversity research in the CAC region with collections in two CAC countries and others planned for 2003.

ICARDA is a partner in activities in the Challenge Programmes (CP) on Water in Agriculture and in Biofortification, and is involved in the new CP on Genetic Resources. ICARDA has been actively participating in the process to launch the SSA Challenge Programme.

In general, ICARDA is paying increased research attention to climate change in response to the increased magnitude and confidence of the predictions of warming and drying in dry areas in general, and CWANA in particular. ICARDA is a partner in the Challenge Programme pre-proposal on climate change and several other aspects of the Centre's research contribute to building the scientific knowledge base on mitigating the effects of climate change such as policy research, rangeland management and rehabilitation, water harvesting, conservation tillage, land use planning and watershed management. ICARDA's meteorological database now contains over 5 million records. An overview of the agroecology of CWANA with thematic layers of soil, altitude/slope and land use/cover and agroecological zones has been completed.

In parallel, the Centre has increased its engagement with NARS and other regional and international organizations in preparing action plans for implementation under the UN Convention to Combat Desertification (UNCCD) to combat desertification and mitigate the effects of drought. ICARDA is the CGIAR focal point for UNCCD. ICARDA with ICRISAT launched a Challenge Programme pre-proposal on 'Agriculture to Combat Desertification and Poverty'.

4.2.6 ICRISAT

ICRISAT's continuing commodity focus is on crops and commodities of importance to the semi-arid tropics of Asia and Sub-Saharan Africa. In order of planned investment for 2006 these are groundnut, sorghum, millet, pigeon pea, chickpea, livestock, other crops and trees. Of a projected total budget of around US\$ 24.6 million, slightly over half (US\$ 12.7 million or 51.6 per cent) will be utilized in SSA and 11.9 million (48.4 per cent) in Asia.

ICRISAT has developed its 2004-2006 MTP one year after changes in organization following a series of consultations and priority-setting undertaken with stakeholders, and in line with the Centre's vision and strategy. The research portfolio is made up from six global themes with an Impact Assessment Unit incorporated into Global Theme 6, to strengthen multi-disciplinary thrusts in research planning and priority-setting (see Table 4.6). The global themes promote regional projects focusing on Sub-Saharan Africa and Asia.

Table 4.6 – ICRISAT: Centre Projects		Centre designation
1	Harnessing Biotechnology for the poor	GT1
2	Crop improvement, management and utilization for food security and health	GT2
3	Water, soil and agro-biodiversity management for ecosystem resilience	GT3
4	Sustainable seed supply systems for productivity	GT4
5	Enhancing crop-livestock productivity and systems diversification	GT5
6	SAT Futures and development pathways	GT6
7	Impact Assessment Office	GT7

Following the Centre's EPMR, consideration is being given to incorporating the research proposed under Global Theme 5 into Global Themes 2 and 3 as recommended by the Review Panel. To maximize the synergy between themes four *Global Impact Target Areas (GITAs)* have been articulated:

GITA 1 - Impact of shocks from drought, desertification, degraded environments, and pests mitigated and the efficiency of disaster preparedness and relief enhanced.

GITA 2 - Livelihood resilience strengthened through improvement and diversification of crop and crop-livestock systems, enrichment of income generation opportunities and a specific orientation towards markets and trade.

GITA 3 - Human and livestock health sustained through improved agricultural productivity, gender-based initiatives, better food/feed quality, and enhancement of potential for international agricultural trade.

GITA 4 - R & D partners empowered by enhanced competence, capability, capacity and strengthening of ability to prioritize and project trends.

The Desert Margins Programme (DMP): A major contribution is made by ICRISAT to this Systemwide programme, which is a collaborative initiative among nine African countries: Burkina Faso, Botswana, Mali, Namibia, Niger, Senegal, Kenya, South Africa, and Zimbabwe

assisted by five CGIAR Centres (ICRAF, ICRISAT, IFDC, ILRI, TSBF-CIAT) and three Advanced Research Institutes (CEH, CIRAD, IRD). The overall objective of the DMP is to arrest land degradation and conserve biodiversity in Africa's desert margins through demonstration and capacity building activities. The programme is a multi-million dollar investment of the countries, the GEF and other donors. The overall objective of the GEF within the agricultural research portfolio of activities is to conserve and restore biodiversity in the Desert Margins through sustainable utilization.

ICRISAT continues to make contributions to other Systemwide initiatives: the Rice-wheat consortium, IPM, Genetic Resources, Livestock, Malaria, Climate Change, Soil and Water, SWIM II, and the CGIAR Information Technology.

4.2.7 IITA

IITA has principal responsibility in the CGIAR in Africa for the commodities (by estimated investment level in 2006) cassava, bananas/plantain, maize, cowpea, soybean, and yam. Its research for development approaches also include other crops, and at lower levels, trees, fish and livestock. IITA's work contributes to all CGIAR undertakings with major contributions (in 2006) to increasing productivity (40.8 per cent) and to strengthening NARS (25 per cent). The great majority of this work is conducted in and for sub-Saharan Africa. In 2006, the projected budget will be invested 69.3 per cent in West and Central Africa, and 30.3 per cent in East and Southern Africa, with small spillovers to other regions. IITA organizes its agenda in six medium-term plan projects, three of which are considered disciplinary projects, and three further projects based on agroecological zones, as follows:

1	Preserving and enhancing germplasm and agrobiodiversity with conventional and biotechnological tools
2	Developing biologically-based pest, disease, and weed management options, and conserving biodiversity for sustainable agriculture
3	Assessing impact, formulating policy options, and systems analysis
4	Promoting income generation and food security through enterprise development and sustainable production of starchy and grain staples in eastern and southern Africa
5	A future through farming: enhancing livelihoods, improving the resource base and protecting the environment through starchy staple, peri-urban and tree crop systems of the humid and sub-humid zones of West and Central Africa
6	Intensifying grain-based systems in the West African savanna for improved food security, income generation, and livelihoods

IITA actively participates in a very large number of networks and in global and ecoregional Systemwide programmes. The latter include:

AHI - African Highlands Initiative

ASB - Global Initiative on Alternatives to Slash-and-Burn

CAPRI - Systemwide Programme on Property Rights and Collective Action

CAS - Systemwide Central Advisory Service on Intellectual Property Rights

CSI - Systemwide Consortium for Spatial Information
 EPHTA - Ecoregional Programme for the Humid and Subhumid Tropics of Sub-Saharan Africa
 ICIS - International Crop Information System
 INRM - Inter-Centre Working Group on Integrated Natural Resources Management
 INTG - IARC-NARS Training Group
 IVC - Inland Valley Consortium
 PRGA - Systemwide Programme on Participatory Research and Gender Analysis
 SGRP - Systemwide Genetic Resources Programme
 SIMA - Systemwide Programme on Malaria and Agriculture
 SINGER - Systemwide Information Network for Genetic Resources
 SIUPA - Systemwide Initiative on Urban and Peri-Urban Agriculture
 SLP - Systemwide Livestock Programme
 SP-IPM - Systemwide Programme on Integrated Pest Management
 SWI-HIV/AIDS - Systemwide Initiative on HIV/AIDS

Similarly IITA contributes to all four approved Challenge Programmes on Water and Food, Biofortification, Sub-Saharan Africa, and Unlocking genetic diversity in crops for the resource poor.

4.2.8 IFPRI

IFPRI's mission within the CGIAR is to identify and analyze policies for sustainably meeting the food needs of the developing world. Research concentrates on economic growth and poverty alleviation in low income countries, human well being and sound management of the natural resource base. IFPRI puts emphasis on the communication of its research results. In 2004, IFPRI's allocation of resources by CGIAR output is about 59 percent to policy research, 5 percent sustainable production, and 36 percent enhancing NARS.

IFPRI uses four sets of criteria to concentrate on the key food security research gaps. These criteria are based on strategic principles, emerging issues, comparative advantage, and processes drive by demand for new knowledge.

- IFPRI's work programme must conform to its mission: *to provide policy solutions that reduce hunger and malnutrition.*
- IFPRI seeks to address the major emerging issues affecting food security.
- IFPRI considers its comparative advantage to be giving priority to research that produces results applicable to many countries - i.e., international public goods.
- IFPRI confers with and responds to stakeholders to select essential food policy research that helps the greatest number of people in deepest need.

IFPRI's choice of study region and countries is guided by the Centre's commitment to bring potential benefits to poor and malnourished people in the country and the presence of large concentrations of poor people. The Institute gives higher priority to research that can yield results that will allow generalization across countries and regions. IFPRI works in places where there is high interest among researchers and policymakers in study countries and where there are

available national and international partners (including other CGIAR Centre) for collaborative efforts. Finally, the Institute ensures there are acceptable logistical and security conditions. In 2004 (i.e. before the addition of the ISNAR programme) IFPRI anticipates conducting approximately 51 per cent of its research with relevance to SSA, 33 per cent to Asia, 13 per cent to LAC and 3 per cent to WANA. The Centre will pursue a process of decentralization through outposting staff, particularly to China, South Asia (India), and Southeast Asia (Indonesia), East Africa (Ethiopia), and West Africa (Senegal). Similarly food policy networks are being planned and developed to serve developing regions.

Table 4.8 – IFPRI: Centre Projects		Centre designation
1	Markets and Trade: Public Policies towards Development of Local, Regional, and Global Markets	MP1
2	Property Rights and Collective Action for Natural Resource Management	MP11
3	Macroeconomic Policies, Growth and Food Security (this may change to Economy-wide Strategies once division plan is set)	MP12
4	Urban Challenges to Food and Nutrition Security	MP14
5	Gender and Intra-household Aspects of Food Policy (ends in 2003)	MP17
6	Policies for Biotechnology and Genetic Resource Management	GRP1
7	Global and Regional Trade: Issues within the Overall Context of WTO	GRP2
8	Priorities for Public Investment in Agriculture and Rural Areas	GRP3
9	The 2020 Vision for Food, Agriculture, and the Environment Initiative	GRP4
10	Sustainable Development of Less-Favoured Lands	GRP5
11	Biofortified Crops for Human Nutrition	GRP6
12	Water Resource Allocation: Productivity and Environmental Impacts	GRP22
13	Institutions and Infrastructure for Market Exchange	GRP23
14	Diet Quality and Diet Change	GRP24
15	Nutrition Policy Process	GRP25
16	Pathways from Poverty	GRP26
17	Participation in High-Value Agricultural Markets	GRP27
18	Large-Scale Interventions to Enhance Human Capital	GRP28
19	Networks for Policy Impact	GRPGSP1
20	Spatial Patterns and Processes in the Agriculture, Environment, and Poverty Nexus	GRPGSP2
21	Communications and Impact Assessment	PP20

These projects respond to IFPRI's Strategic Research Themes (for 2003)

1. Global food situation and scenarios of policy risks and opportunities.
 - a. The 2020 Vision for Food, Agriculture, and the Environment Initiative (GRP4)
2. Globalization, retail food industries, and trade negotiations related to food and agriculture.
 - a. Markets and Trade: Public Policies towards Development of Local, Regional, and Global Markets (MP1)

- b. Global and Regional Trade: Issues within the Overall Context of WTO (GRP2)
- 3. Managing natural resources of particular importance to food, nutrition, and agriculture - land, water, trees, genetic resources, and biodiversity - and responding to climatic change.
 - a. Property Rights and Collective Action for Natural Resource Management (MP11)
 - b. Sustainable Development of Less-Favoured Lands (GRP5)
 - c. Water Resource Allocation: Productivity and Environmental Impacts (GRP22)
- 4. Food systems in disaster prevention and relief, and rebuilding after crises.
- 5. Appropriate roles of state, market, and civil society in food, agriculture, nutrition, and natural resource management policy.
 - a. Institutions and Infrastructure for Market Exchange (GRP23)
 - b. Nutrition Policy Process (GRP25)
- 6. Food and water safety policies.
- 7. Policies addressing hidden hunger, enhanced food and diet quality for poor people, and the nutrition transition in developing countries.
 - a. Biofortified Crops for Human Nutrition (GRP6)
 - b. Diet Quality and Diet Change (GRP24)
- 8. Policies and interventions for sustainable poverty reduction and nutrition improvement.
 - a. Pathways from Poverty (GRP26)
 - b. Large-Scale Interventions to Enhance Human Capital (GRP28)
- 9. Cross-cutting research on country and regional food, nutrition, and agricultural strategies.
 - a. Macroeconomic Policies, Growth and Food Security (this may change to Economy-wide Strategies once division plan is set) (MP12)
 - b. Priorities for Public Investment in Agriculture and Rural Areas (GRP3)
 - c. Networks (GRPGSP1)
 - d. Spatial Patterns and Processes in the Agriculture, Environment, and Poverty Nexus (GRPGSP2)
- 10. Food- and nutrition-related science and technology policy (molecular biology, bio-safety, and information and communications) serving poor people.
 - a. Policies for Biotechnology and Genetic Resource Management (GRP1)
- 11. The future of smallholder farming in efficient and equitable food systems.
 - a. Participation in High-Value Agricultural Markets (GRP27)
- 12. Urban-rural linkages and non-farm rural development.
 - a. Urban Challenges to Food and Nutrition Security (MP14)

Several new initiatives were launched in mid-2003.

Institutions for Market Development - Evolving from Public policies for Rural Institutions, Markets, and Infrastructure, this new project will conduct research designed to strengthen the performance of agricultural markets in ways that directly benefit smallholders and the poor. The project will focus on the underlying market institutions needed to enhance the environment in which private sector activities take place.

Diet Quality and Diet Transition - This new project will focus on two broad areas: 1) how diet quality changes the way we look at measuring poverty and food security, whether the differences are significant for policy and intervention design, and the role of public policy in pro-actively improving diet quality, and 2) how diets of the poor in many developing countries are transitioning to diets with unhealthy levels of fat, added sugar, and salt.

Nutrition Policy Process - This new research area will focus on how various agents influence national government decision-making and action on nutrition issues. Policy research results are produced and disseminated but not always translated into action by policymakers. Increasing democratization and involvement of civil society provide an opportunity to conduct research on the political process.

Pathways from Poverty - Building on the work of Targeted Interventions to Reduce Poverty, research on HIV/AIDS and food security, and on Microfinance, this new project will conduct research on why some individuals, households, and communities escape poverty and malnutrition and other do not. Researchers will investigate why some groups have fared better than others and what policies and programmes are more likely to help those that are left behind.

Spatial Patterns and Processes in the Agriculture, Environment, and Poverty Nexus - The project team aims to improve knowledge of the patterns of natural and economic processes over landscapes and time as to increase understanding of constraints to and opportunities for rural development, the reduction of poverty and hunger, and increased provision of ecosystem services. This better understanding can, in turn, improve the effectiveness of policies and development investments.

The Centre leads the Collective Action and Property Rights system-wide initiative, which includes all 16 CGIAR Centres as members.

IFPRI and CIAT jointly manage the Biofortification Challenge Programme, which involves six other CGIAR Centres and numerous NARS, ARIs, NGOs, and private sector organizations. IFPRI also plays the lead role in the policy aspects (Theme 5) of the Water Challenge Programme.

4.2.9 ILRI

ILRI's research portfolio is committed to research on livestock. In 2006 roughly 64.9 per cent of total resources will be committed to SSA, 29.1 per cent to Asia, 4 per cent to LAC and 1.8 per cent to WANA. According to an evaluation carried out in 2002, approximately half of ILRI's resources were being expended on mixed crop-livestock systems, 19% on rangelands, 13% on peri-urban and the landless who consume livestock products, and 19% on non-specific cross-system research. Following a recent strategic reassessment ILRI now describes its programme under 6 projects (see Table 4.9) - five thematic areas and the Systemwide programme on livestock.

1	Targeting opportunities
2	Enabling Innovation
3	Market opportunities
4	Biotechnology
5	People, livestock and the environment
6	System-wide livestock programme

ILRI and IFPRI have developed a joint research programme for Livestock Market Opportunities that builds upon the activities of ILRI's Project 3 (Market Opportunities) and IFPRI's project GRP 27 (Participation in High-Value Agricultural Markets).

The strategic reassessment, which included an increase in ILRI's understanding of poverty, encompasses new priorities for ILRI's research agenda. In the future there will be a progressive change to:

- A portfolio of research that focuses on enhancing market access of poor livestock keepers, allowing them to move into market-oriented production to increase their income.
- Improved targeting of how livestock research and development can contribute to poverty alleviation.
- Greater work with peri-urban and landless systems, in view of predicted increases in demand for livestock products, and as a result of growing patterns of rural landlessness and urban migration in many parts of the developing world.
- Enhance the focus on livestock of pastoralist peoples, particularly those in Africa.
- Increased activities to add value to existing studies in South Asia and other parts of Asia (whilst maintaining a two thirds share of activities in Africa).
- Research covering a wider range of smaller livestock species, not only cattle.
- Prioritize the needs of poor women in all research activities because of their marginalized status and in view of the vital role they play in agriculture in the developing world and their effectiveness at channelling benefits to families.

Through the New Partnership for Africa's Development (NEPAD), ILRI is developing a NEPAD centre of excellence in Biosciences. This development, named the Biosciences East and Central Africa Initiative, will provide shared facilities and networks for agricultural biotechnology for use by regional scientists. It has the possibility of providing capacity building and common platforms for bioscience services such as bio-safety, bio-informatics and intellectual property management, within the NEPAD framework.

ILRI convenes the System-wide Livestock Programme (SLP) within the CGIAR. Research within the SLP has targeted improved crop-livestock integration, particularly improving both the human food and animal feed value of important crops.

The Centre also participates in the following CGIAR Systemwide initiatives:

- Desert Margins Programme led by ICRISAT
- Inter-centre Working Group on Climate Change
- Participatory Research and Gender Analysis Programme, led by CIAT
- Sub-regional consortia in the CAC-WANA region, led by ICARDA
- System-wide Livestock Programme, led by ILRI
- System-wide Genetic Resources Programme, led by IPGRI
- System-wide Programme on Collective Action and Property Rights, led by IFPRI
- Systemwide Initiative on Malaria in Agriculture (SIMA), convened by IWMI

Water and Food Challenge Programme: ILRI is involved in a number of Water and Food CP proposals (leading in one and a partner in three others - with IWMI and ICRAF). In the proposal it is leading, ILRI is focusing on the role of livestock in increasing the productivity of water in crop-livestock systems. The efficiency of water use will be an increasingly important research area for ILRI.

Sub-Saharan Africa CP: ILRI has participated in the design and development of the SSA CP proposal being coordinated by FARA. ILRI plans to be closely involved in the further development of the CP, both in the overall process and in the development of research projects in the proposed pilot learning sites in East, South and West Africa.

4.2.10 IPGRI

The mandate of IPGRI is to advance the conservation and use of genetic diversity for the well-being of present and future generations. IPGRI contributes to research and policy for genetic resources of relevance to a large number of CGIAR mandate crops. However its own commodity research focuses (in order of share of proposed budget in 2006) on banana/plantain, tropical fruit, trees, coconut, and roots and tubers. The research and research-related activities of the Centre are expected to be shared in 2006 between SSA (32 per cent: approximately US\$ 5.1 million in Central and West Africa and US\$ 5.8 million in East and Southern Africa), Asia (25 per cent, US\$ 5.4 million in East Asia/SE Asia and the Pacific, and US\$ 3.0 million in South Asia; LAC 20 per cent (US\$ 2.4 million in Central America and the Caribbean, US\$ 4.4 million in South America) and 23 per cent of total budget in CWANA.

The IPGRI Research Agenda is a central component of the system's strategy and the portfolio contributes to all five of the CGIAR Outputs. All IPGRI Outputs are assigned at least 11% of the total budget in 2004 and the contributions to Outputs 1 and 5 (Germplasm Collection and Enhancing NARS respectively) are numerically greatest, each at 29% of the total budget. The IPGRI Programme generates significant public goods in the form of germplasm collections and knowledge of how plant genetic resources can most effectively be conserved and put to use by the research-and-development community and farmers. Such goods are generated both directly by the INIBAP in-trust banana collection and International *Musa* Testing Programme, and also indirectly, as in the case of the International Coconut Genebank, coordinated by the Coconut Genetic Resources Network (COGENT) and, more broadly, through the efforts of the SGRP, including the Global Conservation Trust.

Activities continue to reflect the directions defined in the institutional strategy, *Diversity for Development*, launched in 1999. Rationalisation of IPGRI's projects (see Table 4.10) followed a specific review of the Project Portfolio conducted at the end of 2002.

1	Strengthening national plant genetic resources programmes and networks in the Americas
2	Strengthening national plant genetic resources programmes and networks in Asia, the Pacific and Oceania
3	Strengthening national plant genetic resources programmes and networks in Europe
4	Strengthening national plant genetic resources programmes and networks in the Sub-Saharan Africa
5	Strengthening national plant genetic resources programmes and networks in Central and West Asia and North Africa
6	Capacity-building for plant genetic resources conservation and use
7	Global forest genetic resources strategies
8	Commodity chains research to promote sustainable livelihoods
9	Locating, assessing and monitoring plant genetic diversity
10	Plant genetic resources conservation strategies and technologies
11	Laws and policies affecting the conservation, use and exchange of genetic resources for food and agriculture
12	Agricultural biodiversity management and production systems
13	Livelihoods and institutions: social, cultural and economic aspects of agricultural biodiversity
14	Plant genetic resources information management and knowledge sharing
15	Understanding and communicating the value and impact of plant genetic resources
16	<i>Musa</i> genetic resources management
17	Genetic improvement of <i>Musa</i>
18	<i>Musa</i> information management and sharing
19	Regional support to <i>Musa</i> research
20	Supporting global genetic resources conservation and use through the System-wide Genetic Resources Programme

IPGRI's work will continue to be conducted through three programmes, the Plant Genetic Resources Programme, the International Network for the Improvement of Banana and Plantain (INIBAP), and the CGIAR Genetic Resources Support Programme. It will be conducted on a pan-regional basis with a high proportion of resources continuing to be allocated to Sub-Saharan Africa and a continued expansion of work in Central Asia. The revision of the IPGRI Project Portfolio has involved, for example, the combining of thematic work on *ex situ* and *in situ* conservation methodologies and strategies into one project to promote the desired level of synergy and complementarity.

In contrast, IPGRI's policy and legal work has now been redistributed between two projects. A project originally focusing on coconut has been broadened to bring together work on commodities of importance to the poor.

IPGRI has been heavily involved in the development of Challenge Programmes and in the Global Conservation Trust campaign. The Trust, launched in 2002 in collaboration with FAO seeks to create a public-private endowment to secure the long-term conservation of important collections of crop diversity held *ex situ* in national, regional and international genebanks,

including those of the CGIAR. It has seen a high level of interest among donors from governments north and south, industry and private foundations, and now has approximately US\$90 million in real and expressed commitments.

Recent new activities include:

- Plant genetic resources networking in the Pacific,
- Molecular approaches to improving *Musa* (banana and plantain),
- Agrobiodiversity initiatives including expanded work on neglected and underutilized species,
- The launching of the Global Conservation Trust campaign,
- Increased genetic resources policy research and advice to national programmes and governments.

IPGRI is contributing to four Challenge Programmes. The Centre plays a leading role, together with CIMMYT and IRRI, in the Challenge Programme on Unlocking Genetic Diversity. This is expected to be in the heartland of the IPGRI's work over the next five years. IPGRI will be very active in Subprogramme 1, on Genetic Diversity of Global Genetic Resources, in Subprogramme 2 on Comparative Genomics for Gene Discovery, through work on *Musa*, in Subprogramme 4 on Genetic Resources, Genomic, and Crop Information Systems, and in Subprogramme 5 on Capacity Building.

IPGRI's involvement in the Challenge Programme on Water and Food will relate to the conservation and use of drought-resistant horticultural crops of strategic importance to the CWANA region.

In the Challenge Programme on Biofortification, IPGRI is contributing to a component on adding nutrients to crops by focusing on the nutritional value of bananas and plantain in baby food.

IPGRI has contributed to the development of the Challenge Programme on Sub-Saharan Africa, and will work with other CGIAR Centres to move genetic resources forward on the African agenda as an essential element of a strategy to achieve production increases across the continent.

During 2004 IPGRI will be finalizing a major strategic planning exercise (see Section 4.5).

4.2.11 IRRI

IRRI has a global mandate for rice improvement. It particularly focuses on Asia and collaborates with other CGIAR Centres like WARDA and CIAT, having regional mandates for the same commodity. In 2006, it anticipates expending 92 per cent of its budget for research and related activities benefiting Asia, 4 per cent for SSA, 3 per cent for LAC and 1 per cent in WANA.

IRRI's core agenda in addressing *current and emerging problems in rice* is reflected in the adoption of four programmes that relate to specific problems in the major rice ecosystems - irrigated, rainfed, and upland. The programmes are implemented through its project portfolio for 2004-2006 which describes 12 projects (see Table 4.11). It also takes advantage of new scientific opportunities (including in biotechnology) and the portfolio straddles the continuum of strategic to applied research. Its portfolio of research contributes to all the CGIAR output categories - with shares anticipated for 2006 to be 27.3 per cent for germplasm improvement, 9.2 per cent for germplasm collection, 31.4 per cent for sustainable production, 13.1 per cent for policy and 19 per cent for enhancing NARS.

1	Germplasm conservation, characterization, documentation and exchange
2	Functional genomics
3	Genetic enhancement for yield, grain quality, and stress resistance
4	Managing resources under intensive rice-based systems
5	Enhancing water productivity in rice-based production systems
6	Integrated Rice Research Consortium
7	Genetic enhancement for improving productivity and human health in fragile environments
8	Natural resources management for rainfed lowland and upland rice ecosystems
9	Consortium for unfavourable rice environments
10	Understanding rural livelihood systems for rice research prioritization and impact assessment
11	Enhancing ecological sustainability and improving livelihoods through ecoregional approaches for integrated natural resources management
12	Facilitating rice research for impact

The relationship between IRRI's programmes and projects in rice research is as follows:

Programme 1 Genetic resources conservation, evaluation, and gene discovery
Project 1: Germplasm conservation, characterization, documentation, and exchange
Project 2: Functional genomics

Programme 2 Enhancing productivity and sustainability of favourable environments
Project 3: Genetic enhancement for yield, grain quality, and stress resistance
Project 4: Managing resources under intensive rice-based systems
Project 5: Enhancing water productivity in rice-based production systems
Project 6: Irrigated Rice Research Consortium

Programme 3 Improving productivity and livelihood for fragile environments
Project 7: Genetic enhancement for improving productivity and human health in fragile environments
Project 8: Natural resource management for rainfed lowland and upland rice ecosystems
Project 9: Consortium for Unfavourable Rice Environments (CURE)

Programme 4 Strengthening linkages between research and development

Project 10: Understanding rural livelihood systems for rice research prioritization and impact assessment

Project 11: Enhancing ecological sustainability and improving livelihoods through ecoregional approaches to integrated natural resource management

Project 12: Facilitating rice research for impact

The overall programme structure links conservation activities (and the International Rice Genebank) with upstream capabilities in functional genomics and testing and extension activities through networks (particularly in Asia). There are extensive links to other CGIAR Centres in the operation of these projects - for instance, IRRI Project 7, *Genetic enhancement for improving productivity and human health in fragile environments* will link closely with the Challenge Programmes on *Biofortified Crops for Improved Human Nutrition*, *Unlocking Genetic Diversity in Crops for the Resource-Poor*, and *Water and Food*.

4.2.12 ISNAR

The International Service for National Agricultural Research (ISNAR) has traditionally provided a neutral source of expertise, new information and tools for national agricultural research organizations and regional organizations, as well as acting as a facilitator of country-led processes. Its work therefore contributes to the strengthening NARS and policy outputs of the CGIAR. Its remit has been global with 47 per cent of its budget invested in work relevant to SSA, 25 per cent to LAC, 24 per cent to Asia and 4 per cent to WANA (estimated for 2004, see below).

However, ISNAR is in the process of restructuring and its programme will pass under the direction of IFPRI in 2004. As part of the restructuring process, the Centre has confirmed three priority areas for continuation in the future (see Table 4.12). ISNAR will discontinue its work on policies for institutional innovation, building capacities for cross-sector demands, and entrepreneurial partnerships.

1	Institutional Change
2	Organization and Management
3	Innovation in Biotechnology

The project *Institutional change* will address institutional learning and change through considering effective innovation systems more broadly. This will include evaluation mechanisms to strengthen the poverty focus of research organizations; international partnerships, and collaborative work on local agricultural knowledge systems in West Africa.

Organization and Management will work to strengthen agricultural research organizations, initially in Vietnam, Cambodia, and Mozambique. ISNAR's training activities will be concentrated through this project.

In the *Innovation in Biotechnology* project the emphasis will be on the implementation of a Programme on Biosafety Systems in sub-Saharan Africa and in parts of Asia. This project

builds on the work of the Central Advisory Service on Intellectual Property, previously hosted by ISNAR.

ISNAR will increasingly try to strengthen the poverty focus of its work, through (i) focusing work on regions where there are many poor, such as sub-Saharan Africa and parts of South and South-East Asia, (ii) working on approaches to increase the influence of the poor in setting the agenda of agricultural research organizations, (iii) incorporating poverty considerations in our tools for innovation management, (iv) analyzing how institutional change affects the poor.

ISNAR's work brings it in contact with a large number of individual, national, regional and international organizations. During 2002, ISNAR collaborated with over 35 national agricultural research organizations in over 30 countries in Latin America, Africa, Asia, and Central Asia and the Caucasus. ISNAR has played a prominent role in GFAR and FARA meetings.

System-interactions: ISNAR collaborates with other CGIAR institutes at the project, programme, and institute level. IFPRI and ISNAR manage the ASTI website and jointly maintain a database on agricultural science and technology indicators. ISNAR works on evaluating capacity development with various CGIAR Centres, notably IPGRI.

ISNAR participates in the Systemwide initiatives on (1) Malaria and agriculture, (2) transition economies in Central Asia and Caucasus, and (3) impact of HIV/AIDS on agriculture with IFPRI, ICRAF, CIAT, and WARDA. The RENEWAL (Regional Network on HIV/AIDS, Rural Livelihoods and Food Security) project has now established national networks in Uganda and Malawi and is in the process of building networks in Zambia and South Africa.

ISNAR manages the CGIAR Central Advisory Service on Intellectual Property (CAS). ISNAR's work on gender relations focuses on strengthening the voice and influence of marginalized stakeholder groups (women, youth, pastoralists), maintaining close links with the CGIAR PRGA and Gender and Diversity Programmes.

4.2.13 IWMI

IWMI focuses on the sustainable use of water and land resources in agriculture and on the water needs of developing countries. The objectives of IWMI's work are to: (i) Identify the larger issues related to water management and food security that need to be understood and addressed by governments and policymakers, (ii) Develop, test and promote management practices and tools that can be used by governments and institutions to manage water and land resources more effectively, and address water scarcity issues, (iii) Clarify the link between poverty and access to water and to help governments and the research community better understand the specific water-related problems of poor people, and (iv) Help developing countries build their research capacities to deal with water scarcity and related food security issues.

The Centre organizes its research around 5 priority themes (identified as projects 1-5 in Table 4.13). Projects 6 and 7 are Systemwide initiatives led by IWMI. MTP project 8 is an

addition to the most recent Medium Term Plan and reflects the launching of the Challenge Programme on Water and Food.

1	Integrated Water Management for Agriculture
2	Smallholder Land and Water Management
3	Sustainable Groundwater Management
4	Water Resources, Institutions and Policies
5	Water, Health and Environment
6	Comprehensive Assessment (CA) of the Benefits, Costs and Future Directions of Water Management for Agriculture
7	System-wide Initiative on Malaria and Agriculture (SIMA)
8	The Challenge Programme on Water and Food

The rapid growth experienced by IWMI includes an almost doubling of the Centre's budget and research capacity. Challenge Programme funding accounts for \$10 million of the projected \$22.75 million income for 2004. Of the US\$10 million, US\$7 million is budgeted for the non-IWMI component of the CP. The enhanced capacity has been in part caused by the absorption of the IBSRAM programme on soils research. These changes have led to further strategic reassessment of the future programme of IWMI. See section 4.5 for future priority activities for 2004-2008 (which are however strongly based in existing ones).

The Challenge Programme on Water and Food: This CP is implemented by a consortium of 18 partners led by IWMI. The goal of this project is to maintain the level of global diversions of water to agriculture at the level of the year 2000, while increasing food production, to achieve internationally adopted targets for decreasing malnourishment and rural poverty by the year 2015, particularly in rural and peri-urban areas in river basins with low average incomes and high physical, economic or environmental water scarcity or water stress, with specific focus on low-income groups within these areas. The Challenge Programme addresses the water-food-environment issues at river-basin level through a comprehensive systems approach that recognizes 5 key sub-systems as priority research themes. This approach enables the new knowledge gained to be synthesized and analyzed for its potential global application to water productivity in crop, tree, livestock and fish production systems. Increased access to food, and an equitable and predictable lifestyle that is also environmentally sustainable is sought as an end product.

The CP is at the stage of reviewing and confirming the first round of competitive project components, and the processes of working on the basis of experiences in 2003.

4.2.14 WARDA

WARDA's activities are centred on developing improved technologies to assist West and Central African farmers to increase rice production in an economically and environmentally sustainable manner. The strategy is to gather, develop and transfer technical options and knowledge that enables farmers to sustain and intensify their production to ensure sustainable growth in West and Central African food production. Major focus has been placed on breeding

intra- and inter-specific lines of rice and augmenting biotechnical capacity in-house, as well as effective collaboration and capacity building amongst partners in their mandate region. Although the actual investment in improving rice productivity is projected to remain fairly constant through 2006, its relative share in WARDA's portfolio will decrease (from 32 per cent in 2002 to 26 per cent in 2006) because of an increasing investment in strengthening NARS, which is anticipated to reach 44 per cent of budget in 2006.

WARDA conducts its research and research related activities through a portfolio of 17 projects (see Table 4.14). Thirteen of the projects address specific problem issues in improving rice cultivation. WARDA continues to play a leading role in several networks bringing together NARES and other stakeholders from West Africa. The Inland Valley Consortium, ROCARIZ and the African Rice Initiative significantly contribute to the integration of research activities in West Africa. Given the importance of these networks to WARDA's agenda, they are identified as projects in the 2004-2006 portfolio.

1	Sustainable Intensification of Lowland Rice Based Systems
2	Stabilization of Upland Rice Based Systems Under Shortened Fallow
3	Applying Watershed Management Methods to Optimize Resource Use in Inland Valleys
4	Creating Low Management Plant Types for Resource Poor Farmers
5	Development of Environment Specific Breeding Approach for Drought Resistant Rice Varieties
6	Characterization of Blast Fungus Genetic Diversity and Development of Donors with Durable Blast Resistance
7	Integrated Management of Iron Toxicity in Lowlands
8	Improvement of Resource-Use Efficiency in Irrigated Rice-Based Systems
9	Development of Profitable Land/Water Use Systems - Preventing Soil Degradation in Sahelian Rice Irrigated Systems
10	Integrated Management of Rice Yellow Mottle Virus in Lowland Ecosystems
11	Technical & institutional change and rice-based livelihoods
12	Policy environment and rice market development
13	Sustainable natural resources management strategies for rice development
14	Participatory technology exchange and partnership building
15	Réseau Ouest et Centre Africain du Riz (ROCARIZ)
16	The Consortium for the Sustainable Use of Inland Valley Agro-ecosystems
17	The African Rice Initiative

The Inland Valley Consortium (IVC): WARDA hosts the IVC, which is a research and development network of NARES, IARCs and Advanced Research Institutions which has as its objectives to develop knowledge, technologies and operational-support systems for intensified, sustainable use of inland valleys in order to contribute significantly to future food security and poverty alleviation in Sub-Saharan Africa.

Réseau Ouest et Centre Africain du Riz (ROCARIZ): ROCARIZ is a CORAF network created in 2000 and hosted by WARDA. Through its Task Force mechanism (Rice Breeding, Mangrove Swamp Rice, Natural Resource Management, Sahel Natural Resource Management,

Integrated Pest Management, Technology Transfer and Rice Economics), ROCARIZ contributes to the development, testing and dissemination of rice-based technologies, using adapted participatory approaches.

The African Rice Initiative (ARI): ARI is a consortium of National Agricultural Research and Extension Systems, NGOs, Farmers and donors/investors established with the aim of spreading the NERICAs (*NEw RICEs for Africa*) and other highly performing rice varieties across Sub-Saharan Africa. ARI will also promote complementary technologies to enhance soil fertility. Results from the pilot countries will be gradually extended to non-pilot countries in West and Central Africa, and other countries in East and Southern Africa.

4.2.15 World Agroforestry Centre (ICRAF)

The World Agroforestry Centre (previously ICRAF, The International Centre for Research on Agroforestry) seeks to address the goals of the CGIAR and the Millenium Development Goals through research on trees and tree crops directed at the following challenges:

1. Help eradicate hunger through basic, pro-poor food production systems in disadvantaged areas based on agroforestry methods of soil fertility and land regeneration
2. Lift more rural poor from poverty through market-driven, locally led tree cultivation systems that generate income and build assets
3. Advance the health and nutrition of the rural poor through agroforestry systems
4. Conserve biodiversity through integrated conservation-development solutions based on agroforestry technologies, innovative institutions, and better policies
5. Protect watershed services through agroforestry-based solutions that enable the poor to be rewarded for their provision of these services
6. Enable the rural poor to adapt to climate change, and to benefit from emerging carbon markets, through tree cultivation
7. Build human and institutional capacity in agroforestry research and development

The Centres' activities are now defined in the context of four major themes:

1. Land and People: Land productivity for sustainable livelihoods
2. Trees and Markets: Enhancing tree-based systems and markets
3. Environmental Services
4. Strengthening Institutions

The Centre addresses these themes through 15 projects (described in Table 4.15). The research and related activities contribute to all of the CGIAR output categories, with an expected emphasis in 2006 of 36 per cent to sustainable production, 27 per cent to enhancing NARS and 24 per cent to policy. In 2006, the Centre anticipates investing 77.3 per cent of its budget in research related to SSA, and 19.3 per cent to work of relevance to Asia.

Table 4.15. World Agroforestry Centre (ICRAF): Centre Projects		Centre designation
1	Integrated soil fertility management for improving rural livelihoods	LP1
2	Soil and water conservation for maintaining productive agricultural landscapes	LP2
3	Vegetation management for increased system productivity and reduced human vulnerability	LP3
4	Land management interventions for reaching the poorest landusers	LP4
5	Market analysis and support to tree product enterprises	TM1
6	Sustainable seed systems and management of genetic resources of agroforestry trees	TM2
7	Tree domestication with intensification of tree cultivation systems	TM3
8	Farmer-led development, testing and expansion of tree-based options	TM4
9	Strategies to enhance watershed functions	ES1
10	Wise use and conservation of biodiversity	ES2
11	Climate change mitigation and adaptation for rural development	ES3
12	Policies to harmonize rural development and environmental stewardship	ES4
13	Research systems and institutions	SI1
14	Development systems and institutions	SI2
15	Educational systems and institutions	SI3
16	Inter-institutional collaboration and knowledge management	SI4
17	System-wide collaboration for alternatives to slash and burn	SW1
18	Ecoregional collaboration for the African highlands initiative	SW2
19	CGIAR Gender and Diversity Programme	SW3

The Centre is addressing new thematic and geographical priorities (e.g., marketing and enterprise development, basic education, and in South Asia). The Centre will forge new partnerships to help meet these objectives: particularly with NEPAD, the Forum for Agricultural Research in Africa (FARA) and the sub-regional organizations in Africa (ASARECA, CORAF and SACCAR/SADC). Work on agroforestry research and development is congruent with NEPAD's agriculture priorities related to land and water management, market development, and capacity building.

Many of the World Agroforestry Centre's activities are conducted through inter-Centre or Systemwide initiatives with other CGIAR Centres. The Centre is the convening centre for the Alternatives to Slash-and-Burn Programme (CIFOR provides the chair of the ASB Steering Committee) and the African Highlands Initiative (both included in the Centre's project portfolio). Collaboration in a range of other eco-regional and System-wide programmes, coordinated by other Centres, includes:

- System-wide Livestock Programme (ILRI)
- System-wide Genetic Resources Programme (IPGRI)
- System-wide Information Network for Genetic Resources (IPGRI)

Desert Margins Initiative (ICRISAT)
 Common Property Rights Initiative (IFPRI)
 Integrated Pest management Initiative (IITA)
 System-wide Water Initiative (SWIM)
 Ecoregional Initiative for the Humid and Sub-humid Tropics of Africa (IITA)
 Systemwide programme on gender and diversity.

The World Agroforestry Centre is participating very actively in the Sub-Saharan Africa Challenge Programme and the Water and Food Challenge Programme. The Centre will continue to play a lead role in the further development of the pending proposals for the Rainforest, Climate Change, and Desertification Challenge Programmes.

4.2.16 WorldFish (ICLARM)

The World Fish Centre's portfolio of research is focused on fish: fisheries, aquaculture and other living aquatic resources and their ecosystems. The Centre gives highest priority to work on pond aquaculture (Asia, SSA), coral reefs (Small Island Developing States (SIDS) in the Pacific and Caribbean, Southeast Asia, East Africa), coastal waters (South Asia, Southeast Asia, SSA, SIDS), and floodplains, streams and rivers (Mekong River Basin, South Asia, SSA). WorldFish expects to deploy 58 per cent of its 2006 budgetary resources for research in Asia and the Pacific, 30 per cent in SSA, 8 per cent in WANA and 4 per cent in LAC (principally the Caribbean).

The Centre has focused its research into 13 Projects (see Table 4.16). Projects 2 (on alien species) and 5 (on freshwater fisheries in land water management context in Asia and SSA) represent new priority areas for research. There is increased emphasis in a number of aspects of the portfolio on the fisheries of the Mekong Basin countries.

1	Conservation of aquatic biodiversity
2	Mitigation against adverse impacts of alien species
3	Genetic improvement and breeding
4	Strategies and options for realizing gains from sustainable freshwater aquaculture systems
5	Freshwater fisheries in an integrated land and water management context
6	Increased and sustained coastal fisheries production
7	Restoration and protection of coastal habitats
8	Knowledge bases and training for improved management of coastal resources
9	Economic, policy and social analysis and valuation of aquatic resources in developing countries
10	Aquatic resources planning and impact assessment
11	Legal and institutional analysis for aquatic resources management
12	Improved partnerships and capacity building among developing country NARS
13	Access to information for sustainable development of fisheries and aquatic resources

To increase awareness of the sector and potential policy related impacts of the Centre's research, the WorldFish Centre recently launched the *Fish for All* initiative. The ultimate goal of *Fish for All* is to establish fish-related matters as a significant issue on world economic and environmental agendas.

The WorldFish Centre is involved in the Water and Food Challenge Programme. The Centre coordinates the work to be undertaken on Theme 3, Aquatic Ecosystems and Fisheries, and expects to contribute research on (i) Policies, institutions and governance, (ii) Valuation of ecosystem goods and services, and the costs of degradation, (iii) Environmental water requirements, and, (iv) Improving water productivity.

The Centre is also acting as the convening Centre for the potential Coastal Challenge Programme: "Making the Most of the Coast". As formulated, the Challenge Programme would focus on two themes and six research projects, probably focused in the first instance at sites in SE Asia and the Pacific. These are:

Theme 1: Reversing degradation of coastal resources

- Understanding material transfers from watersheds, and reducing "downstream" effects of agriculture and forestry on coastal aquatic ecosystems;
- Addressing non-optimal use of resources through valuation and "environmental payments"; and
- Identifying and promoting ways to rehabilitate critical coastal habitats.

Theme 2: Enhancing livelihoods for coastal people

- Understanding the factors determining livelihoods for poor coastal people;
- Restoring production from capture fisheries; and
- Developing technologies for alternative or supplementary livelihoods for coastal people.

These relate to activities planned under project 7 but which can only be completely developed through a fully-funded challenge programme.

WorldFish also contributes to the second phase of the Systemwide Initiative on Water Management (SWIM-2).

4.3 Systemwide Programmes and Inter-Centre Activities

Simultaneously with the evolution of system planning, however, there has been a natural and increasing tendency for IARCs to work as partners on themes of common interest or where it was appropriate to share expertise. These interactions were initially encouraged by the concept of ecoregional programmes, in which Centres collaborated in approaches to the particular issues (particularly natural resource management issues) of specific ecoregions and their agro-ecologies. Each Centre contributed according to its specific expertise and with regional partners and knowledge. Other inter-Centre initiatives, including all 16 Centres or smaller groups of Centres, have developed around common themes. A number of these are formally constituted as Systemwide initiatives (see Table 4.17, this section). They have been developed over time according to the broader needs of regions, of partners or to meet requirements in Centres'

research programmes which are more effectively met by collaborative research. They have not, in general, been developed competitively. Work conducted through the system-wide initiatives is an integral part of the research and activity portfolio of the individual Centres, with particular convening and reporting responsibilities allotted to a lead Centre or Centres. They are not necessarily time bound, although each initiative has their own, iteratively reviewed plans.

The SWIs are applied to a range of requirements. They include successful long-standing eco-regional research initiatives like the Rice-wheat initiative tackling the issues of yield declines in cereals in the Indo-Gangetic plains. This is a consortium approach in which NARS and ARIs are lead players. There are also CGIAR communities of practice on such subjects as integrated natural resources management, genetic resources and common property rights systems. There are initiatives that raise awareness and operational efficiency both within the CGIAR and with external partners - as exemplified by the gender and biodiversity initiative, and the integrated voice and data network. The Consortium for Spatial Information is playing a particular role in raising the capacity of the system in establishing data layers on the geographical distribution of poverty and allied factors from international sources and thus unifying knowledge and capacity for Centre-level planning.

The SWIs are an effective and integral strategic mechanism for tackling priority research, knowledge sharing or capacity enhancement of cross system importance.

Table 4.17: Systemwide Programmes in the CGIAR	
Systemwide programmes including:	
•	Systemwide genetic resources programme
•	Collective action and property rights
•	Participatory research and gender analysis
•	Systemwide integrated pest management
•	Systemwide livestock programme
•	Systemwide initiative on water management
Eight Systemwide ecoregional programmes:	
•	Alternatives to slash-and-burn agriculture
•	Sustainable mountain agricultural development programme, including CONDESAN & Africa Highlands Initiative
•	Systemwide Programme for enhancing agricultural research effectiveness in tropical America
•	Systemwide Programme for rice-wheat based cropping system in the Indo-Gangetic plain
•	Systemwide on-farm water husbandry programme for WANA
•	Systemwide Programme for the humid and sub-humid tropics in Asia
•	Systemwide Programme for the humid and sub-humid tropics in Africa, including inland Valley Consortium
•	Systemwide desert margins programme for sub-Saharan Africa

There are also other inter-Centre programmes which have the word Systemwide in their titles, but are not necessarily formally approved as such, e.g. Malaria, HIV/AIDS, and urban/perurban agriculture.

4.4 CGIAR Challenge Programmes

The Challenge Programmes were defined with the following objectives:

A CGIAR Challenge Programme is a time-bound, independently governed programme of high-impact research that targets the CGIAR goals in relation to complex issues of overwhelming global and/or regional significance (and global impact), and requires partnerships among a wide range of institutions in order to deliver its products.

Arising from the discussions of the Change Design and Management process they were also considered as vehicles that may encourage Centre development and restructuring through adopting a programmatic approach to system priorities. High visibility topics were to be chosen to overcome three shortcomings that had affected previous thematic and eco-regional System-wide programmes: (1) insufficient funding, (2) poorly defined timelines, (3) lack of adequate governance and management in some cases.

They differ in scale from most System-wide initiatives, and provide opportunity to develop partnerships with a wider range of relevant providers of research and associated expertise, and with an emphasis on time-bound impacts.

Three CPs have been selected under pilot assessment procedures, and an additional CP following the installation of regular processes for the development and assessment of CP proposals. These are (with lead institute and proposed budget in brackets):

- Water and Food (IWMI, \$82 million)
- Harvest Plus [formerly called Biofortification] (CIAT/IFPRI, \$42 million)
- Unlocking Genetic Diversity in Crops for the Resource Poor (CIMMYT, IPGRI, IIRI and partners \$69 million)
- Improving Livelihoods and Natural Resource Management in Sub-Saharan Africa (Forum for Agricultural Research or FARA, \$100 million)

The successful implementation of these programmes will substantially augment natural resource management activities within the CGIAR portfolio (on water and soils) as well as genetic enhancement aimed at pro-poor outcomes. The programme on unlocking genetic diversity has identified the search for drought tolerance traits as a key objective, which accords with the high priority given to research on drought tolerance in the current consultation on priorities. The specific programme for sub-Saharan Africa increases assistance to agricultural development in this continent as identified in the System Review (1998) and subsequent CGIAR and development priorities. It is led by an RO, indicative of the rapid emergence of regional organizations in the development of global programmes. Other potential CPs considered by the regular process (climate change, coastal zones, desertification and rain forests) have been encouraged to develop further consultations and opportunities for participatory proposal

development, and a longer period of development of these proposals is likely before decisions are made¹⁸. The inclusion of these areas in a portfolio of Challenge Programmes would provide a more comprehensive coverage of major approaches and ecosystem issues to the work of the system - at least as operated through global programmes. Such a strategy has not been articulated however.

Are there additional areas arising from the current Priorities and Strategies exercise that respond directly to the System's comparative advantage and might be considered through concerted approaches? Sections 4.5 and 4.6 review newly arising priorities at the Centre level or initiated through the continuing strategic review processes of the SC.

4.5 CGIAR Centres Current Plans for the Future

Undertaking research is a constantly evolving process, and Centres have occasion to review priorities for the future as new results, opportunities and partnerships emerge, for instance when global conventions are discussed or brought into force. The Centres also review strategic directions according to their own planning cycles or those induced by other aspects of structural change. Section 4.2 reviewed the consolidated projects and priorities of the Centres proposed in their MTPs for the current planning period, 2004-2006. For some Centres (e.g. ILRI), 2004 is the first year of implementing new strategic directions and programme changes. Priorities for the future are vested in the existing plans. For other Centres, however, strategic reviews have been completed or put in train since the MTPs were published. In some cases these strategic reviews will lead Centres to reorient plans to include new priority areas for research. This section outlines some of this new thinking or ways of working, and can be considered as the Centres' views of "current priorities for the future".

4.5.1 CIAT

CIAT's new priority areas for research continue to be those listed in the Medium Term Plan for 2004-2006. Building on the earlier programme in line with the Centre's strategic plan (for 2000-2010), CIAT has embarked recently on three cross-project initiatives which will form pillars of CIAT research in the coming years, namely:

- Enhancing and sharing the benefits of agro-biodiversity
- Recovering degraded lands and restoring them to social profitability
- Learning to innovate

Combining forces around these themes on a cross-project basis is anticipated to enable more effective use of resources, and to allow better responsiveness to major development challenges in keeping with partner and stakeholder priorities. The cross-project initiatives are not reflected in CIAT's financial tables, where all resources continue to be managed and accounted through the project structure.

¹⁸ These additional areas did not receive any direct support from the outcomes of the Consultation on CGIAR priorities. However, as respondents were asked to review *new* opportunities for CGIAR research, it is possible that the subject matter of the CP proposals "in preparation" were considered as already constituting CGIAR research areas.

CIAT's new cross-project initiatives can be summarized as follows:

1. *Enhancing and sharing the benefits of biodiversity:* CIAT's NARS partners in Latin America have expressed a strong interest in cooperating in the design of policy and scientific responses to new international treaties affecting future management of genetic resources. These treaties include the Convention on Biological Diversity, the Biosafety Protocol, and the Treaty on Plant Genetic Resources. The objectives of this research are to help countries make better use of existing diversity in the emerging global economy; to rationalize conservation efforts through the development of sound policies; and to identify functional diversity for the enrichment of gene pools. Related topics in CIAT's research portfolio already include, for example, research on gene flow between cultivated and wild species, more recent work on the below-ground biodiversity effects of transgenic crops, GIS research on the distribution of wild relatives of crop species, and socioeconomic analysis of the benefits of genetic resources and the distribution of these benefits.

2. *Recovering degraded lands and restoring them to social profitability:* The objective of this initiative is to generate technical, institutional, and policy innovations aimed at restoring the potential of degraded agricultural lands to enhance the livelihoods of small farmers and maintain agro-ecosystem health. The initiative will build on CIAT's traditional strengths in research on land degradation for the humid and sub-humid tropics through the development and dissemination of improved stress-adapted crops, the identification of degradation hotspots and vulnerable populations, as well as participatory research and capacity building in local communities, focusing, for example, on models of agro-enterprise development that provide incentives and capital for land restoration.

3. *Learning to innovate:* This initiative aims to increase the incomes and assets of the rural poor through strong farmer participation in growth markets and knowledge networks. Turning the traditional approach to development and dissemination of complex technology on its head, the initiative will offer rural households a choice of approaches for learning and innovation, through which they can make their agriculture more competitive, while managing the risks involved in technical and social change. Moreover, by means of creative applications of modern information and communications technologies (ICTs), the initiative will provide rural communities with powerful tools and approaches for building and sharing the knowledge they need to take advantage of new economic opportunities.

4.5.2 CIFOR

CIFOR is currently undergoing a strategic reassessment, and CIFOR's research agenda has been re-organised under three programmes. The new MTP for 2005-2007 will articulate CGIAR Projects that broadly correspond to the programmatic 'themes' described below. The research priorities reflected in the agenda are unlikely to change during 2004 although there will be some further minor modifications to the structure presented below.

Forests and Livelihoods Programme

Theme 1: Forest conservation strategies supporting sustainable livelihoods

- Sub-Theme 1: Enhancing conservation and development outcomes

- Sub-Theme 2: Society-wide changes and landscape dynamics

Theme 2: Improving human health and well-being through forests

- Sub-Theme 1: Forest biodiversity, household livelihoods and local practices
- Sub-Theme 2: Forest industry partnerships and local livelihoods
- Sub-Theme 3: Poverty alleviation strategies, programmes and policies

Environmental Services and Sustainable Use of Forests

Theme 1: Sustainable use of forests

- Sub-theme: Promotion of sustainable management of natural forests
- Sub-theme: Sustaining viable small-holder forest plantations

Theme 2: Biodiversity in fragmented landscapes

- Sub-theme: Multidisciplinary landscape assessment
- Sub-theme: Rehabilitation of degraded forest landscapes
- Sub-theme: Inform and influence biodiversity agreements and processes

Theme 3: Ecosystem functions and environmental services in forested catchments

- Sub-theme: Forests and watersheds: multiple environmental services in forested catchments
- Sub-theme: Forests and climate change

Forests and Governance Programme

Theme 1: Social learning, institutional change and grassroots movements

- Sub-theme: Adaptive collaborative management
- Sub-theme: Networks and social movements

Theme 2: Forest finance and corporate accountability

- Sub-theme: Forest finance, industry restructuring and trade
- Sub-theme: Money laundering and suspicious forestry transactions

Theme 3: Conflict, illegal activities and forest law enforcement

- Sub-theme: Illegal forest activities, livelihoods, and law enforcement
- Sub-theme: Forest related conflict

Theme 4: Decentralization

- Sub-theme: Decentralization for forest sustainability and livelihoods
- Sub-theme: Enhancing capacity for decentralized governance

4.5.3 CIMMYT

CIMMYT's new strategy document (which is in the process of being published), highlights a number of new, high-priority areas for research to 2020. These areas of research have emerged as priorities largely because of two key changes in perspective that are reflected in CIMMYT's strategy: the integration of a livelihoods and systems approach into all aspects of CIMMYT's work, and an emphasis on knowledge sharing and management.

CIMMYT's recent Medium-Term Plan, completed before CIMMYT's strategy was finalized, describes most of these new research initiatives. As CIMMYT came to closure on its

strategy, however, two broad initiatives related to knowledge sharing were given greater priority. They are described below. Both initiatives are of global relevance. CIMMYT will define this priority research for 2005-2010, to be conducted with specific partners, more precisely in the coming months.

1. Adding value to partnerships and networks through knowledge management: The knowledge produced by CIMMYT and its partners will almost certainly become as important a “global public good” as improved varieties or practices. Networks and partnerships also become much more effective when careful attention is given to how people create, manage, and share knowledge. CIMMYT will initiate research on ways of supporting knowledge management and information flows to contribute to the development of sustainable networks for innovation in developing countries. Some of this research will involve learning how to improve capacity building and organizational processes to meet these goals. For CIMMYT - which cannot work well without effective partnerships - it is crucial to know whether its own approaches to managing knowledge, partnering, and networking are leading to effective innovation.

2. Crop information systems to amplify the power of genetic research: New fields of molecular biology, particularly functional and comparative genomics, will contribute to food security only if genotypes are intimately linked to phenotypes for accurately catalogued germplasm. The CGIAR Centres and national agricultural research systems are rich in phenotypic information. In fact, this information and its collection of genetic resources are arguably CIMMYT’s most important assets. This information cannot be used effectively, however, without an information management system that links islands of data collected from dispersed research efforts and provides continuous access to a multitude of researchers around the world. As a global institute with many partners, CIMMYT is uniquely positioned to anchor such an information management system. To do so, CIMMYT will make a significant strategic investment in information and communications technology to support a high-capacity, relational database platform, along with rapid data input methods that rely on geo-referencing and electronic data capture technologies. Specific components of the proposed venture in information management include a genbank management system (including molecular maps and plant pedigrees), GIS, bioinformatics, and data management systems related to GxE interactions. The goal is to permit information contained in each of these subsystems to be linked, permitting powerful new insights into the relationships between genes, environment, and the productivity of crops and agricultural systems.

4.5.4 CIP

CIP has just completed a Visioning and Priority setting exercise based on the Millennium Development Goals (MDGs). This high lighted the importance of two new areas for meeting these Goals. They are Urban and Peri-urban Agriculture, and Health and Agriculture.

1. Urban and Peri-urban Agriculture (Urban Harvest): This new area has been developed into a Systemwide programme (building on the approval given by TAC in 1999). With rapid urbanization, *Urban Harvest*, as it is now called, provides a major new front in the battle to fulfil the MDGs. It is designed to contribute towards the MDGs for poverty, hunger, under 5 mortality, maternal mortality and four other MDGs. It is particularly focused on MDG 11, which

deals with slum dwellers. It is likely that nearly all CGIAR Centres can make contributions given the congruence of Centre goals.

2. Health and Agriculture: The second new area emerged forcefully from the CIP Visioning exercise and the subsequent impact targeting work. The areas of disease susceptibility, mitigation of disease effects, human nutrition, land and water management related diseases, zoonoses, and impact of agricultural toxins all combine to create an area of high potential impact by the CGIAR. CIP believes that the CGIAR Centres, complemented by health and nutrition capabilities, can make a unique contribution to many MDGs by developing a new initiative in this area. The health aspects are already included in CIP's new Vision and Strategy and CIP expects to cooperate with other CGIAR Centres in this work.

Given the goals of this work, should the initiatives on Urban Harvest and Agriculture and Health evolve in the future from Systemwide activities to Challenge programmes, they may then appropriately contribute to the United Nations Millennium Project and its key task forces.

4.5.5 ICARDA

The high priority research areas for ICARDA are described in the Centre's MTP for 2004-2006. Current work is based on the last ICARDA Strategy which was published in 1998. ICARDA is just initiating a new Strategic Visioning exercise. Until this exercise is complete, ICARDA will not be undertaking any major new research initiatives beyond those in the published MTP.

4.5.6 ICRISAT

ICRISAT has identified a new priority initiative as a primary vehicle for tackling the problem of scaling out and scaling up research for additional impact at a continental level.

The Virtual Academy for the Semi arid Tropics (VASAT): Drought and desertification are serious problems affecting millions of people living in the dry tropics. Research shows that rural communities are better able to cope with drought when they have timely access to information and knowledge. The UNSO studies (in 2000) make "information the backbone of drought preparedness". ICRISAT is fostering the formation of a coalition of partners to develop an effective, impact-oriented information and communication programme that uses the methods of contemporary non-formal or open learning paradigm that puts to use relevant innovations in information and communication technology (ICT). The VASAT's focus is on the semi-arid tropical regions of Sub Saharan Africa and South Asia.

VASAT's main focus is to create content that is demand-driven; content that can be easily used by rural families and their intermediaries. Such content is always a blend of generic or scientific information, and location-specific information. The ultimate aim is convert scientific knowledge into implementable knowledge in the field - creating opportunities for impact on a very large scale.

VASAT has four core functions: content creation and its validation; user mobilization; network support and delivery; impact assessment and evaluation. Content creation and validation

will be carried out first with the large volume of available information and also with virtual information that the coalition partners make available; on-line validation processes will follow established methods (such as those of the Internet Engineering Taskforce). Validated information materials will be formed into a repository of learning objects, constructed using global standards (such as SCORM). Partners therefore will be able to access the material irrespective of their own access methods or platforms. They will be able to transform them rapidly into locally relevant material without losing authenticity. Partners will be enabled to set up and operationalize rural information hubs to serve the ultimate users.

The first set of materials will be literacy-type modules and learning objects covering water, weather, drought-area-compatible crop and livestock production, and on markets. Partner organizations have been identified for the collaborative development of VASAT in South Asia, and in West and Central Africa, including advanced research partners such as the NOAA-USA, IRI-Columbia University and regional organizations such as the CILSS. The Commonwealth of Learning, an inter-governmental agency that promotes open and distance learning in the Commonwealth, is providing technical support and advice. The VASAT is anchored by ICRISAT and is supported by IWMI and ILRI among the CGIAR Centres. The VASAT initiative will be included in ICRISAT's forthcoming MTP (for the period 2005-2007).

4.5.7 IITA

IITA's priority research is described in the MTP for 2004-2006

4.5.8 IFPRI

IFPRI have identified two major new project areas that have arisen from exploratory studies conducted earlier (as part of the programme described in the Centre's MTP for 2004-2006). The association of ISNAR's programme with IFPRI, and the opportunity for new policy studies on National agricultural research systems in Africa also provide new priorities. Additionally, a number of new areas are listed that will be explored, through IFPRI-led research, to determine their relative priorities for agricultural policy research in the future.

1. Development Strategy Options: Research on this topic was described as exploratory in the 2004–06 MTP. In 2004, the proposed project will undergo an *ex ante* review and, if approved, be designated as a full project. The objective is to contribute to better understanding of development strategy options for different types of countries. To do this, practical strategic analysis and decision support systems will be developed that can underpin country and donor investments. Analytical tools and databases to address options for food policy reforms will be developed. The policy issues will be addressed by cross-country analysis and country strategy case studies (including country studies from Asia, Africa, LAC and WANA).

2. Governance Issues: Research on this topic was also exploratory in last year's Plan and it will undergo an *ex ante review* for full project approval. The objective is to investigate how governance issues affect economic performance, and to assess the implications of the changing roles of stakeholders for development strategies and implementation processes. Countries and regions will be selected according to IFPRI's identified criteria.

3. Institutional Change in Agricultural Innovation Systems: This research and capacity strengthening effort will be developed by IFPRI's new office in Ethiopia. It will focus on institutional change, organization and management for enhancing the impact of agriculture and food related science and knowledge systems in low-income countries. The programmes research and services to national research systems will relate to all critical elements of the food chain (from natural resources to farm production to food processing). These efforts will emphasize the global public goods nature of the research. The project proposal will be developed upon completion of the programme team.

4. Organization and Management for Strengthening of Agricultural Research Institutions: This research will also be developed by IFPRI's Ethiopia office. The project aims to strengthen the organization and management of agricultural research organizations in order to enhance their contribution to agricultural innovation for the poor. Most of this work will be focused on African institutions.

New Exploratory Research areas:

5. Food and Water Safety: Food safety regulations are becoming increasingly important in international markets. An overarching policy issue is whether rising safety and quality standards enforced by regulations will marginalize exporters from developing countries. Given the economic rationales for government involvement in food regulation, a second issue is to define the appropriate roles of the public and private sector within countries in meeting food safety and quality goals. Thirdly, there is a need to enhance the net benefits derived from performance of the international framework for national food regulation.

IFPRI and its partners will undertake exploratory research on the policies and institutions needed for food and water safety that are needed across sectors at household, community, national, and regional levels. The regions to be considered include Central America, South Asia, and Africa. Additionally, IFPRI will add a component to the IMPACT-WATER model to assess water quality by investigating groundwater extraction; drainage and flooding; crop waterlogging damage functions; point and non-point pollution; and crop damage due to water quality and salinity issues.

6. Urban-Rural Linkages: Exploratory research on this topic, another priority in IFPRI's strategy, will address the urban-rural linkages related to food consumption, resource flow, communication, labour migration, and gender role issues. Key questions to be address under this theme include: What is the relevant role of the rural non-farm economy in rural development and poverty reduction strategies in different types of countries? What are the links between the rural and urban non-farm economies? How can migration and income diversification help the poor? What policies and investments can promote the development of the rural non-farm economy? Case studies to address these questions will be undertaken in Sub-Saharan Africa, Asia, and Latin America.

7. Global Change and Global Warming: This exploratory research will seek to model global risk scenarios, including climate change and extreme weather events, human demographics, health and disease, biotechnology and genetically modified organisms, with an emphasis on the poor and vulnerable. In addition, researchers will investigate land degradation,

specifically analyzing the impact of agricultural production processes on soil erosion, soil salinity, and other types of land degradation; and the impact in turn of land degradation on agricultural productivity. Finally the programme will assess agricultural and natural resource adaptation strategies to global climate and water cycle, as well as human alteration of land use patterns, urbanization, elimination of wetlands, nutrient cycling and overloading, and other biophysical changes. The research will address the impact of policies at several levels as they affect adaptation to global change, and the resulting impact on food production, food security, water availability, ecosystem services, and human health.

8. *Small Farmers and Eco-System Services:* In substantial parts of the developing world, particularly Asia, local forms of land use have emerged that allow people to make a living while protecting environmental resources. If left unrewarded, smallholders can revert to more environmentally unsustainable land management schemes in an effort to increase income. IFPRI and its partners including the World Agroforestry Centre will explore policies to promote market-based approaches to ‘environmental services,’ which can provide an opportunity to enhance rural livelihoods through not only economic benefits (rewards) but also through increased social and human capital (recognition). The research initially will apply to Sub Saharan Africa, and East and Southeast Asia.

4.5.9 ILRI

ILRI’s research priorities are described in the Centre’s MTP for 2004-2006.

4.5.10 IPGRI

IPGRI has identified two new research priorities. They have been included in outline in the MTP 2004-2006, but the Centre and its stakeholders believe them to be of increased importance, which may best be tackled at the system level. These are:

1. *Managing agricultural biodiversity for sustainable development: strengthening the knowledge base:* A fundamental challenge for developing countries over the next decades is to increase food production and improve livelihoods in a manner that is ecologically sustainable, does not increase vulnerability, and is profitable for farmers in these countries. This challenge, embedded in the Millennium Development Goals, will require that the biodiversity present in agroecosystems is maintained and used to increase productivity, resilience, and sustainability and to provide key ecosystem services in a profitable manner. Such an approach will need to recognize that the diversity of plant and animal species maintained in traditional farming systems in developing countries, and the knowledge associated with managing these resources, constitute key assets of the rural poor. Indeed, in marginal and difficult farming conditions these materials are especially important, and diversity management can become a central part of the livelihood strategies of farmers and communities in stress prone production areas.

Commodities and ecosystem approach: Meeting this challenge will require a new level of knowledge of the biodiversity in production systems, of its functions and benefits, of the consequences of changes in different elements and of the ways in which different components of that biodiversity (e.g. crops, animals, fish, agro-forestry species, pollinators etc.) interact to

support healthy ecosystem function and improved production, both at the global and the local level.

Key research elements in developing an improved knowledge base: The CBD Programme of Work on agricultural biodiversity identifies a number of areas where a strengthened knowledge base is particularly important, and different international fora have extended these. Some of the most important that have been identified include:

- Developing methods for measuring amounts of, and changes in, agricultural biodiversity at different scales (for different components as outlined in Programme Element 1 of the Work Programme of the CBD for agricultural biodiversity);
- Investigating the linkages, interactions and associations between different components of agricultural biodiversity i.e. between crops, animals, fish, agro-forestry, pollinators soil biota and other elements, including “natural” and “managed” components of the agro-ecosystem;
- Determining the ways in which diversity can contribute to stability, resilience and productivity in different kinds of production systems;
- Developing ways of ensuring that diversity in agricultural systems supports adaptation to change and maintains production and ecosystem function under fluctuating environmental conditions (so-called “*sustainability*”);
- Fully recognizing linkages of agricultural biodiversity to the provision of ecosystem services and undertaking full economic analyses of these. These analyses should pay particular attention to the consequences for all different components of agricultural biodiversity of adopting so called environmentally friendly cultural practices (e.g. zero-tillage, IPM).
- Understanding how sustainability and agricultural biodiversity maintenance can be combined with intensification so that improved agricultural biodiversity maintenance produces tangible benefits to poor farmers in developing countries.

2. Plant resources for nutrition: enhancing human health through sustainable use of biodiversity: Addressing global hunger and malnutrition and enabling vulnerable populations to adapt to environmental and socioeconomic change require strategies not only for food production and distribution, but also for quality. Concerns about crop quality and production seldom include nutrition, or tend to focus on protein. Similarly, acknowledgement that loss of biodiversity and other environmental changes affect diet and health is usually limited to general considerations of food security without attention to the complexity of nutrition-health relationships. This work explicitly seeks to contribute to food security and improved nutrition for poor families. Increased utilization of minor crops of nutritional importance can be stimulated by disseminating information and raising awareness through partnerships with development and community-based organizations. Resulting improvements in nutrition can alleviate the human impacts of poverty, whilst enhanced use of particular crops and new marketing opportunities arising from enhanced knowledge will generate income and directly alleviate poverty. The focus of the project on food plant biodiversity provides a direct link to the conservation and rehabilitation of natural resources.

Commodities and ecosystem approach: Some research and intervention programmes have focused on providing micronutrients such as vitamin A or minerals through enrichment, genetic improvement, crop diversification and soil management. However, more attention is needed to identify crop varieties and minor crops with selective nutritional assets and analyse the nutritional content of indigenous fruits, vegetables and wild edible species. Greater importance should be given to maintaining diversity of cultivated and uncultivated species in home gardens and local agroecosystems where they can be managed sustainably to improve nutrition and contribute economically to livelihoods.

Key research areas and partnership elements: Institutional approaches addressing problems of a global magnitude, and national efforts that involve local communities will be required. Multi-disciplinary activities will combine nutrition research, ethnobotany, and ecosystem and resource management with health-care activities, and will embrace participatory models for local empowerment and initiative. Important elements are:

- Support the role of crop genetic resources in meeting nutrition and health needs of poor families in developing countries.
- Articulate the nutritional and health contributions of plants as rationales for conservation and rehabilitation of rural and urban environments.
- Raise awareness of i) nutrition and health priorities among agricultural and environmental scientists; and ii) the role of plant biodiversity within the international health community.
- Develop and implement nutrition-orientated methods to evaluate food plant genetic resources.
- Create capacity building opportunities.
- Establish consumer criteria for evaluating dietary quality (e.g. taste, nutrition, medicinal properties, cooking quality) in conjunction with community-based programmes,
- Develop methods for assessing these as descriptors of diversity. Incorporate considerations for gender-specific knowledge and practice in relation to diversity and health.
- Develop plant-based dietary diversity indices as indicators of nutritional status in developing country contexts.
- Compile data on nutritional and functional properties of (accessions of) food plants, also in the context of IPGRI's work on neglected and underutilized species.
- Carry out community-based case studies to develop and test methodologies for nutritional assessment of foods with genetic diversity implications.
- Produce publications on policy and methodology development and case-study experiences.

4.5.11 IRRI

IRRI's priority projects are described in the Centre's MTP for 2004-2006

4.5.12 ISNAR

ISNAR's consolidated priorities for 2004 are described in the Centre's MTP for 2004-2006. ISNAR's Programme will be under the governance of IFPRI from April 1 2004. During the

course of 2004, consultations will be held to develop the ISNAR Programme under IFPRI in more detail (and see IFPRI new priorities 3 and 4 in this section).

4.5.13 IWMI

At the time of developing this report, IWMI had just completed drafting its new Strategic Plan (2004-2008). The new priorities outlined below are thus subject to the approval of the IWMI Board of Trustees. While IWMI's five priority research themes (or MTP projects identified in 2000) have not changed since the last Strategic Plan and MTP, the new Strategic Plan offers greater evolutionary detail on activities under these thematic areas and identifies key sub-themes and related research hypotheses. The general thematic areas and the areas for research are just listed here as renewed IWMI priorities including identification of the geographic regions in which activities will be focused.

1. Agricultural Water Management: The objective is to contribute to the understanding and evolution of water management strategies that enhance water productivity, food production and livelihoods, within two contrasting contexts: 1) declining or fixed water availability for agriculture (most of Asia) and 2) well-advised and environmentally sound development of new water resources (most of Africa). This can be achieved through better quantification of water and land productivity at a basin scale, taking into account the complexities and tradeoffs of interactions between climate, hydrology, water use and its environmental consequences. It requires the identification and evaluation of appropriate technologies and management methods that can help put such strategies into practice and disseminate them through pathways that catalyze their adoption in practice. The research areas (sub themes) that will contribute to meeting these objectives will include a) Water productivity at basin scale, b) Integrated land and water modeling, and c) Operation, maintenance and management of irrigation systems.

2. Smallholder Land and Water Management: The objective is to contribute to the sustainable management of land and water resources in order to raise the economic productivity of smallholders equitably, and to enhance the provision of environmental goods and services. The theme concentrates on the essential link between soil and water productivity at the farm, community, and system levels. Each of the three sub-themes focuses on innovative, sustainable solutions to key problems facing smallholder farmers that can be addressed through enhanced knowledge of the complex interactions between the biophysical components of the landscape and socio-economic attributes of communities. The theme will be addressed through research in three areas: a) Productivity in rainfed and small scale irrigation systems, b) Managing catchments for productivity and environmental services, and c) Rehabilitation of degraded lands.

3. Groundwater Management: The development of knowledge about the use of groundwater in agriculture has so far remained asymmetric: while the world has learnt a great deal about the occurrence and behaviour of groundwater resources, it has done little to understand the users of groundwater and the factors that shape their behaviour, and the social and economic institutions of groundwater irrigation and its political economy. Nor has it explored ways to direct and control the appropriation and use of this resource. Today, agricultural use of groundwater in some of the most populous regions of the world is rapidly surpassing limits of sustainability. Thus for much of Asia and Africa, the key groundwater challenge now is one of protecting the massive welfare gains that groundwater irrigation has created while minimizing the

environmental, health and social costs associated with its intensive use in agriculture. In this new era, understanding the socio-economic and institutional context of groundwater irrigation is becoming as critical as understanding the resource itself. The objective of the Groundwater management theme is to promote productivity, equity and environmental sustainability in groundwater use in agriculture by bringing to the forefront of global, national and regional discussions (i) the role of groundwater irrigation in food, livelihood and environmental security; and (ii) practical approaches to improved governance of groundwater socio-ecology such that food security and livelihood gains from intensive groundwater use in agriculture are preserved but the negative social, environmental and health impacts associated with it are minimized or eliminated.

Research on this theme will address: a) Regional assessments of groundwater potential and impacts, b) Groundwater technologies and institutions, and c) Sustainability issues and approaches.

4. *Water Resources Institutions and Policies:* The recognition that major problems in the water sector are mainly caused by failures in governance has prompted several countries to search for new and more effective policies and institutional models that seek to optimize the interests of all stakeholders while ensuring food security, alleviating poverty and protecting vital ecosystems. This theme focuses on best practices in institutions and policies that will enable governments, communities, entire societies to translate these principles into practice. The objective is to produce through systematic comparative research, knowledge-based guidelines for best practices in policies, governance frameworks and organizational designs to improve the productivity of water and land, enhance food security, improve the livelihoods of the rural poor and sustain the environment. The theme also seeks to develop guidelines for water policy reform, design of river basin management institutions that provide a voice to poor people, and support systems for the local management of irrigation that lead to more effective management of water in river basins. A second aim is to engage in capacity building of national partners and collaborators to facilitate better research and development, policy formulation, and implementation of appropriate interventions for the sustainable management of water resources.

Research areas will be a) Water resources governance, b) Water security for the poor, c) Economic instruments for water management.

5. *Water, Health and Environment:* The objective of this theme is to contribute to improved human health, better livelihoods and greater environmental sustainability in water and land resources development and management by (i) increasing knowledge of the relationships between water, human health and ecosystems through a process of scientific documentation, and (ii) developing practical measures to minimize negative and maximize positive health and environmental impacts. The theme has a commitment to participatory research and capacity building as important means to both generate knowledge and achieve impact, through the acceptance and implementation of recommendations.

Research will be conducted in three major areas a) Malaria and agriculture, b) Irrigation using polluted water sources, c) Irrigation - ecosystem interactions.

Table 4.18. Matrix of Relative IWMI Priorities by Themes/Regions 2004-8

(Absence of stars in a region does not imply that there are no activities ongoing in that area. The regions refer to regions where IWMI works and not to IWMI's regional offices.)

Theme / Sub-theme	South Asia	SE Asia	SS Africa	CWANA
1. Agricultural Water Management				
1.1 Water productivity at basin scale	*	*	**	**
1.2 Integrated land and water modelling	**			*
1.3 Operation, maintenance and management of irrigation systems	*	*	*	
2. Smallholder Land and Water Management				
2.1 Productivity in rainfed agriculture and small scale irrigation systems	*	**	**	*
2.2 Managing catchments for productivity and environmental services	**	**	*	
2.3 Rehabilitation of Degraded Lands	*	*	**	**
3. Groundwater Management				
3.1 Regional Assessments of Groundwater Potential and Impacts	*	*	*	*
3.2 Groundwater Technologies and Institutions	*	*	*	*
3.3 Sustainability issues & approaches	**	**		
4. Water Resources Institutions and Policy				
4.1 Water Sector Governance	*	**	**	**
4.2 Water security for the Poor	**		**	
4.3 Economic instruments for Water Management		*		*
5. Water, Health and Environment				
5.1 Malaria and Agriculture	*	*	**	
5.2 Irrigation Using Polluted Water Sources	*	*	**	**
5.3 Irrigation - Ecosystems Interactions	*	**	**	

* Priority area, ** High priority area.

4.5. 14 WARDA

For the period 2003-2012 WARDA confirms its focus on three main rice-production ecologies (rainfed upland, rainfed lowland and irrigated) that together cover most of the rice-growing areas of Sub-Saharan Africa. The research priorities address the following core areas:

1. Integrated Production Systems: This area will encompass (i) Best use of existing genetic resources for development of rice varieties that fit farmers production systems, and (ii) Maximizing resource use efficiency for productive and profitable rice-based production systems.

2. Rice Policy and Development: focused on (i) Factors affecting the market dynamics and competitiveness of locally produced rice, and (ii) Impacts of technical policy and institutional changes in rice sector with respect to livelihoods and well-being of the poor.

In implementing this strategy WARDA will:

- Focus primarily on rice with priority on West and Central Africa
- Invest in the development of new germplasm and complementary technologies

- Address key constraints in the major rice production ecologies
- Rely on the network model for regional rice research collaboration
- Work in partnership with all research institutes throughout the world
- Work with a more integrated understanding of rice as a component of farming, natural resource management and livelihood systems
- Seek opportunities to contribute on a continent-wide scale by expansion of activities into the Eastern, Central and Southern Africa regions in line with WARDA's designation as the "Africa Rice Centre"
- Place significantly more emphasis on post-harvest policy and institutional imperatives
- Engage much more directly and vigorously with the rice development sector
- Seek to make maximum and appropriate use of recent advances in biotechnology

4.5.15 World Agroforestry Centre (ICRAF)

The World Agroforestry Centre has just completed a year of major organizational and personnel change, and four new priority areas (for research, policy impact and new regional approaches) have been initiated. The Centre will be undertaking a self-assessment in preparation for an EPMP in 2005 through which additional priorities may emerge for the latter part of the review period.

1. Four broad thematic areas have been adopted for the organization and reporting of the work of the Centre: (a) Lands and People, (b) Trees and Markets, (c) Environmental Services, and (d) Strengthening Institutions. The second and third themes give renewed emphasis, respectively, to enterprise and markets as important drivers; and to the environmental services from farm trees (carbon fixation, soil-water balances, biodiversity value, and so on).
2. ICRAF intends to contribute increasingly to global fora for environment and development, to enhance the Centre's impact on policy formation and international agendas including agroforestry. A new post of Director of Strategic Initiatives was recruited to meet this requirement.
3. While the Centre's action research will remain largely committed to Africa, ICRAF intends to build better links to South and East Asia, as in India and China agroforestry practices are widespread and fairly well developed. Initial efforts focus on India in South Asia, where the Centre expects to act as "broker" for technical and knowledge exchanges between continents e.g. through international workshops, conferences, etc in agroforestry.
4. For an integrated research and development approach to eastern, central, and southern Africa, ICRAF assimilated RELMA (Swedish Sida's Regional Land Management Unit) into its overall programme in late 2003. With this merger, ICRAF's scientific and technical contributions can complement the development orientation of RELMA. This arrangement will be evaluated after three years.

4.5.16 WorldFish (ICLARM)

The research priorities of WorldFish are provided in the approved MTP for 2004-2006. This plan highlights substantive changes in the thrusts and outputs of the Coastal & Marine Resources Research Programme. In planning in 2004 for the new MTP period, the Centre will be further developing multi-sectoral approaches to coastal zone management, requiring large scale, multi-year and multi-partner research approaches. The Centre also expects to develop a formalized approach to integrating knowledge management concepts and tools into the Centre's core research programmes.

Conclusion on guidelines for CGIAR future directions of research derived from Centre perspectives

4.6 Strategic Studies of the iSC and TAC

The selection of topics by the SC for strategic study and review, inevitably raises the profile of those topics as potential research areas for consideration by the CGIAR. Table 4.19 lists the strategic studies of this type conducted and published in the last three years.

Table 4.19: Strategic Studies conducted by the iSC and TAC in the last three years¹⁹

2003

- Applications of molecular biology and genomics to genetic enhancement of crop tolerance to abiotic stress - a discussion document

2002

- Guarding the quality and relevance of science in the CGIAR: an operational framework for the Science Council
- Applications of molecular biology and genomics to genetic enhancement of crop tolerance to abiotic stress - a discussion document
- A study about the causes for low adoption rates of agriculture research results in west and central Africa: possible solutions leading to greater future impact
- A study and comprehensive analysis of the causes for low adoption rates of agricultural research results in west and central Africa: possible solutions leading to greater future impacts

2001

- What are the possible strategies for the CGIAR to conduct research and deliver technological innovations that benefit the poor in a context of intellectual property rights?
- Social science in the CGIAR: supporting the strategy-achieving development impact
- NRM research in the CGIAR: a framework for programme design plus attachment "evolution of NRM concepts and activities in the CGIAR"
- Water and the CGIAR- a discussion paper

¹⁹ See www.sciencecouncil.cgiar.org/publications/sspubs.htm for full text copies of these reports. The Science Council also conducts and publishes reviews of Systemwide programmes and stripe reviews (cross system reviews of particular subjects) which also provide strategic insights on the best means to conduct thematic or regional research.

- A regional approach to setting priorities and implementation: towards satisfying national regional and international concerns
- A status note on food safety
- Poverty in meso-America: tendencies, causes and implications for agricultural research
- regional approach to research for the CGIAR and its partners
- CGIAR research and poverty reduction (IFPRI-prepared and TAC-commissioned)

2000

- TAC's views on implications of the new CGIAR Vision and Strategy for structure and governance
- CGIAR Research Priorities for Marginal Lands

It should be emphasized that the studies are (as intended) strategic in nature, focused as much on how particular approaches can be used to address the goals and mission of the CGIAR (or, for example, redress constraints to adoption and impact from certain technologies), than in defining or ranking the individual research priorities to be addressed. Nevertheless, status reviews also lead to recommendations on the next or best steps to be taken in an area (e.g. on the basis of new science, or new analyses). These outcomes accord closely with the outcomes of the recent priority setting exercise and those of other stakeholders. Examples will be given in four areas: abiotic stress resistance, biotechnology and food safety, marginal lands and poverty research.

Abiotic stress resistance: The report “*Applications of Molecular Biology and Genomics to Genetic Enhancement of Crop Tolerance to Abiotic Stress. A Discussion Document (2003)*” provided the rationale and encouragement for the CGIAR to build upon existing work, the major advances in genomics, and the opportunity to forge international partnerships, to tackle abiotic stresses in its mandate crops as a system priority. This recommendation was endorsed by the TAC/iSC and incorporated into the Challenge Programme on Unlocking Genetic Diversity in Crops for the Resource Poor that has a focus on abiotic stress. The discussion document also clearly identified “unpredictable drought as the single most important factor affecting world food security and the catalyst of the great famines of the past”. Noting the increasing competition for water resources globally, “drought stress is a concern for most crops at most Centres for most regions”. Improving productivity through a focus on genetic enhancement research for drought tolerance is a clearly emerging priority from the recent SC-led, participatory priority evaluation.

Food safety: The report “*A status note on food safety (2002)*” Takes a broad view of food safety, and clearly differentiates the issues in meeting international trade requirements from domestic consumption concerns. It notes that currently, “within the CGIAR System, there has been no set strategy to provide guidance on the topic and that work done to date has been largely incidental to the respective priority research thrusts of individual Centres or, at best, of an *ad hoc* nature.” “The formulation of such a strategy would naturally enable drawing synergies from the currently isolated activities. Key components for managing food safety are: efficient and rapid surveillance systems; prompt communication to consumers about the nature of risk; a credible and responsive regulatory system based on an on-farm food safety programme. Food safety is often a function of degree of development of the agricultural processing industry (including commodity storage and transport), which is rather under-developed in the poorer countries of SSA. It may be well worth tailoring food quality improvement technologies to: 1) the different

agroecological zones and the associated growing environments; 2) various socioeconomic classes of producers/consumers; and 3) rural and urban settings.” Direct approaches to enhancing food safety could come from integrated pest management research and post-harvest research.

Agriculture, food safety (and human health) is an emerging priority in the strategies and project portfolios of individual Centres (see section 4.2) but has not been unified as an approach at the system-level.

The note goes on to observe that “decision making by developing countries to promote or block the import and commercialization of biotechnologies rests on five factors: Intellectual Property Rights (IPR), biosafety (including the risks of biotechnology), trade policy, food safety policy, and public research investment policy. The CGIAR Centres have a vital role to play in all five areas, but perhaps by far the most important is IPR.” This accords with the high priority given to the need for the CGIAR to provide assistance to NARS in these areas, particularly in IPR.

Concerning food safety in relation to animal (livestock and fish) products, researchable areas include epidemiology and informatics, genomics and biotechnology, food safety and veterinary public health, and policy formulation (covering domestic surveillance and international trade). These aspects form part of the GFAR strategic priorities and were included in part in the pre-proposal for a potential Challenge Programme on Animal diseases, food safety and trade (which was not selected as formulated). The Consultation did not prioritize any approaches to the livestock sector, but the eminent scientist’s panel suggested healthy foods for export and global trade issues as high priority areas for the CGIAR. These diverging recommendations may warrant further review.

Marginal Lands: The report “*CGIAR Research Priorities for Marginal Lands*” was prompted by the consideration that the CGIAR should work more specifically towards the needs of the poor. A large number of rural poor are associated with marginal lands and the conventional wisdom was that there was a linkage between poverty and unsustainable land-use practices. However, as the report makes clear, a single definition of marginal lands is difficult to make. Identifying marginal areas having concentrations of poor people would perhaps be a better operational focus. The supposed linkage between poverty and (degrading) land use practices requires much more study, long term statistical data and knowledge of decision making at the household level in the face of risk and variability. This led the report to make four recommendations to further guide work in this area:

1. The CGIAR needs to sharpen its strategic focus on poverty alleviation, particularly in setting priorities for research related to marginal rural areas. A prerequisite is development of a geo-referenced database linking biophysical land conditions with poverty and the processes that produce it (i.e. the dynamics of poverty).
2. The Centres should establish new forms of partnership in order to effectively address their roles in a broader poverty alleviation strategy related to those who live in marginal rural areas.
3. The CGIAR System should develop improved mechanisms by which Centres can be involved with other partners in generating and interpreting improved scientific

evidence on (i) the extent and magnitude of the impacts of agriculture, forestry and fisheries on the degradation or enhancement of natural resources and the consequences for production and food security; and (ii) the linkage between poverty and observed resource degradation.

4. Expanded collaborative mechanisms and activities should be developed among Centres and between Centres and their non-CGIAR partners, to help focus research and institutional strengthening on issues related to adoption, adaptation and utilization of research results that so far have remained unused.

Despite the variety of types of marginal lands, the report identified common research and development approaches applicable to all categories of marginal lands:

Reforming policies and institutions: this involves improving the social, institutional and physical infrastructure (access to markets and market information; price policies; access to credit and essential purchased inputs; establishment and strengthening of markets; improved property rights; improved roads, communications, transportation and do forth);

Generating and diffusing new and improved technologies: This applies to crop, livestock, forestry, agroforestry and fisheries. The new technologies need to fit the various biophysical and institutional characteristics and constraints of the diverse agricultural and associated lands;

Diversifying land use systems and income opportunities: This includes increasing access to off-farm employment (e.g. through forestry, fisheries and agro-industrial opportunities associated with improved post-harvest technologies, small-scale enterprise development, etc).

The report was at pains to point out that the CGIAR will be able to contribute to some but not all of these areas (and the work should support that of other international agencies where they have comparative advantage - see chapter 5). However, the research areas encompassed in the above approach were also strongly supported in the consultations on new research priorities, with emphasis being given to policies for land and water management ensuring access of the poor; improving market access; agroecological systems approaches including crops, livestock, forestry and fisheries; systems diversification - including vegetables and perennial crops; and greater attention to the production chain including post-harvest technologies. There is also a key role to be played by the Centres in contributing to global knowledge on the connection between land use and poverty through the appropriate framing of research in collaboration with others.

Poverty research: The report “*Poverty in meso-America: tendencies, causes and implications for agricultural research, 2001*” treats poverty in Central American countries but provides a generic rationale for an attack on rural poverty through agricultural research. The rationale, in substantial concordance with the findings above, includes the following:

- An argument for a “rural-first” priority for alleviating poverty.
- A focus on assisting the poor adopt “dual purpose” technologies (which increase agricultural productivity and resource conservation simultaneously).

- Because poverty is affected by multiple variables, a true integration of efforts is called for.
- Poverty reduction programmes including agricultural research can most usefully be guided by a thorough-going analysis of occupations with special reference to the poor.
- Rural poverty campaigns should attack poverty in agriculture first.
- There should be a focus on acquisition of skills and assets to help the poor qualify for higher paid jobs
- Agricultural research should seek to raise the returns to labour, or labour productivity
- More emphasis should be placed on cash crops (“double-edged” commodities) for greater returns and additional opportunities for packaging and processing.
- Increasing the food supply reduces the cost of staple commodities for the poor.

Interestingly, poverty research *per se* was not prioritized by the Consultation (or by some earlier considerations of the Global panel, for instance), although some high ranking priorities do address marginal environments (and see above). However, it is clear from section 4.2, that individual Centres, particularly those which have recently undergone strategic planning processes, have taken into account the MDGs and the approaches detailed in the iSC report, much more evidently than formerly. In this respect the individual Centre research priorities are becoming progressively more closely aligned with the holistic approaches to poverty and development adopted and promoted by the development Banks and other investors (see chapter 5).

4.7 Conclusions – the Research Portfolio of the CGIAR Centres

An analysis of the distribution of the portfolio of centre projects in terms of the dollar value of investments by CGIAR activity has been given at the start of this chapter. The current portfolio of research is examined in section 4.2. However, it is also useful to examine the major types of research thrusts included in the activity classification. This has been done (as a first approximation) in Appendix 2, describing projects as near as possible by a single category (although the tendency, increasing recently, is for centres to develop integrated approaches to commodities, farming systems, policy etc.). Nevertheless, such a rough analysis leads to the following characterisation of the 196 projects making up the 2004-2006 research portfolio.

- The Centres continue to conduct needed commodity improvement research in their mandated commodities.
- Improvement is carried out through genetic enhancement research which encompasses breeding approaches and new genetic biotechnology approaches, and farming systems research which is undertaken in a commodity-specific fashion, or more often in general improvement approaches to the key agro-ecosystems of developing countries where the commodities are grown or raised.
- Whilst farming systems research encompasses aspects of resource management, there is a large body of centre research on integrated natural resource management (INRM) directed principally at water, soils, watersheds, fisheries, forestry, forages and pastures aimed at augmenting the sustainability of agricultural and natural production systems. Commodity,

INRM and farming systems research are integrated in some ecoregional programmes run by centres as research networks or as system-wide programs.

- The conservation and use of biodiversity supporting agricultural productivity is carried out through the programs of IPGRI, the operation of gene banks by the plant commodity centres, the system-wide genetic resources programme and in conjunction with INRM research in natural ecosystems (forestry, fisheries) or agricultural systems.
- There are smaller but emerging bodies of research on climate change, the links between agriculture and human health, and the system-wide programme on gender and diversity.
- There is a large body of policy research conducted by the CGIAR Centres. This is focused on the programme of IFPRI, and aspects of food security and nutrition, but is wide ranging across centres addressing markets, trade and globalization; poverty research and sectoral or regional assessments (e.g. for livestock, or the semi-arid tropics), individual high priority issues (like genetic resources policy); and governance issues, particularly for common pool natural resources (such as forestry and fisheries).
- Approaches adopted by the centres to enhance performance are participatory approaches (to assist design, dissemination and adoption of interventions); impact assessment procedures (aimed both at centre impacts and the effects of external factors on sectors or commodities), and the conversion of publication systems into true knowledge management systems for centre efficiency and for the benefit of partners and stakeholders.
- There is similarly a major component of the portfolio directed towards NARS capacity building, implicit in conducting research through partnership, but also as a specific goal in some regions, commodities and sectors, and subject to analysis through research on institutions and processes of development change.

This rule of thumb characterisation of the current composite portfolio emphasises the “heartland” areas of the CGIAR research, and its importance in balancing new or additional priorities and in determining the future evolution of the System’s agenda.

The evolution of priorities “from within” the CGIAR arises from three main considerations: (i) The long term conduct of mission-oriented research and the awareness that builds of the key and emerging issues governing the impact of CGIAR Centre programmes in developing countries, (ii) Changes in strategic direction brought about by success, shifts in the external environment, and the response to new partner demands and requirements, or (iii) Opportunities provided by new science, levels of support, or partnerships. New priorities being developed by the Centres on the basis of the emerging issues are described in section 4.5. Amongst these it is possible to note three major areas:

- A heightened concern for knowledge management (both for Centres, the global sector and developing country end-users) - e.g. CIMMYT, ICRISAT, IPGRI, WorldFish

- A focus on systems of innovation amongst farming or resource management communities and NARS - e.g. CIAT, IFPRI, augmenting work in train by ISNAR and more recently by ILRI.
- More explicit examination of the linkages between agriculture, health and trade - e.g. CIP, IFPRI, IWMI, building upon the work of ILRI.

It should also be noted however, that a great deal of effort (and transaction costs) has been expended within and across CGIAR Centres in the careful consideration of priority themes for prospective Challenge Programmes, since this potential vehicle for a more programmatic approach to research was raised. A number of priority areas of concern for the Centres are therefore part of authorized Challenge Programmes (described in section 4.2), which are still developing the detailed project plans, or invested in Challenge programme proposals (coastal zones, rainforests, desertification, climate change) which have not yet proceeded to full concept development. In some cases, Systemwide activities, considered a priority at individual regional level (such as urban-peri urban agriculture, and HIV/AIDS and agriculture) are being supported by investors even though they are not formally endorsed as part of the System's research agenda.

CHAPTER 5 - EVOLVING PRIORITIES FOR AGRICULTURAL RESEARCH IN OTHER ORGANIZATIONS

In establishing priorities for agricultural research to be undertaken by the CGIAR system it is important to determine the constraints and trends influencing agriculture in developing countries (reviewed in Chapter 2). In order to properly gauge and position effort in new priority areas for research it is also necessary to evaluate the current and planned activities of the CGIAR Centres, and the aspirations of its stakeholders. This chapter reviews the priorities for new research identified by global and regional partners and briefly reviews the scope and ways of working that the CGIAR system has so far adopted.

5.1 GFAR and Regional Organizations

5.1.1 GFAR

A key component of the participatory development of priorities for agricultural research in developing countries is the Global Forum for Agricultural Research (GFAR). Established in 1996, GFAR is the apex body representing the five developing or transitional country regional organizations. GFAR provides a neutral and transparent platform involving all stakeholders in agricultural research for development.

In 2001, at the request of donors, GFAR developed a short list of global priorities for developing countries on the basis of commonalities in the individually expressed priorities of the regions. The exercise was careful to distinguish overall development goals (such as poverty alleviation) from the researchable issues which would assist the regional and national organizations contribute to the development goals through agriculture. The resulting research priorities were also formulated as potential programmes of global significance (either addressing a multiregional problem, or because addressing more locally defined issues would provide outcomes of widespread applicability to the challenges of agricultural sustainability, conservation of biodiversity etc.). Each issue was considered of sufficient magnitude as to require concerted action for its solution. Programmes were understood either as sets of specific manageable research projects addressing the theme or, in some cases, as a “common framework for action”:

Seven major topics emerged as potential priority global programmes from the GFAR assessment:

1. Access to information and information management
2. Agrobiodiversity and research issues related to conservation and sustainable utilization of plant genetic resources for food and agriculture
3. Natural Resources Management, Agro-Ecology and Tropical Ecosystems
4. Under-utilized and orphan species and commodities
5. Commodity-chains of interest to two or more regions
6. Animal Health and Production for Human Food Security and Food Safety
7. Linking Farmers to the Market: Post-Harvest, Rural Innovation Systems and Rural SMEs (small to medium enterprises)

The major contribution to global priority setting is that the outcomes are demand driven by the national and regional programmes themselves, based on common needs. However, as recognized by GFAR, the priorities preferentially consider national programme considerations for farming systems, with less explicit emphasis given to the needs for fisheries and forestry.

Content and Coverage

This section considers the initial subject matter and intention of each of these GFAR global programme areas and their potential relationship to the activities of the CGIAR.

1. Access to information and information management: Information and Communication Management (ICM) was identified as being of high priority for developing countries in the regional priority setting exercise carried out by all the Regional/Sub-regional Fora. RF/SRF are currently building up their ICM capacity through the development of Regional Agricultural Information Systems (RAIS) in each region: INFOTEC in the case of Latin America and the Caribbean; APARIS for the Asia/Pacific region; the AARINENA-RAIS in the case of the WANA region; and EIARD-InfoSys in the case of Europe. In Sub-Saharan Africa, the European Union is supporting two sub-regional information projects, in CORAF/WECARD and ASARECA. The concept of a multi-stakeholder led platform for communication and exchange of information is now widely shared and will become a key tool in the construction of an electronic global forum for agricultural research (EGFAR). EGFAR will have a particular role to play in the development of information and communication on the other topics in the priority list, such as common commodity chains, and will be developed in close collaboration with the WAICENT outreach group in FAO. The CGIAR Centres are likely to be one of the major sources of information, case studies and syntheses on genetic resources management and biotechnology, natural resources management and agroecology, commodity chains and under-utilized commodities, and policy management and institutional development.

2. Agrobiodiversity and research issues related to conservation and sustainable utilization of plant genetic resources for food and agriculture: This is conceived as global programme approach, in response to the ‘Dresden Declaration on Plant Genetic Resources for Food and Agriculture’, and to meet national requirements under the International Undertaking (IU) on Plant Genetic Resources, and to add financial and political support to the operation of the ‘Global Plan of Action (GPA) for the Conservation and Sustainable Utilization of Plant Genetic Resources for Food and Agriculture’. The Dresden declaration recognizes the importance of the conservation of agrobiodiversity for development and the twenty priority activity areas of the GPA are grouped in four clusters: *in situ* conservation and development, *ex situ* conservation, use of plant genetic resources, and institutions and capacity building. On the basis of the regional priorities identified by RF/SRF the following activities were highlighted:

- Collection and documentation of indigenous knowledge on conservation and use of plant genetic resources
- In situ conservation strategies and the sustainable use of native, at risk, species,
- Recovering local knowledge
- Developing and evaluating truly participatory farmer-led research methodologies

- Eco-regional survey, exploration and collection of endemic, endangered, neglected and traditional cultivars
- Bioinformatics and management of germplasm banks
- Strengthening regional networks of genetic resources
- Sustainable use and conservation of biodiversity and agrobiodiversity
- Utilization of underutilized crops
- Identification, isolation and characterization and use of genes of interest (i.e.disease or stress resistance) for breeding programmes
- Policy advocacy on IPR/IPP and sharing of genetic resources and of their benefits
- Implementation of Biosafety regulations and risk assessment for decision making
- Human Resource Development and capacity-building efforts

The GFAR priority programme was expected to be implemented by all developing regions and EU partners, and linking effectively with NGOs and with international research institutions and networks such as the CGIAR, in particular IPGRI and the FAO. The stated priorities focus on plant genetic resources but the GFAR note the need to similarly treat animal genetic diversity in collaboration with existing programmes of international agencies. There is a high correlation with the specific recommendations of the current CGIAR Priority setting exercise in all these fields.

3. Natural Resources Management, Agro-Ecology and Tropical Ecosystems: High priority was accorded to the sustainable use, management and conservation of the natural resource base for agriculture in all regional priority setting. The GFAR proposal is an attempt to bring together the developments and best practices in this broad area, some of which are derived directly from the results of eco-regional initiatives of the CGIAR. Two general types of approach were identified: Firstly the requirement to examine specific thematic interventions with a geographic or ecoregional focus (e.g. conservation tillage, humid tropical ecosystems) and the opportunity to develop and test alternatives through interactions among NARS, ARIs, IARCs, farmers and NGOs. A second approach, according to GFAR, focuses analytical emphasis on local innovation and stakeholder participation (e.g. farmer-to-farmer, participatory technology development, etc.) in improving farm agro-ecology. It is process-oriented, with less specific geographical focus, and the approach can be applied to any aspect of NRM or agro-ecology.

There is consensus that improving the sustainability of agriculture (in its widest sense) is absolutely critical in meeting the food production and development goals of the CGIAR. However, the choice of means (bio-technical, institutional, policy etc) and scales through which research can stimulate such improvements, relate to the resource and the bio-physical and human context in which it is being utilized. Incorporation of the emerging paradigms within priority setting approaches is further complicated at the global level as, by its nature, natural resource management research involves iterative and multidisciplinary approaches. For these reasons it was less easy to determine from the outcomes of the CGIAR priority setting individual future priorities for natural resources management - and its overlap with policy research. More specific integrated approaches to resource management can be expected to emerge through the prioritization of ecoregions however (and definition at the level of watersheds within ecoregional analyses as suggested in the Priorities for Soil and Water Aspects of Natural Resources Management Research in the CGIAR, TAC 1996). More emphasis is required at the level of

specific sectoral resources such as fisheries²⁰ given their increased importance with respect to earlier CGIAR assessment frameworks.

4. Under-utilized and orphan species and commodities (UOCs): About 30 crops provide the bulk of human nutrition, roughly one hundred species of plants contribute 90 percent of the supply of food crops by weight and calories, but around 7000 plant species are recorded in agriculture not just for nutrition but to supply energy, fibres, medicines and other needs. Similar situations can be found for animal and fish species. These UOCs have particular importance at local levels for household nutrition or income.

The approach recommended by GFAR is to develop a Global Facilitating Mechanism that would coordinate and facilitate the work that is undertaken on different aspects of UOCs by agencies and organizations world-wide. It would cover the identification, assessment, improvement, development, sustainable use and marketing of these species and the commodities derived from them, for the benefit of local farmers and users. It would encourage the development of common tools and approaches and provide a forum for discussion and suggestions for action. The GFAR will be joined by FAO, IFAD, IPGRI and the International Centre for Underutilized Crops (ICUC) in steering the process for promoting research and development of UOCs. The launching of the GFU for UOCs has already received support from the government of Germany.

The CGIAR Priority setting exercise similarly recognized that as well as the improvement of the major cereal crops and animal species, one direction for improved sustainability and supplementary nutrition and income development for small holders is through enterprise diversification. A specific research focus (over and above the GFU) was suggested for tree crops and vegetables. Given the GFAR initiative in this area (and priority 5 below) it will be important to prioritize the CGIAR research focus as the importance of target tree and vegetable crops vary according to climatic and regional considerations e.g. date palm, olives, citrus in the CWANA region, tarot in the Pacific Islands. IITA has existing research thrusts to enhance diversification and market-orientation in its focus ecoregions of West Africa.

5. Commodity-chains of interest to two or more regions: The concept of “commodity chain” considers a crop from its production through to its consumption or use by the consumers. All regions have identified in their priorities the development or the strengthening of international cooperation on some major commodity crops which form the backbone of the economies of many developing countries, especially the Least Developed Countries. The commodity chain approach is not restricted to the conventional increases in productivity, and therefore adds new dimensions and partners for its support. GFAR therefore suggested to assist its stakeholders in developing global programmes and to begin on a small number of commodity chains jointly identified, based on the priorities expressed by the commodity communities and NARS Regional Fora. A feasibility study has begun with IPGRI and CIRAD on developing programmes which address globally important, public goods aspects of the major commodity chains (citrus, cocoa, coconut, coffee, cotton, oil palm, pineapple, rubber and sugarcane).

²⁰ see T. Bostock (2003) and section 5 of this report.

Whilst a more explicit emphasis on “farmer to market” chains emerged amongst the priorities of the CGIAR exercise, this will be considered in relation to GFAR priority 7, below.

6. Animal Health and Production for Human Food Security and Food Safety: Farming livestock (including fish from aquaculture) provides food and nutrients for people. It is a source of cash, income and income security. It is often the main source of livelihood of the poor, enabling them to exploit common resources, particularly land and water. Livestock and fish make particular contributions to rural income in times of stress and forced changes in farming practices. The importance of livestock and fish to developing countries has recently been reconfirmed by trend and congruence analysis. Livestock and fish products are increasingly likely to enter local and more distant market supply chains. The idea of food security has now evolved to include the concept of “food safety” for human populations. This includes hygiene in animal husbandry and the use of their products, safe and rational use of drugs to avoid contamination and reduction in infectious and zoonotic diseases. The GFAR proposal for a global programme aims to generate predictive models (e.g. for animal health and production, mixed farming systems and land use) which can be used in the development of disease control strategies for improved productivity and for human health.

One specific outcome of the GFAR focus on livestock has been planning for “A Global Initiative to exploit biotechnology and animal genetic resources for the improvement of livestock productivity through control of trypanosomosis” between representatives of CIRAD, FAO, Concerted Action ICPTV, ILRI, OIE, the University of Montpellier and the GFAR Secretariat. However this does not cover the wider and more general issues in relation to marketing and trade of livestock products, which remains a global priority (see Challenge Programmes).

7. Linking Farmers to the Market: Post-Harvest, Rural Innovation Systems and Rural Small to Medium Enterprises (SMEs): This priority results from a growing awareness in all regions of the need to complement the traditional approach to agricultural research and development with a new approach based on the concept of “rural innovation systems”. Rural innovation is required to meet the objectives of poverty reduction and sustainable development. Additionally, trade liberalization requires farmers to be competitive, even in local markets. As a result, commodity-chain approaches in which post-harvest technologies and agro-industries based on small and medium-sized rural enterprises (rural SMEs) are becoming important. Agro-industrial development patterns need to be promoted so that benefits also accrue to the farmer in the rural sector. The overall aims of the global programme are to develop knowledge, analyze and collect best practice including institutional issues for the development of innovation networks and SMEs. Among IARCs, ISNAR is developing a programme on rural innovation. The involvement of farmers, of NGOs and of the private sector is essential in this type of project.

Similarly, within the CGIAR priority setting, new research on farmer to market chains was supported, as was an approach to ILAC (institutional learning and change) which could be extended to the NARS and farmer situations to enhance understandings of rural innovation. Appropriate cognizance of the GFAR initiative should be taken and contributions made to aspects of the work only where the CGIAR has comparative advantage.

5.1.2 Regional/Sub-Regional Organizations

The priority setting for the CGIAR considers, in the first instance, the provision of global public goods and global activities. In general, global activities are being carried out through an increasingly diversified range of research partnerships, and modes of collaboration, (i) international centres with a global mandate, (ii) various types of inter-regional cooperation between NARS and other stakeholders in agricultural research for development, including donors, and (c) global programmes and networks for specific areas of research. The objectives of GFAR include the facilitation of the participation of NARS and of other stakeholders in inter-regional research partnerships through their respective Regional Organisations or fora, and in promoting the development of global programmes in areas of agricultural research of key importance to developing countries (as discussed above).

The basic mechanism for the mobilisation of stakeholders of agricultural research for development at the regional level has been the establishment of Regional/Sub-regional Organisations (RO/SRO) that have been established, mostly during the nineties: AARINENA for West Asia and North Africa, APAARI for the Asia/Pacific region, the CAC Forum for Central Asia and the Caucasus, FARA for Sub-Sahara Africa, and FORAGRO for Latin America and the Caribbean. Over the last couple of years, all regional/sub-regional fora have been actively engaged in regional priority setting and in formulating regional and sub-regional strategies in agricultural research and development. This more distributed priority setting allowed the inclusion of the increased number of actors (NGOs, the private sector and farmers' organisations, as well as the NARS, IARCs and other ARIs) in agricultural research. (the regional priorities are attached to this report ²¹.)

These recently established regional and sub-regional priorities provide the basis for the CGIAR's own global agenda to respond more directly to the needs of developing countries. The potential areas for research are enlarged over the earlier set of activities adopted by the Centres. In responding therefore to NARS-led priorities for agricultural research it becomes necessary for the CGIAR as a whole to best assess which of the major global and regional priorities it is able to address and by what means. The CGIAR therefore utilized both global and regional panels to take account of new science and opportunities for new research. Global public goods research may be addressed through individual Centre research or global challenge programmes. Region-specific research is best addressed through ecoregional initiatives in appropriate partnerships with RO/SROs and their component institutes.

Additional roles played by ROs/SROs: RO/SROs are starting to exchange information on research priorities and on research areas that are of mutual interest, as well as information on policy issues that are of interest to them. Interactions between the ROs and developed country agricultural research are being developed more directly through new collaborative arrangements: (i) the establishment of the European Forum on Agricultural Research (EFARD), in the case of Europe, (ii) the emergence of the "Mediterranean agricultural research area" at the confluence between Europe and the AARINENA region; (iii) the emergence of PROCINORTE that brings

²¹ Annex 2 of the GFAR report

together Canada, the US and Mexico with other partners from Latin America and the Caribbean; and (iv) the emergence of collaborative research partnerships in the context of APEC that brings together the Pacific rim countries. These arrangements present new opportunities for the catalysis of agricultural science, as well as for the positioning of the CGIAR to assist agricultural research in new ways. The reappraisal of priorities in relation to food crop and cash/industrial crop balance in research is one example precipitated by the greater involvement of ROs in priority setting.

Challenges for the future: Whilst the recent contribution to strategic priority setting has been considerable, the future funding of the ROs and SROs and the scale of development of projects to meet the needs of sub-regions, and the NARS of smaller countries, is to be worked out. Certainly the existence of very large and strong NARS in some regions (e.g. Brazil, China, India) makes it necessary for the ROs to assume different shapes and functions in terms of regional cooperation amongst the NARS and linkages with the research systems from outside the region. This will require flexibility in governance mechanisms, both for the ROs themselves and the forms of project collaboration and organizational arrangements that are entered into.

The SROs have taken over and strengthened the regional agricultural research networks previously run by the IARCs. The networks have become channels for agricultural assistance and technology transfer by a variety of providers. The longer term strengthening of AKIS or rural innovation networks and/or the more explicit development of the IARCs as regional research entities, would alter the roles that NARS, SROs and the IARCS will play in the conduct of research in the future. The IARCs should confine themselves to clear international public goods research in deciding on the forms of intervention in future relationships.

5.2 World Bank and Selected Regional Banks (AfDB, ADB and IDB)

The International Development Banks play key roles in the provision of development assistance to developing countries, and in the compilation of statistics, experiences and thinking on agriculture and the environmental issues affecting development. Within their total remits, agriculture sometimes plays a small but essential part of the total development assistance approach, often with increased emphasis in poorer countries. This section reviews the strategic priorities and some key programmes of these development institutions. The international development banks discussed here are all members of the CGIAR and investors and partners in its research and allied programmes.

5.2.1 The World Bank

The World Bank was a founding member of the CGIAR in 1971, and is one of the Group's three Co-sponsors. The Bank's Vice-President for Environmentally and Socially Sustainable Development (ESSD) also serves as Chairman of the CGIAR. The Director of Rural Development represents the Bank at CGIAR meetings. The CGIAR Director and Secretariat are based at World Bank Headquarters in Washington, DC.

The World Bank Group's mission is to fight poverty and improve the living standards of people in the developing world. As a development Bank and specialized agency of the UN, it provides loans, policy advice, technical assistance and knowledge sharing services to low and

middle income countries to reduce poverty. In 2003 the World Bank²² provided \$18.5 billion and worked in more than 100 developing countries around the globe. The Bank promotes growth to create jobs and to empower poor people to take advantage of these opportunities.

The Millennium Development Goals (MDGs), agreed to by 189 nations in 2002 at the United Nations Millennium Summit, embody an unprecedented level of consensus on what is needed for sustainable poverty reduction. Meeting the MDGs is a major driving force of the Bank and the development community. The Goals are:

- Eradicate extreme poverty and hunger
- Achieve universal primary education
- Promote gender equality and empower women
- Reduce child mortality
- Combat HIV/AIDS, malaria, and other diseases
- Ensure environmental sustainability
- Develop a global partnership for development

The Bank seeks to play a catalytic role in development, concentrating on the twin pillars of its Strategic Framework: - building the climate for investment, jobs and sustainable growth, and investing in and empowering poor people to participate in development - as critical elements to achieving sustainable poverty reduction and helping clients meet the MDGs.

Agriculture & Rural Development

Because currently 70% of the world's poor live in rural areas, the Bank places major emphasis on combating rural poverty. The Bank's approach to rural development is multi-sectoral, focused on improving the well-being of rural people by building their productive, social, and environmental assets. A recent review of the World Bank's lending for rural projects showed that:

- The Bank invested an average of US\$5 billion annually from July 1999 through June 2002 in rural areas, representing 25% of total World Bank lending for the same time period;
- 30% of rural lending was directed at the agriculture sector;
- Ninety-eight percent of projects with components in rural areas are through investment lending;
- Thirty percent of Bank projects in rural areas use community-based approaches.

Rural development and agriculture projects include:

²² The "World Bank" is the name that has come to be used for the International Bank for Reconstruction and Development (IBRD) and the [International Development Association \(IDA\)](#). In fiscal 2002 IBRD provided loans totalling \$11.5 billion in support of 96 projects in 40 countries. In fiscal 2002 IDA provided \$8.1 billion in financing for 133 projects in 62 low-income countries. The "World Bank Group" includes three additional organizations: The International Finance Corporation (IFC), the [Multilateral Investment Guarantee Agency \(MIGA\)](#) and the [International Centre for Settlement of Investment Disputes \(ICSID\)](#).

Forests and Forestry - advocating sustainable forest management for poverty alleviation, economic growth, and global environmental protection

Water Resources Management - disseminating emerging lessons on water issues

Sustainable Agriculture - promoting wider understanding and awareness of the range of options for sustainable agricultural development

Gender and Rural Development - promoting systematic gender integration into the World Bank's rural development activities

Agricultural Trade - a focal point for key discussions and reports on the Bank's activities in agricultural trade

World Bank priorities

Responding to the challenge of reducing poverty, and meeting the multiple objectives of the MDGs requires that the Bank and its partners scale-up the impact of current work. This is reflected in the Budget Document for IBRD/IDA for Financial Year (FY) 2004 (which includes indicative proposals for FY05-06) and which seeks a Net Administrative Budget of \$1,395.3 million in FY03 dollars, an increase of \$39 million over FY03. The indicative budget increase proposed for FY05, and FY06 is in the order of \$15-\$25 million in each year.

Table 5.1: Regional Country Services by Sector

	FY04-06 Average share	FY03-06 Growth rate
Agriculture, Fishing & Forestry	11%	30%
Law & Justice & Public Administration	27%	1%
Information & Communications	1%	-17%
Education	9%	20%
Finance	8%	10%
Health & Other Social Services	16%	21%
Industry & Trade	6%	-7%
Energy & Mining	7%	0%
Transportation	7%	4%
Water, Sanitation & Flood Protection	8%	25%
Total	100%	10%

Source: World Bank Programmes and Budgets for FY04

The Bank's regional budget by sector (Table 5.1) reflects the emphasis on rural development and a growing focus on the service delivery of the MDGs. Agriculture, fishing, and forestry are projected to grow by 30 percent between FY03 and FY06. Increasing investments in health and other social services, the education sector, and in water and sanitation are also expected.

The Bank's global approaches are diversified according to regional needs and according to differences in resource and development status of countries within regions. The Bank classifies six regional groupings of countries (slightly differently from the CGIAR but with substantial practical overlaps). The strategic directions for all regions focus on promoting economic growth (including investment climate), improving education and health services, and strengthening both private and public governance with additional objectives reflecting different regional needs as follows:

The Africa Region (AFR) focuses on: (a) improving governance by strengthening performance and accountability in public institutions, creating a transparent regulatory environment, and supporting measures to promote political stability and peace in post conflict situations; (b) promoting growth and competitiveness by improving the business climate and conditions for trade, strengthening agribusiness and supply chains, investing in infrastructure and access to clean water and sanitation; (c) developing human capital by supporting HIV/AIDS programmes, rolling-out the Education For All initiative in 13 African countries to improve literacy rates and gender equality, and providing decentralized service delivery in education and health; and (d) improving aid effectiveness by working with partners and stakeholders to pursue community driven development, monitor impact of aid: and simplified procedures to reduce the transaction cost of aid.

The East Asia and Pacific Region (EAP) aims to: (a) maintain macroeconomic stability, improve provision of infrastructure and the environment for private sector development and deepen structural reform of the financial and banking sectors to further economic growth; (b) assist clients pursue regional integration through intra-regional agreements on trade, services, infrastructure, and water resource management and integrate into the global economy in a pro-poor manner; (c) strengthen the governance environment by improving transparency to reduce corruption and establishing a framework for effective decentralization; and (d) enhance social stability by channelling increased amount of resources directly to poor communities, improving access of poor people to assets and services, enhancing management of natural resources, strengthening social protection systems, and supporting post-conflict reconstruction.

The two principal objectives of the Europe and Central Asia Region (ECA) are to: (a) assist the ECA countries in their transition to market economies; and (b) help countries achieve the Millennium Development Goals by 2015 as a proxy for "making transition work for everybody." These strategic objectives are operationalized through four priority areas of client support: (i) improved investment climate; (ii) efficient, transparent, honest government; (iii) improved social and environmental conditions; and (iv) pursuit of key global public goods (communicable diseases, environmental commons, information and knowledge, international financial architecture, trade and integration).

The Latin America and Caribbean Region (LCR) focuses on ensuring a strong poverty focus and assisting their clients manage volatility and vulnerability more effectively by pursuing innovative approaches, developing social protection and insurance systems, and supporting them with financial instruments (e.g., counter-cyclical lending, contingent lending). LCR will continue to support countries facing crisis, but will provide greater support to the smaller countries and non-crisis nations in the region.

The Middle East and North Africa Region (MNA) contributes to strategic objectives of growth, investment, and employment by helping improve public sector efficiency and governance, private sector development and employment creation, education, water management; and gender equality. It will do so by scaling up interventions for maximum impact, increasing participation of concerned stakeholders, building partnerships with institutions within countries (think tanks, universities, etc.) and with other donors, and mainstreaming outreach activities to civil society. To complement strategically focused financial support, MNA will also continue to strengthen knowledge services. The Region is pursuing a new business model, introducing more systematically “programmatic economic and sector work,” and deepening its involvement in Reimbursable Technical Cooperation, while managing the Region’s existing, more traditional portfolio.

The South Asia Region (SAR) aims to: (a) reduce poverty by fostering economic growth, improving macroeconomic management, strengthening the investment climate, promoting “pro-poor” education, health, population, and social policies, and enhancing access to basic services for poor people; (b) promote fiscal stability; (c) improve governance through a strengthened private investment climate and better public sector management and reduced corruption; (d) reduce HIV/AIDS and other communicable diseases; and (e) improve access to/and management of water resources.

When dealing with individual countries the World Bank works within the principles of the Comprehensive Development Framework (CDF) and the Poverty Reduction Strategy Papers (PSRPs), to apply its framework of selectivity to work most effectively within countries, across countries, and globally. Noting that economic growth is not a sufficient condition to automatically lift people out of poverty, emphasis is placed on community-driven development approaches. Sector strategies help shape the Bank's approach and activities in a given sector or thematic area, identifying aspects of relatively weak country performance for priority attention. The Bank recently released new sector strategies on Forests, Water Resources, Rural Development, Environment, Gender, Information and Communications Technologies and Private Sector Development. The Bank has continuing research initiatives on Rural Development and on Poverty²³, amongst other themes.

Additional resources are directed at special global difficulties faced by the poorest and most vulnerable countries such as the HIV/AIDS epidemic, or debt relief under the enhanced Heavily Indebted Poor Countries (HIPC) Initiative. The World Bank also contributes to its overall goals through global programmes (and the CGIAR is such a global programme for agricultural research) and to its environment goals through the Global Environment Facility (GEF).

Global Environment Facility Programme

The World Bank is an implementing agency (with the UNDP and UNEP) of the Global

²³ The Poverty Research programme is relatively recent with priorities to: (1) improve current data and methods of poverty and inequality analysis, including greater standardization of household survey data, and making the data more accessible to users, and (2) use the improved data and existing data sources to better understand what makes “pro-poor growth.”

Environment Facility (GEF) Programme. The GEF is a mechanism for providing new and additional grant and concessional funding to meet the agreed incremental costs of measures to achieve agreed global environmental benefits in the four focal areas - Climate change; Biological diversity; International waters; and Ozone layer depletion. The agreed incremental cost of activities concerning land degradation, primarily desertification and deforestation, as they relate to the four focal areas, are also eligible for funding. It serves as the financial mechanism for the Conservation of Biological Diversity and the UN Framework Convention on Climate Change. In 2001, Stockholm Convention on Persistent Organic Pollutants (POPs) agreed GEF as the interim financial mechanism for the implementation of the POPs programme. The GEF is a major means of providing assistance to global environmental issues in the four priority areas.

5.2.2 The African Development Bank

The African Development Bank (AfDB) became a member of the CGIAR in 1978. The ADB's Principal Agricultural Economist and the Western Region's Agricultural Division are vested with responsibility for the CGIAR.

After a period of review and new planning for future operations, the AfDB Strategic Plan 2003-2007 became effective on 1st January 2003. Achieving the Millennium Development Goals in Africa²⁴, the elaboration of the New Partnership for Africa's Development (NEPAD) and the Water Initiative are key elements structuring the strategic approach of the Bank. The AfDB seeks greater selectivity in operations to maximize development effectiveness

Whilst the AfDB is committed to pursuing a broad agenda of poverty reduction in all its RMCs, for the period 2003-2007, it will give priority to allocating its resources to agriculture and rural development in particular, with greater emphasis being given to the water and sanitation initiatives in the rural and peripheral urban areas, and to human capital formation through primary education and basic health services. Selective support, through a scaling-up approach, will be given to core public utilities where this is an essential component of rural development, a priority element in a specific RMC's poverty reduction strategy, or a vital component of NEPAD's regional economic integration initiatives. Support will also be given to cross-cutting development themes such as gender concerns, environment, and good governance (particularly financial, economic and corporate governance), as well as to the fight against trans-boundary and communicable diseases such as HIV/AIDS, malaria and tuberculosis, global environmental problems, and assistance to post-conflict countries, in particular through strategic alliances with the Bank Group's development partners, by leveraging complementary and mutually reinforcing assets.

The AfDB anticipates being more selective in country assistance strategies with choices spelt out in enhanced Country Strategy Papers (CSPs), these being the major instruments for defining the Bank's RMCs priorities. The Bank Group, therefore, will be selective, concentrating on demonstration and high-impact projects that facilitate economic cooperation and regional

²⁴ Millennium Development Goals in Africa; Progress, Prospects and Policy Implications. Global Poverty Report, 2002. (a product of the AfDB in conjunction with the World Bank, Asian Development Bank, European Bank for Reconstruction and Development, the IMF and the IDB).

integration and generating confidence amongst participating RMCs. This approach calls for greater emphasis on projects and programmes in power interconnection, upgrading transport and telecommunications infrastructure, the fight against communicable diseases and promotion of environmental protection. The Bank will also focus on enhancing linkages between RMCs and improving market access, in particular for land-locked countries, where such linkages and access are economically sound and represent important components of regional integration programmes such as NEPAD.

A special premium will be paid to private sector development and capacity building initiatives and programmes in Africa in particular, in order to take advantage of the benefits of globalization by attracting private investments to the region, especially to high-performing RMCs, that they may become the forerunners of Africa's transition from high aid dependency to a more robust development path, led by the private sector. Likely sector and thematic approaches to lower and middle - income African countries are given in the two subsequent tables.

Box 5.1: Sector and Thematic Priorities in Regional Member Countries Eligible for African Development Fund (ADF) Resources only
(Source: Annex IV, African Development Bank Strategic Plan 2003-2007)

A. Strategic Choices: ADF-Countries Leadership Sectors (Niches)

Agriculture & Rural Development;

Water & Sanitation;

Regional Integration & NEPAD: Infrastructure, Banking & Financial Standards;

Governance (financial, economic and corporate governance): African Peer Review Mechanism to ECA;

Non-sovereign lending to Commercially Operated Public Entities;

Budget Support Loans.

The African Development Bank Group will build expertise and expand its portfolio.

B. Strategic Choices: ADF-Countries Equal Partnership Sectors²⁵

Health: WB, Bilaterals, WHO, UNAIDS;

Education: WB, Bilaterals, UNICEF, UNESCO;

Poverty Reduction: WB, Bilaterals, UN System;

Infrastructure: WB, PPPs, EU, Arab Funds;

Public Sector: Bretton Woods, Bilaterals;

Capacity Building: ACBF, AFRITAC, JAI, ADEA, etc

HIPC: WB, IMF, other donors;

Governance & Public Sector Reforms: WB, IMF, other donors.

The African Development Bank Group will re-negotiate effective MOU's.

²⁵ The list of these key strategic partners is just indicative not exclusive.

C. Strategic Choices: ADF-Countries Supporting Partnership Sectors

*Information & Communication Technologies (ICT);
Biotechnology & Scientific Programmes & Projects;
High Tech - Digital Divide Operations including E-governance;
Large infrastructures through BOO/BOOT;
Political governance - to ECA.*

The African Development Bank Group will not seek to build a core competency but will respond to investment opportunities, in particular from the private sector and the commercially operated public entities.

**Box 5.2: Sector and Thematic Priorities for Middle-Income Regional Member Countries
(Source: Annex V, African Development Bank Strategic Plan 2003-2007)**

A. Strategic Choices: ADB-Countries - New Growth Sectors

NEPAD (Infrastructure, Banking & Financial Standards);
Water & Sanitation;
Private Sector (Lines of Credit) for Small & Medium Enterprises;
Non-Sovereign Lending to Commercially Operated Public Entities;
Budget Support Loans;
Urban Renewal Schemes & Municipal Financing in MICs.

The African Development Bank Group will build expertise and grow portfolio. It will also seek to give a premium to the development of private sector activities.

B. Strategic Choices: ADB-Countries - Mature Partnership Sectors

Agriculture modernization and Agribusiness;
Education & Health Strengthening Programmes;
Infrastructure (Road, Power, Telecommunications Projects);
Privatization (Public-Private Partnerships).

The African Development Bank Group will consolidate its position and grow through new partnerships, including the private sector.

C. Strategic Choices: ADF & ADB Countries - Common Features

Mainstreaming cross-cutting issues - Environment, Poverty Reduction, Gender & Micro-credit;
PBLs, ESW, SWAPs, SSPs, APPR;
Financial sector development through innovative schemes;
Procurement procedures enhancing activities;
Diagnostic Trade Integration Studies (DTIS);
Sovereign credit ratings in high performing RMCs to attract private capital flows & develop capital markets.

5.2.3 The Asian Development Bank

The Asian Development Bank (ADB) became a member of the CGIAR in 1971. The Bank has adopted a specific focus on poverty, recognizing that “the greatest challenge for the Asia and the Pacific is the need for robust and sustainable economic growth to address the

poverty reduction agenda.” As with the other Development Banks, the long term and mid-term strategies are implemented through country strategy and programme processes²⁶. The ADB has identified its priorities in relation to the long and medium term challenges to the region.

A. *Long-Term Challenges and ADB’s Strategic Response*

1. *Poverty reduction*, the overarching goal of the ADB, remains the most significant development challenge for the Asia and Pacific region. While the region achieved unprecedented growth and development over the past three decades, it is home to almost two thirds of the world’s poor. The majority of the poor live in South Asia and the People’s Republic of China (PRC); substantial numbers live in Southeast Asia. Many people in the Central Asian republics have slipped into poverty during the transition of their countries to market economies, and the island countries in the Pacific continue to experience deteriorating economies and increased vulnerability due to conflict and external economic shocks. Poverty-reducing efforts in the Asia and Pacific region, therefore, remain central to the fight against global poverty.

2. *Achievement of the international development goals (IDGs) by 2015*. An approach that comprehensively addresses these multidimensional goals is necessary. Such an approach requires major economic and social progress, and robust, sustainable economic growth. This will provide the resources necessary to address the IDGs at the country level.

3. *ADB’s long-term strategic framework (LTSF)* defines the basic elements of a long-term strategic agenda for ADB to address these challenges, and broad operating principles for implementing this agenda. It identifies three core areas of intervention in support of poverty reduction: (i) sustainable economic growth, (ii) inclusive social development, and (iii) governance for effective policies and institutions. These core areas are considered necessary for achieving the IDGs. To broaden and deepen the impact of the core areas, three crosscutting themes are identified: (i) promoting the role of the private sector in development, (ii) supporting regional cooperation and integration for development, and (iii) addressing environmental sustainability. The LTSF specifies four operating principles to ensure selectivity and focus of ADB’s interventions at the country level, and to enhance the development impact and effectiveness of ADB’s support to its DMCs: (i) ensure country leadership and ownership of the development agenda, (ii) take a long-term approach to development assistance, (iii) enhance strategic alliances and partnerships, and (iv) measure development impact.

4. *The LTSF covers 15 years (2001-2015)*; and will be implemented through a set of three medium-term strategies (MTSs), each covering a five-year period. The first MTS addresses the medium-term needs and challenges for the region for 2001-2006.

²⁶ In 2001 the ADB provided loans totalling US\$ 5.3 billion and supported 257 technical assistance activities in relation to projects and programmes through the approval of US\$ 146.4 million. Traditionally agriculture and rural development have received the bulk of support, although recently, in line with its poverty drive, the social infrastructure sector - including, health, education and water supply have increased in importance. A special programme (the JFRP) for the reduction of poverty was started in 2000, through a US\$ 90 million grant from the Government of Japan.

B. *Medium-Term Challenges*

5. The greatest challenge for the Asia and Pacific region is the need for robust and sustainable economic growth to address the poverty reduction agenda.

6. *To effectively reduce poverty, economic growth must be broad based and pro-poor.* Social development will be an important ADB objective in support of economic growth in the region.

7. *Improving ineffective institutions and policies* - the biggest constraints to growth and development in the region.

8. *The role of the private sector must be enhanced to achieve the growth necessary for poverty reduction.* The ADB must play a key role in helping create the enabling environment for the private sector to be fully engaged in the development process by supporting institutional capacity building and policy reform. In addition, ADB will help create investment opportunities; build public-private partnerships, particularly for infrastructure needs; and provide direct private sector investments. ADB will also act as a catalyst to mobilize private resources through commercial cofinancing.

9. *Environmental degradation must be reversed* because it constrains both agricultural and industrial productivity, and hence income growth and the region's prospects for poverty reduction. The promotion of sound institutions and policies are central to addressing environmental issues and to ensuring environmental safeguards. In addition, future economic growth must not be at the cost of further depletion of scarce natural resources. The many cross-border environmental problems must be addressed through regional cooperation efforts, an area of particular ADB strength.

10. *Greater efforts at regional cooperation are essential to widen the range of development options.* Regional public goods include both shared problems and opportunities, for example, the environment (such as forest fires and riparian water rights), health issues (infectious diseases and HIV/AIDS), cross-border trafficking of drugs, trade facilitation, and regional financial stability. Regional cooperation will be an area that must receive increased emphasis over the medium term and become a key area of strategic intervention for ADB.

In addition the ADB has additional policies for important elements of the development approach. For instance, the ADB's Environment Policy was approved in 2002, and there are sector policies for Agriculture and Natural Resources, Fisheries, Forestry and Water, and a strategy for the Pacific, amongst others. As an example, the Environment Policy has been prepared to address five main challenges:

- the need for environmental interventions to reduce poverty
- the need to mainstream environmental considerations into economic growth and development planning
- the need to maintain regional and global life support systems
- the need to work in partnership with others

- the need to further strengthen the processes and procedures for addressing environmental concerns in ADB's own operations.

The Policy highlights a number of areas that require attention in ADB's environmental assessment process. It addresses the need for more upstream environmental assessment at the level of country programming, the need for more structured consultation in the conduct of environmental assessments, the need for greater emphasis on monitoring and compliance with environmental requirements during project implementation, and finally the need to view environmental assessment as an ongoing process rather than a one-time event.

ADB's own analysis of how the Bank should move to encompass poverty is to develop and enhance its poverty-sensitive monitoring and evaluation systems. The challenges include the need to build a systematic framework for analyzing incidence, forms and causes of poverty. The multidimensional nature of poverty necessitates fact-finding without a predetermined sector focus. TAs for poverty assessments will therefore move more to multisectoral approaches.

5.2.4 The Inter-American Development Bank (IDB)

The Inter-American Development Bank (IDB) was a founding member of the CGIAR in 1971. The IDB is the principal source of multilateral financing for economic, social and institutional development projects in Latin America and the Caribbean. These include policy and sector reform programmes and support for public and private investment. The Bank provides loans and technical assistance using capital provided by its member countries, as well as resources obtained in world capital markets through bond issues. The Bank also promotes and participates in a significant number of project cofinancing arrangements with other multilateral, bilateral and private organizations. In its four decades of operations, the Bank has helped to transform Latin America and the Caribbean. Although much remains to be done, the region's social and economic indicators have improved significantly in such areas as literacy, nutrition and life expectancy.

The IDB has two fundamental goals and seven strategies to guide its own activities.

Goals and Priorities

The two main objectives of the Bank as set out in its institutional strategy are:

- poverty reduction and social equity, and
- environmentally sustainable growth.

To attain these objectives, the Bank works in four priority areas:

- Fostering competitiveness through support for policies and programmes that increase a country's potential for development in an open global economy.
- Modernizing the State by strengthening the efficiency and transparency of public institutions.
- Investing in social programmes that expand opportunities for the poor.

- Promoting regional integration by forging links among countries that develop markets for goods and services.

The IDB has a series of strategies aimed at increasing its effectiveness in achieving its own institutional mandates. It has an institutional strategy (entitled *Renewing the Commitment to Development: Report of the Working Group on the Institutional Strategy*), as well as a set of strategies for its two overarching goals, sustainable economic growth and poverty reduction and promotion of social equity. The IDB has also developed strategies for cross-cutting issues, and for each of the countries and sectors in which it operates. In 2003, the institution approved seven new sector strategies on competitiveness, the environment, modernization of the state, poverty reduction, regional integration, social development and sustainable growth. These strategies outline areas for Bank priorities in the immediate future.

The *poverty strategy* notes the requirement to increase opportunities for the poor in the rural sector and to promote a more balanced development in the region. Small producers account for the majority of the rural poor, followed by landless inhabitants and indigenous persons. A significant proportion of small-scale agricultural producers are smallholders with limited opportunities to emerge from poverty through agricultural development. Consequently, the fight against poverty in rural areas requires a set of specific actions to boost the productivity of small-scale farmers with agricultural potential (improvements in access to land and ownership rights, irrigation, research and technology transfer, development of rural financial markets, coordination with the market), and to generate employment and increase the incomes of small-scale farmers without agricultural potential and other rural inhabitants (development of land markets, rural micro enterprise, rural private investment in activities that add value to primary production, and training).

The *sustainable economic growth strategy* notes that the assimilation and development of new technologies is an area that is essential for competitiveness. The Bank expects to play a leading role that will benefit in particular the less developed countries, small-and medium-sized enterprises, and small producers. In this area, the countries will be given support to assess science and technology systems to identify their weaknesses and strengths; improve institutions that generate science and technology through integrated programmes and organizations that generate science and technology knowledge; and strengthen intellectual property rights and accelerate the technical improvement of enterprises. In developing these activities, the Bank will promote partnerships between government, business, and entities that generate knowledge and technology. In particular, the Bank will support efforts aimed at disseminating the use of information technology by micro-enterprises and small businesses in rural areas.

The strategy will also seek to improve productivity of the poorest and excluded populations, since actions that directly benefit marginalized populations and those that promote sustainable economic development are complementary in most cases.

Cooperation between the public and private sectors is required for competitiveness. The Bank has a key role as catalyst and support of dialogue and cooperation processes between the public and private sectors. Additionally, the Bank will promote Corporate Social Responsibility.

The *environment strategy* notes that “one of the major institutional challenges for environmental management has been the tendency to regard the environment as a sector and not as a cross-cutting dimension with shared responsibilities at different levels of policy decision making”. This leads to priorities for institutional strengthening for environmental management, and for the strengthening of the policy framework and incentives.

The *availability and quality of natural resources* are essential parts of the productive base of the region economies and contributing factors to the competitiveness of goods and services produced and exchanged by countries of the region. The Bank will support actions and projects that: preserve and improve the endowment of natural capital as an element to develop environmental goods and services; increase factor productivity; enhance employment of clean production processes; and contribute to the competitiveness of the region through sustainable use of its natural endowment.

The IDB will focus on improving the supply and facilitating access to key productive resources - including the strengthening of property rights. The IDB will support actions that enhance sustainable agriculture, basin and deep valley management, the use of coastal and forest resources as well as eco-tourism. Private sector involvement will be encouraged in environmental initiatives.

5.3 Other Selected International Organizations: FAO, IFAD, and IUCN

There are a number of international agencies and organizations which contribute to the global sum of research for development and environmental sustainability. We have chosen three of these, the FAO, IFAD and IUCN to illustrate how international priorities are addressed through other programmes and the existence of alternative sorts of expertise to complement the work of the CGIAR.

5.3.1 FAO

The Food and Agriculture Organisation (FAO) of the United Nations was a founding member of the CGIAR in 1971, and remains one of the Group's three Co-sponsors, hosting the Technical Advisory Committee and its Secretariat, and until 1994, the CGIAR's International Board for Plant Genetic Resources (IBPGR). Responsibility for the CGIAR is vested in the FAO's Sustainable Development Department.

Today, FAO serves 183 Member Nations and one Member Organization, the European Community, and focuses on the reduction of hunger and poverty in the world. FAO is a crucial source of expertise in agriculture, fisheries, forestry, economics, nutrition and sustainable development. The Organization assists its member countries by disseminating information, providing policy advice and technical assistance, setting standards and organizing fora to forge agreements aimed at promoting food security and the sustainable use of natural resources.

FAO's activities are funded by Regular Programme resources and voluntary extrabudgetary contributions. The Regular Programme, which is developed and approved for a two-year period, is financed through assessed contributions from Member Nations. The scale of

contributions used by FAO is derived from the system adopted by the United Nations (UN) General Assembly.

For the 2002 - 2003 biennium, the Organization is expected to implement projects financed by more than US\$700 million from voluntary contributions. Recent reorganizational efforts have led to substantial decentralization of the organization with greater numbers of field operatives. FAO Representatives have strengthened their involvement in UN country team efforts, including the Common Country Assessment (CCA) and the United Nations Development Assistance Framework (UNDAF).

What are described as “normative activities” are of major importance for an organization recognized as a centre of excellence in setting standards and servicing international conventions and intergovernmental instruments in the areas of its mandate. These activities include:

- Providing a neutral forum for policy dialogue among nations and for the negotiation of international agreements. Significant international agreements and undertakings have been concluded under the auspices of FAO, such as the *Code of Conduct for Responsible Fisheries* and the related international plans of action, and the *International Treaty on Plant Genetic Resources for Food and Agriculture*.
- Developing international norms, standards and conventions. Activities in this area include, among others, the *Codex Alimentarius Commission*, the *International Agreement on Plant Protection*; and the *Prior Informed Consent (PIC) Procedure for Certain Hazardous Chemicals and Pesticides in International Trade*.
- Maintaining and updating databases and statistical information.
- Disseminating information. In this regard, *WAICENT*, which consolidates more than 40 databases, provides governments, research institutions, universities and private users with fast, economical access to the knowledge and information gathered by FAO in its various fields of activities. FAO publishes periodically major reports on the state of food and agriculture, fisheries, forestry, and food insecurity in the world.

Operational activities serve as the main vehicle for the provision of the Organization’s technical assistance to its member countries. FAO has reinforced several major operational initiatives and programmes to mobilize governments, international organizations and all sectors of civil society in a coordinated campaign to eradicate hunger. These include:

The *Special Programme for Food Security (SPFS)*, which mainly assists low-income food-deficit countries. It aims to improve their household and national food security through reduction of year-to-year variability in agricultural production and improvement of people’s income and employment, and thus access to food.

National Strategies for Agricultural Development and Food Security up to the 2010 horizon have been prepared in cooperation with Departments of Agriculture and Economic Affairs and Planning of 150 developing countries and countries in transition. These national

documents are also being integrated into *Regional Strategies for Food Security*. For Africa, the Regional Strategies are now being developed within the framework of NEPAD, and with the involvement of the continent's Ministers for Agriculture.

The *Emergency Prevention System against transboundary animal and plant pests and diseases (EMPRES)* was set up as a medium for early warning and early reaction to address emergencies of this nature. In addition, EMPRES provides a research network to ensure sustainable control techniques.

The *Technical Cooperation Programme (TCP)*, provides quick response to urgent and unforeseen needs for technical assistance.

The *Emergency Operations and Rehabilitation Division (TCE)* was constituted to allow for a more effective and rapid response to food and agricultural emergency needs in countries affected by exceptional natural or human-induced disasters. TCE uses information provided by the *Global Information and Early Warning System on Food and Agriculture (GIEWS)*, which monitors the crop and food supply and demand situation and warns of emerging food crises.

Food Insecurity and Vulnerability Information and Mapping Systems (FIVIMS) is an Inter-agency initiative to promote information and mapping systems on food insecurity and vulnerability.

It will also build on the work of the Millennium Project Task Force on Hunger and other measures being taken to attain Millennium Development Goals.

**Box 5.3: FAO Strategies to Address Member's Needs
(Source: Strategic Framework for FAO 2000-2015)**

A. Contributing to the eradication of food insecurity and rural poverty

A.1 Sustainable rural livelihoods and more equitable access to resources

A.2 Access of vulnerable and disadvantaged groups to sufficient, safe and nutritionally adequate food

A.3 Preparedness for, and effective and sustainable response to, food and agricultural emergencies

B. Promoting, developing and reinforcing policy and regulatory frameworks for food, agriculture, fisheries and forestry

B.1. International instruments concerning food, agriculture, fisheries and forestry, and the production, safe use and fair exchange of agricultural, fishery and forestry goods

B.2 National policies, legal instruments and supporting mechanisms which respond to domestic requirements and are consistent with the international policy and regulatory framework

C. Creating sustainable increases in the supply and availability of food and other products from the crop, livestock, fisheries and forestry sectors

C.1 Policy options and institutional measures to improve efficiency and adaptability in production, processing and marketing systems, and meet the changing needs of producers and consumers

C.2 Adoption of appropriate technology to sustainably intensify production systems and to ensure sufficient supplies of food and agricultural, fisheries and forestry goods and services

D. Supporting the conservation, improvement and sustainable use of natural resources for food and agriculture

D.1 Integrated management of land, water, fisheries, forestry and genetic resources

D.2 Conservation, rehabilitation and development of environments at greatest risk

E. Improving decision-making through provision of information and assessments and fostering of knowledge management for food and agriculture

E.1 An integrated information resource base, with current, relevant and reliable statistics, information and knowledge made accessible to all FAO clients

E.2 Regular assessments, analyses and outlook studies for food and agriculture

E.3 A central place for food security on the international agenda

Strategies to Address Cross-Organizational Issues

Medium Term Plan 2004-2009

The Organization's programme is designed to meet the needs of Members through cross cutting (interdivisional) activities but particularly, through the existing divisions of the FAO, such as Fisheries, Forestry etc. Implementation of the aspects of the strategy and plan are influenced by Members' requirements expressed through FAO and sectoral divisional conferences.

Priority Areas for Inter-disciplinary Action (PAIAs) have been identified as follows:

- Local Institution Building to Improve Capacity for Achieving Sustainable Rural Livelihoods
- Disaster Prevention, Mitigation and Preparedness and Post-Emergency Relief and Rehabilitation
- Biosecurity for Agriculture and Food Production
- WTO Multi-lateral Trade Negotiations on Agriculture, Fisheries and Forestry
- Climate Change Issues in Agriculture
- Organic Agriculture
- Food for the Cities
- Integrated Production Systems (SARD/SPFS)
- Biotechnology Applications in Agriculture, Fisheries and Forestry
- Integrated Management of Biological Diversity for Food and Agriculture
- Strengthening Capacity for Integrated Ecosystem Management
- Spatial Information Management and Decision Support Tools
- Definitions, Norms, Methodologies and Quality of Information
- Global Perspective Studies

- Gender and Development
- Ethics in Food and Agriculture

Box 5.4: The FAO Medium Term Plan
(Source: FAO Medium Term Plan 2004-2009, published 2002)

Major Programme 2.1: Agricultural Production and Support Systems

Covers: Interdepartmental issues arising in Natural Resources, Crops, Livestock, Agricultural Support Systems, and Agricultural Applications of Isotopes and Biotechnology.

Major Programme 2.2: Food and Agriculture Policy Development

Covers: Interdepartmental issues arising in Nutrition, Food Quality and Safety; Food and Agricultural Information; Food and Agricultural Monitoring, Assessments and Outlooks; Agriculture, Food Security and Trade Policy.

Major Programme 2.3: Fisheries

Covers: Fisheries Information; Fisheries Resources and Aquaculture; Fisheries Exploitation and Utilisation; and Fisheries Policy.

Major Programme 2.4: Forestry

Covers: Forest Resources; Forest Products and Economics; Forest Policy and Institutions; Forestry Information and Liason.

Major Programme 2.5: Contributions to Sustainable Development and Special Programme Thrusts

Covers: Research, Natural Resources Management and Technology Transfer; Gender and Population; Rural Development; Food Production in Support of Food Security in LIFDCs.

Major Programme 3.1: Policy Assistance

Covers: Coordination of Policy Assistance and Field Programme Development; Policy Assistance to Various Regions; Legal Assistance to Member Nations.

5.3.2 The International Fund for Agricultural Development (IFAD)

The International Fund for Agricultural Development (IFAD), a specialized agency of the United Nations, was established as an international financial institution in 1977 as one of the major outcomes of the 1974 World Food Conference. IFAD joined the CGIAR in 1979 and is now a co-sponsor of the CGIAR. It has played a particular role in the development of GFAR. Membership in the Fund is open to any state that is a member of the United Nations or any of its specialized agencies, or of the International Atomic Energy Agency. Presently there are 163 Member States.

One of the most important insights emerging from that early Conference was that the causes of food insecurity and famine were not so much failures in food production, but structural problems relating to poverty and to the fact that the majority of the developing world's poor populations were concentrated in rural areas. In this context, IFAD was created to mobilize resources on concessional terms for programmes that alleviate rural poverty and improve nutrition. Unlike other international financial institutions, with broad development objectives, the

Fund has a very specific mandate: to combat hunger and rural poverty in developing countries. The Fund's target groups, therefore, are the poorest of the world's people: small farmers, the rural landless, nomadic pastoralists, artisanal fisherfolk, indigenous people and rural poor women.

Projects are specifically aimed at assisting the poorest of the poor to increase their food production, raise their incomes, improve their health, nutrition, education standards and general well-being on a sustainable basis. Nine major areas are supported:

- agricultural development
- financial services
- rural infrastructure
- livestock
- fisheries
- capacity-and institution-building
- storage/food/processing/marketing
- research/extension/training
- off-farm activities

The cross-cutting issues of environment, household food security and gender continue to be mainstreamed in operations. As a concrete example, anthropometric measures of malnutrition and gender-disaggregated indicators have been introduced on a pilot basis to monitor project impact. A Knowledge-Management Facilitation and Support Unit has been established and a knowledge-management strategy is in preparation. Four thematic groups are operational on the specific themes of diagnostic tools, rangeland management, rural microenterprise and rural finance. Knowledge management on gender-related issues is also being developed.

Approved projects and programmes are financed through loans provided to IFAD's developing Member States²⁷. IFAD also provides grants for: agricultural research (which has included CGIAR Centre partners); other research; and training. IFAD provides technical assistance grants to institutions and organizations in support of activities to strengthen the technical and institutional capacities linked to agricultural and rural development. Grants are limited to 5% of the combined loan and grant programme.

In addition to its Regular Programme, IFAD has mobilized contributions for financing programmes such as the Special Programme for Sub-Saharan African Countries Affected by Drought and Desertification and the Belgian Survival Fund Joint Programme. Collaboration is being strengthened with other international financial institutions in the assessment of policy and institutional environments, notably with the World Bank in the context of developing poverty-reduction strategy papers (PRSPs) and country-specific operations.

²⁷ IFAD's annual commitment level is approximately US\$ 450 million. Since its establishment, IFAD has financed 653 projects in 115 countries and independent territories, to which it has committed US\$ 8.1 billion in project financing. Governments and other financing sources in the recipient countries - including project beneficiaries - have contributed US\$ 8.0 billion to these projects. External cofinanciers have provided US\$ 6.7 billion in cofinancing of which bilateral donors contributed US\$ 1.1 billion, multilateral US\$ 5.3 billion and various international and northern NGOs US\$ 30.2 million.

IFAD's future strategic priorities

IFAD's Strategic Framework for 2002 to 2006 is conceived as part of the broad global commitment to achieving the Millennium Development Goals. It shows continuity with the Strategic Framework for the period 1997-2001, the Action Plan 2000-2002, the Rural Poverty Report 2001, existing regional strategies, and the output of several internal IFAD working groups and task forces.

IFAD will continue to work towards enabling the rural poor to overcome their poverty - as perceived by the poor themselves - by fostering social development, gender equity, income generation, improved nutritional status, environmental sustainability and good governance. Concretely, this implies: developing and strengthening the organizations of the poor to confront the issues they define as critical; increasing access to knowledge so that poor people can grasp opportunities and overcome obstacles; expanding the influence that the poor exert over public policy and institutions; and enhancing their bargaining power in the marketplace. All IFAD's strategic choices (as reflected in regional, country and thematic strategies; loan and grant activities; involvement in poverty reduction strategy papers; policy dialogue; and choice of development partners) will be made with these principles in mind. Attention to the differing opportunities and constraints of women and men, and to sources of vulnerability and ways of increasing resilience will be overarching concerns. IFAD will also work to strengthen the capacity of local and national governments so they can be more effective in responding to the needs of the rural poor.

Box 5.5: Examples of Planned Project activities as of September 2003
<i>Western and Central Africa</i>
<ul style="list-style-type: none"> • Republic of Congo: Rural Development Project in the Departments of Plateau, Central and Western Cuvettes • The Gambia: Integrated Watershed Management Project (PIWAMP)
<i>Western and Central Africa Eastern and Southern Africa</i>
<ul style="list-style-type: none"> • Burundi: Post conflict Restructure Programme • Tanzania: Agricultural Technology. Information and Extension Services Programme
<i>Asia and the Pacific</i>
<ul style="list-style-type: none"> • China: South Guansu Poverty Reduction Programme • Indonesia: Central Sulawesi Poverty Reduction Project for Marginal Upland and Coastal Communities • The Philippines: Microenterprise Promotion Programme • Sri Lanka: Livelihood support and Partnership Programme in the Dry Zone
<i>Latin America and the Caribbean</i>
<ul style="list-style-type: none"> • Colombia: Strategic Rural Development Initiatives Support Project
<i>Near East and North Africa</i>
<ul style="list-style-type: none"> • Azerbaijan: North East Development Project • Yemen: Al-Dhala Community Resource Management Project

Box 5.6: Two Examples of the Expression of IFAD's Regional Strategies

1. For the Asia and the Pacific region. Since 1978, IFAD has funded 152 investment projects in the region for a total commitment of about US\$ 2.4 billion” Grant-funded projects, including CGIAR Centre involvement, are undertaken in agricultural research, training, policy analysis and implementation support. IFAD’s strategy for the region focuses on the “less favoured lands”. It also seeks synergies with the poverty-reduction initiatives of other governments.
2. The Near East-North Africa region (NENA). As of December 2001, IFAD had invested US\$ 980 million in 83 projects in the traditional borrowing countries of the NENA region and had mobilized co-financing of US\$ 1,260 million for these projects: the projects have been for agricultural development (40per cent), rural development (20per cent); credit and financial services (10per cent); irrigation (9per cent); livestock (9per cent); fisheries (6per cent) and research (1per cent). In addition 14 large (greater than US\$ 100,000 each) TA grants for research, training, capacity-building and implementation have been provided for activities in the sub-region.

Linking with CGIAR Centres is a part of the strategic regional plans - aspects of IFAD’s policy work is conducted through linkages with the through the CGIAR and GFAR.

5.3.3 The World Conservation Union (IUCN)

In illustrating the discrete mandates but potential for synergies between international agencies and institutes contributing to global agricultural and environmental research (and thus the priorities part of the “other 96 per cent”), we have further selected IUCN, as an example of an organization which is not a member of the CGIAR, but which conducts directly applicable studies and research. Founded in 1948 as the International Union for the Protection of Nature (IUPN), the renamed World Conservation Union is an international members organization with members from some 140 countries include over 70 States, 100 government agencies, and 750-plus NGOs.

IUCN’s six Commissions (see box) are principal sources of guidance on conservation knowledge, policy and technical advice and are implementers of the Union’s programme. The Commissions are networks of expert volunteers entrusted to develop and advance the institutional knowledge and experience and objectives of IUCN.

Box 5.7. The six Commissions of the IUCN

<i>The Species Survival Commission:</i> advises the Union on the technical aspects of species conservation, and mobilizes action by the conservation community for conservation of species threatened with extinction and those important for human welfare.
<i>The World Commission on Protected Areas:</i> promotes the establishment and effective management of a worldwide representative network of terrestrial and marine protected areas.
<i>The Commission on Environmental Law:</i> advances environmental law both by developing new legal concepts and instruments and by building the capacity of societies to employ environmental law in support of IUCN's mission.
<i>The Commission on Environmental Law:</i> advances environmental law both by developing new legal concepts and instruments and by building the capacity of societies to employ environmental law in support of IUCN's mission.
<i>The Commission on Education and Communication:</i> champions the strategic use of communication and education to promote learning and empower stakeholders to participate in achieving IUCN's mission.
<i>The Commission on Environment, Economic and Social Policy:</i> provides a source of expertise on economic and social factors that affect natural resources and biological diversity, and develop policy advice for the conservation and sustainable use of natural resources.
<i>The Commission on Ecosystem Management:</i> provides expert guidance on integrated ecosystem approaches to the management of natural and modified ecosystems.

IUCN staff members in offices around the world are working on some 500 projects. The mission of the Union is “To influence, encourage and assist societies throughout the world to conserve the integrity and diversity of nature and to ensure that any use of natural resources is equitable and ecologically sustainable”.

The Union has two Conservation Goals: (i) Facing the extinction crisis, and, (ii) Restoring and maintaining ecosystem integrity.

The programme seeks to develop results in seven Key Result Areas (KRAs):

- KRA1 Effective management and restoration of ecosystems
- KRA2 Key institutions, agreements, processes and policies
- KRA3 Incentives and finance
- KRA4 Equitable sharing of costs and benefits
- KRA5 Assessment of biodiversity and of related social and economic factors
- KRA6 Information management and communication systems
- KRA7 Effective, efficient, and accountable governance and management of the Union

A priority of the current IUCN Programme (2001 - 2004) is to build recognition of the many ways that the livelihoods of the poor depend on the sustainable management of natural resources. Through its projects IUCN works to apply sound ecosystem management, and ecosystem restoration, to demonstrate how this is the only way to sustainable livelihoods for those directly dependent on natural resources. IUCN's databases, assessments, guidelines and

case studies prepared by its global membership, Commissions and Secretariat are respected and frequently cited sources of information and reference on the environment.

Special aspects of the programme include:

- Giving policy advice and technical support to global secretariats and the Parties of several international Conventions.
- Assessing all new sites nominated by State Parties for natural World Heritage.
- Monitoring the state of the world's species in the IUCN Red List, and supporting the Millennium Ecosystem Assessment.
- Contributing technical assistance to prepare National Biodiversity Strategies and Action Plans.
- Through the Water and Nature Initiative, working with 80 partners in a five-year global action plan in 10 water basins.
- Through the Forest for Life Strategy, promoting wise management through guidelines for fire prevention and community management of forest resources.
- Working with the corporate sector on energy and biodiversity, and mining and protected areas.
- Providing technical support for drafting environmental laws and natural resource management strategies.
- Facilitating Parks for Peace between countries in areas of conflict (e.g. Convening the World Parks Congress (2003) and organizing the Global Biodiversity Forum held before Convention Conferences).
- Disseminating the Union's knowledge and expertise.

IUCN's New Programme and priorities 2005 to 2008

A new framework programme is being developed (in 2003/4) and will be considered and approved in 2004 for the period 2005 to 2008. Most component programmes are now in the planning phase and will consult with their respective constituencies (Members, Commission Members and other key partners). However, six priority areas are identified in the inter-sessional period:

1. Understanding Biodiversity - Improved knowledge about natural systems.
2. Social Equity - Improved knowledge of the interdependence of social equity and natural systems.
3. Conservation Incentives and Finance - Improved knowledge of indicators and incentives, including financing mechanisms, for efficient biodiversity conservation.
4. International Engagement for Conservation - International arrangements that promote and support effective, efficient and equitable biodiversity conservation.
5. Ecosystems and Sustainable Livelihoods - Ecosystem uses are sustainable and managed to reconcile social, economic and environmental aims.
6. Programme Delivery - (internal to the Union) Effective and efficient delivery of the IUCN Policy and Programme Knowledge produced under KRA.

The IUCN programme is designed to address underlying and direct causes of biodiversity loss and environmental degradation by (i) Integrating, managing and disseminating **knowledge**; (ii) Enabling people and institutions to plan, manage, conserve and use nature and natural resources in a sustainable and equitable manner (**empowerment**);(iii) Promoting effective environmental **governance** at global, regional, national and local levels.

However, poverty is not the only cause of biodiversity loss that needs attention. A key strategy for achieving sustainable development is the promotion of change in human attitudes and practices, encouraging the adoption of more sustainable lifestyles, particularly among affluent groups and societies whose consumption patterns have greater impact on the environment and natural resources. Understanding the way in which market failures and governance failures at different levels interact, and how they affect the use of natural resources, will help identify priorities and opportunities for future work by IUCN to promote more sustainable patterns of production and consumption. This will include work on valuing natural resources as well as creating economic incentives and mobilizing finance for conservation.

5.4 Private Sector Thrusts

In the most dynamic area of agricultural research, genetic manipulation and enhancement through biotechnology, around 70 to 80 per cent of the research and development is currently carried out in the private sector. This strength of the private sector to develop and apply agricultural technologies results from the private sector investment in this area (compared with stabilized or reducing public finances to agriculture) and the acquisition of the intellectual property required to conduct research and to guard profits from the sale of products. Economies of scale have led to the concentration of a large percentage of the expertise and critical IP in a small number of agri-business corporations in the North.

The focus of the plant science industry is on yield protection - through control of weeds, diseases and pests; crop improvement - by making it tougher, less vulnerable or better adapted to specific local conditions (e.g. saline lands, arid areas) or adding qualitative elements (e.g. enhancing nutritional quality and other marketable characteristics). These are similar to the goals of the CGIAR. However, the products of private sector research are intended to be sold into agricultural industrial markets, where a competitive return on investment can be anticipated, and are generally too expensive for small to poor farmers to purchase. Similar arguments apply to the feed and other input requirements such as vaccines, required for livestock and more intensive aquaculture industries. The private sector also encompasses experience and expertise in food processing and the commercialization of products, which could augment the research skills of the CGIAR.

There is however scope for more, and more intensive, cooperation between the private and the public sectors - the formation of public-private partnerships (PPPs)²⁸. Many agricultural corporations and private research institutions - while focusing their research on their own areas and markets - are willing to provide research support for efforts that will lead to products to be used in other non-competitive regions and markets. With appropriately detailed agreements on

²⁸ Leisinger, K.M. (2003) Trends in private sector investments in agricultural, forestry and fisheries R&D in developing countries: Implications for the CGIAR.

access and distribution, research designed to benefit developing country conditions and poorer resource-poor farmers can be conducted collaboratively. The interests of the private sector are generally in the sharing of techniques and experiences of the CGIAR and its partners, and not in the provision of financial support or expected financial returns. There are already CGIAR experiences that demonstrate that properly arranged partnerships could be mutually beneficial. However, there are practical and political obstacles to overcome. Sustainable successes must concentrate on mid- to long-term results and remain flexible and resilient. The inclusion of governments (through their respective NARS) can lead to the production of some essential collective goods and services not able to be provided by individual research actors, and a more efficient use of resources.

The success of PPPs involving the CGIAR will be enhanced by:

- Comprehensive stakeholder dialogue and the establishment of flexible relationships (*see box*)
- CGIAR focus on subsistence farmers (and marginal areas) in developing countries - *this would minimize conflicts of interest in the use of IPR and opens doors for negotiations*
- Strategic impact assessment is required.
- Long-term support for the endeavour should be made clear in CGIAR System plans and programmes which include such partnerships.

Box 5.8: Forming Flexible Relationships for Successful PPPs

- Acknowledgment of the fact that the social environment as a whole, and especially those sectors that are directly affected by the activities of a company, have a legitimate entitlement to have their interests taken into account. Restrictions should be minimized, and ideally, positive externalities should be maximized.
- Analysis of the scientific, social, political, and journalistic arguments on all aspects that are of importance in terms of the cooperative strategies between such actors to prevent "political surprises".
- Ongoing evaluation of the potential implications that this dialogue and potential cooperation may have for the CGIAR and the corporate strategy and future success of all institutions involved.
- Ongoing and as far as possible "dominance-free" communication with all relevant stakeholder groups, including NGOs i.e. not only in problematical times and during public conflicts and controversies, but at all times. A better understanding of alternative views.
- The fact that there are potential conflicts between the interests of private sector company and those of CGIAR Centres (or others such as the FAO or IPGRI) must be openly addressed.

Source: Leisinger (2003)

Additional areas in which the CGIAR already enters into private sector agreements to enhance its research and associated capabilities are in the acquisition of software (e.g. for GIS applications) and ICT.

5.5 Major Donors and Bilateral Programmes (including northern platforms)

Several international agencies of countries which act as multilateral or bi-lateral donors to international agricultural research have centralized the linkages amongst their national agricultural research entities and forged linkages to the CGIAR to enhance information exchange, complementary programming and potential collaboration. An example is provided by CIRAD, where the establishment of Agropolis, in Montpellier, focuses research and encourages links to French science, the placement of CIRAD scientists in IARC programmes, and active involvement as partners in the design and implementation of (all four) Challenge Programmes. Similarly, Wageningen Agricultural University in the Netherlands concentrates wide ranging disciplinary research on agriculture, and seeks explicit linkages with the CGIAR to operationalize and extend its international development mandate.

As another example of the growing convergence of interests, the European Union has created an apex body for European NARS - the European Forum on Agricultural Research (EFARD) - to interact with GFAR and RSOs and provide potential bilateral support for aspects of the agreed priority programmes of GFAR.

The strategy of some major donors (e.g. DFID, UK) to place staff within international agencies has tended to unify development thinking (e.g. on such matters as sustainable livelihood approaches). University linkage schemes (e.g. as operated by USAID, CIDA Canada) allow for collaborative exchanges and the CGIAR to extend its research portfolio through outsourcing.

The Foundations have been free to follow their own priorities and points of leverage in the research for development community. They have provided leadership in such areas as rice biotechnology (e.g. the Rockefeller Foundation - cross cutting and expanding the base of players outside the IARCS) and social science (e.g. the Ford Foundation in community-based management, common property studies, and conflict resolution) and promote activities in these areas through project support to the Centres and their partners.

Large NARS of developing countries, which are also CGIAR investors - such as ICAR of India - have provided facilities to cluster country and regional offices of the CGIAR Centres to maximize bilateral benefits from Centre activities and to encourage cross sectoral spillover.

5.6 Conclusions and implications for CGIAR

The international development banks provide relatively large sums of money to countries for development. The efforts, even when expressed regionally or through country programmes are almost identically aligned with the Millennium Development goals and the alleviation of poverty. Whilst support for agriculture within this framework remains strong (and has grown in the World Bank's portfolio) all banks approach their interventions on a much more diagnostic,

country basis and expect that poverty alleviation will require applications in multidisciplinary approaches. The CGIAR can only contribute in some of these areas (i.e. agricultural research) and should be aware of its limits. The Banks (and the FAO) have research programmes on poverty in which the CGIAR Centres join, and from which all can benefit (FIVMS etc) in the design of future research. The GEF mechanism is appropriate for several global initiatives in the environment - but the approach is country, region or ecosystem focused. Not all are research-based. CGIAR may need to use challenge programme approach to areas more directly related to agriculture or the resource issues it wishes to address.

The FAO is a key player in the development of agricultural information (including its specialist divisions in fisheries and forestry), international agreements and codes of conduct. The CGIAR is well placed to provide advice and information to enhance information resources - and to conduct research in areas that could not be strategically addressed by individual country members of the FAO.

An IFAD strength is community involvement and in broadcasting promising new technologies across wide and/or marginal areas and communities. The authoritative, central agenda of GFAR provides areas through which collaborative developments can be sought.

IUCN could be a good collaborative player in environmental issues. International agencies for environmental protection can bring different perspectives on human and biodiversity approaches, which nevertheless can reinforce and complement CGIAR approaches.

There are strong possibilities for augmenting public-private partnerships between the CGIAR and commercial companies, principally in biotechnical applications on behalf of the poor. Integrated natural resource management research relies to a greater degree on publicly funded organizations, upstream links to universities and agencies and down stream links to national government, NGO and user organizations.

Similar and complementary linkages can be formed with many of “other 96 per cent” of organizations which undertake and fund aspects of agricultural research in its widest sense. It is clear from the Centre MTPs that substantial partnership arrangements are already in place, and managing these partnerships (as well as the management of science in consortia) are skills that the CGIAR will need to maintain and augment to be able to address further new priority areas for research.

The existing research portfolio of the Centres (including the system-wide projects and the four initial CPs, and emerging priorities for the future), together with the demand-led priority setting undertaken by the regional NARS bodies, provide the background to the consultative process undertaken by the SC. The SC process so far aims to identify *additional* areas of research provided by new research or new opportunities for addressing the CGIAR goals. As discussed in Chapter 7, a small number of new areas have been identified. These include new research but there was also a major focus on the need to provide assistance to NARS in key public policy areas. This will enhance their capacity to tackle the swiftly emerging contextual issues that frame current agriculture and natural resource management, and is likely to provide them with the means to develop their own participatory research efforts in the future. The means by which such a “Systemwide” effort should be developed is a strategic issue to be addressed.

The CGIAR has a variable comparative advantage in addressing some of the regional priorities developed by the GFAR-led regional planning. Some of the regional programme activities are already in train and it would be redundant to duplicate these. In other areas, such as UOCs, the number of potentially important species is large and complementary efforts following consultation may be appropriate. One area which was considered of high priority which has not yet so far been adequately formulated are the global and market aspects of animal health and production for human food security and food safety. A review of approaches here may be warranted.

Additional funds for new areas of research are expected to be at least partially available for Challenge Programs. The consultation on priorities for the use of additional funds is useful for this purpose. However, for other research initiatives, including Challenge Programs that partially rely on existing funds, the strategic selection and placement of new research within the CGIAR portfolio requires that the whole portfolio be described and the elements evaluated for relative priority - and likely impacts - versus any programmes that may be added. Major additional research efforts may come from adopting the CPs currently at the proposal stage, some of the elements suggested by GFAR (as above), or the new research and NARS support opportunities identified by the Consultation. Certainly, a strategic framework for selection of CPs in relation to the whole portfolio is required, and "the global issue" selection criterion may need to be evaluated against the output framework adopted by the CGIAR. (The very large budgetary estimates of CPs will change the actual investments aimed at different CGIAR outcomes in 2004). Such are the additional funds required for a number of large, new research efforts that guidance on relative priorities is needed by the CGIAR, its partners and investors. This is required so as to avoid recommendations for new research undermining current activities, or potentially leaving any newly implemented initiatives funded at ineffective levels.

CHAPTER 6 - SYSTEM PRIORITIES FOR THE TOTAL INVESTMENT

6.1 Congruence analysis: Investment Shares by Regions, Sectors and Commodities

6.1.1 The Data Bases

TAC's recommended CGIAR Priorities and Strategies for resource allocation over the 1998-2000 period was supported by congruence analysis. To do this, the TAC Secretariat developed a database comprising information on historical production (1992-94 averages), and on forecasts for production and consumption of CGIAR commodities by 2010, commodity prices, and economic welfare in developing countries including poverty data. The database and related methodologies for processing were presented to the Group at MTM 1997 in Cairo, and they formed the basis on which recommendations for the CGIAR's resource allocation for the period 1998 to 2000 were made.

The 2003 database is an elaboration and update of the former database, and includes:

- Baseline production with the three year period 2000-2002 as current reference
- Projections of production are made to the time horizons 2015 and 2030
- An assessment at the sub-regional level in addition to the regional analysis
- Updated commodity prices in international dollars, averaged for the 1999-2001 period
- An improved structure of the database to facilitate updates and sensitivity analysis

The updated database contains information for 152 countries for quantities of production and prices, as a point of departure, and on income measured in terms of purchasing power parity (PPP); growth in income; distribution of income; a threshold level for income, and a factor combining income information to weight for relative poverty. All results are quoted in shares of the overall budget allocated to 15 crops and to livestock, forestry, and fish, and hence rely on estimates of relative rather than absolute values.

6.1.2 Results by Regions and Sub-regions

The results in the Table 6.1 show the relative shares for the six regions. The value of production (VOP) of CGIAR commodities is by far the largest in Asia, followed by Latin America and the Caribbean and Sub-Saharan Africa. There is no trend in projections that would indicate that the regional rankings change considerably over time. For instance, the relative shares for SSA decrease from current 13% to about 11.6% in 2015, and increase to about 13% in 2030.

Table 6.1 - Regional Shares, and Sub-Regional Shares within Regions, of Values of Production (VOP) of CGIAR Commodities and Base Models²⁹ Weighted with Country Poverty Indicators

Region	1993 VOP	Current VOP	2010 VOP	2010 Base	2015 VOP	2015 Base	2030 VOP
SSA	12.1	12.8	14.6	26.5	11.6	27.4	13.1
- <i>Western</i>		38.1			37.1	39.5	36.9
- <i>Central</i>		11.8			12.9	13.8	13.6
- <i>Eastern</i>		38.3			39.1	41.0	39.8
- <i>Southern</i>		11.8			11.0	5.7	9.7
Asia	60.4	49.1	58.5	55.1	54.8	53.2	53.9
- <i>South</i>		40.5			39.1	62.4	41.5
- <i>Southeast/East</i>		59.2			60.7	37.3	58.4
- <i>Pacific</i>		0.3			0.1	0.3	0.1
LAC	19.0	20.0	18.6	11.9	16.0	9.9	16.5
- <i>Central/Carib.</i>		15.1			19.0	18.9	18.8
- <i>South</i>		84.9			81.0	81.1	81.2
CWANA	8.6	5.5	8.4	6.4	7.7	7.6	8.1
- <i>North Africa</i>		24.0			24.4	19.8	24.9
- <i>West Asia</i>		53.9			49.8	49.3	50.9
- <i>CAC</i>		22.1			25.8	31.0	24.2
CIS		7.0			6.5	1.5	5.5
E. Europe		4.0			3.4	0.4	3.0

However, by weighting the production values with the country poverty indicators (see Section 4.2) a strong shift in regional shares occurs (Base Values in Table 6.1). For each of the two forecasts (2010 and 2015) the regional baseline share of SSA increases considerably - reaching twice the VOP share for 2010 and 2015. Thus, the regional importance of SSA rises to 27.4% in 2015, reflecting the income and poverty projections in the developing countries by then.

The regional importance of Asia remains fairly constant when comparing the VOP with the baseline. Latin America's current VOP is in the order of 20% of the overall; however its relative importance is strongly reduced when country production is subsequently weighted with the poverty indicators, reducing to only 10% in 2015. The results for Central and West Asia/North Africa show that the region broadly maintains its importance comparing the VOP with the poverty weighted values of production. CWANA retains a share in the 6-8% range. The other two regions, namely CIS and Eastern Europe, represent 7.0% and 4.0% respectively of the current VOP of CGIAR commodities. The poverty weighting causes a strong decline in the regional importance of these two regions and the values fall to about 1% and below for the 2015 baseline projections.

The comparison of the 2010 base model with the base model for 2015 shows a slight increase for SSA (0.9) and CWANA (1.2 percentage points), and a decrease for Asia (1.9 percentage points) and LAC (2.0 percentage points).

²⁹ With the base model, the production values are weighted by a country poverty indicator: $(1-w/z)^\alpha$, where $w = (1-G)y$, G is the Gini coefficient, y is an income forecast at purchasing power parity, z is an upper bound on y . For the base model, $z = 9,000$, exponent $\alpha = 2$.

Within the SSA region the results for the 2015 and 2030 data show that the sub-regions of Western and Eastern Africa fetch the highest shares in SSA, attaining values in the 40% range. The southern part of the region reduces in importance when the poverty weighting on the commodities is carried out for the 2015 base model. The Central Africa sub-region has about 13-14% of the regional share.

For Asia, the poverty weighting substantially changes the shares between the Southern sub-region and the combined East and Southeast Asia sub-region. While the Southeast and East Asia share of VOP is roughly two-thirds that of the total region, the poverty weighting in the base model turns the sub-regional importance in favour of Southern Asia. In the projections for 2015, the South Asia sub-region reaches 62% of priorities. The Pacific sub-region is of minor importance in all scenarios.

6.1.3 Results by Sectors

The results by sector (Table 6.2) show that, in terms of VOP, crops have about half of the relative importance of all the CGIAR commodities. Crop values become slightly reduced when the weighting for poverty is taken into consideration.

Table 6.2 - Sectoral Shares of Values of Production of CGIAR Commodities and Base Models Weighted with Country Poverty Indicators

Sector	1993 VOP	Current VOP	2010 VOP	2010 Base	2015 VOP	2015 Base	2030 VOP
Crops	50.5	48.4	51.9	50.4	50.3	50.0	50.4
Livestock	21.8	27.1	22.1	21.0	29.2	28.7	31.6
Forestry ³⁰	20.4	14.8	19.9	23.1	8.7	10.4	7.2
Fish	7.2	9.7	6.1	5.6	11.8	10.9	10.9

Livestock (ruminants' meat and milk only) have between 20 and 30% of the relative importance of the CGIAR commodities, with an increasing share over time for this sector. The relative importance of the livestock sector is slightly reduced when a weighting for poverty is introduced.

The estimates for the VOP for forestry diverge in the two databases. The sector had about 20% of 1993 VOP and 2010 production estimates (in the 1997 database), however forestry is reduced to around 15% of the current VOP and 9% of the 2015 VOP in the updated database. In its 1997 document on priorities and strategies, TAC had already suggested that the values for tree products might be significantly overestimated relative to other products, but more reliable estimates were not available. For this sector, however, it is notable that the poverty weighting increases the relative importance of forestry as a sector in the total, showing the strong relevance of forestry products for the poor.

³⁰ Forestry production projected only to 2010. Therefore, 2030 data is probably an underestimate of the importance of the sector.

In the updated database the fish sector has shares of VOP that are in the order of 10% of all CGIAR commodities. Weighting by poverty reduces slightly the importance of this sector as compared to the other sectors in the 2015 base model.

The comparison of the 2010 and 2015 base models shows that the relative value of the crop sector is slightly reduced by 0.4 percentage points, while the forestry sector is drastically reshaped with a loss of 12.7 percentage points of the overall sector shares. On the other hand, the comparison of 2010 vs. 2015 base model values shows a strong increase for the livestock and fish sectors (plus 7.7 and 5.3 percentage points, respectively).

6.1.4 Results for the CGIAR Crop Commodities

Rice is by far the most important CGIAR crop (Table 6.3). Its relative shares are in the order of 15% of the overall CGIAR commodities (including livestock, forestry and fish). The VOP reduces until 2030, while the poverty weighted VOP for this crop increases slightly for the 2015 model.

Table 6.3 - Commodity Shares of Values of Production of CGIAR Commodities and Base Models Weighted with Country Poverty Indicators

Crop	1993 VOP	Current VOP	2010 VOP	2010 Base	2015 VOP	2015 Base	2030 VOP
Banana & plantain	2.4	2.1	2.5	2.6	2.2	3.7	2.3
Barley	0.8	0.9	0.8	0.6	0.9	0.4	0.9
Pulses	3.2	1.7	3.8	4.5	2.3	3.2	2.3
Cassava	2.0	1.7	2.0	2.8	1.6	3.1	1.7
Coconut	0.9	0.6	0.7	0.7	0.7	0.8	0.7
Groundnut	2.3	2.0	2.8	3.2	2.4	3.0	2.7
Maize	5.5	4.8	5.8	4.6	5.7	4.0	6.2
Millet	0.8	0.6	0.7	1.1	0.6	1.2	0.6
Potato	2.0	4.5	1.9	1.6	4.4	2.7	4.2
Rice	17.1	15.4	17.7	16.9	15.2	16.4	14.2
Sorghum	1.0	0.7	1.1	1.3	0.7	1.1	0.8
Soya bean	2.6	2.7	3.5	2.5	3.0	2.0	3.7
Sweet potato	1.8	1.7	1.5	1.0	2.0	1.8	1.9
Other roots	0.7	1.0	0.6	1.0	0.4	0.8	0.4
Wheat	7.4	8.0	7.0	5.9	8.0	5.7	7.7

By VOP, wheat and maize follow as most important crops. However, for both commodities, the poverty weighting dampens their relative importance. For the 2015 baseline calculations, both crops are reduced by about 2 percentage points, though together they still represent 9.7% of the total (in the 2015 baseline).

The other crops follow with an order of magnitude between 0.6% (coconut and millet) and 4.4% (potato) of the current value of production of CGIAR commodities. Essentially, the commodities can be evaluated according to the effect the poverty weighting has on their relative importance, e.g., those that are lifted up in relative importance, those that remain stable and the commodities that are reduced in importance.

For the 2015 calculations, the commodities that significantly gain from poverty weighting, showing their importance for poorer countries and poor farmers, are banana and plantain, pulses, cassava, groundnut, millet, sorghum and other root crops. The greatest difference following poverty weighting for individual commodities occurs for cassava, and banana and plantain, which gain 1.5 percentage points after weighting.

The comparison of the 2010 with the 2015 base models shows that for many crops there are only slight differences in relative importance with changes in the order of 0.1 to 0.3 percentage points. Marked increases in the 2015 model are for banana and plantain (+ 1.1%), potato (+ 0.9%), and sweet potato (+0.8%). Reductions occur in pulses (-1.3%), although this also reflects the new commodity price estimates that are lower for pulses, as well as for maize (-0.6%) and rice (-0.5%).

6.1.5 Regional Importance for the CGIAR Sectors in the 2015 Base Model Projections

Table 6.4 shows that Asia has the highest values for the aggregates of the four CGIAR sectors, having roughly one-half of the relative shares of each sector. Only in the case of forestry is there comparability between regions - with Africa reaching 40%, close to Asia's 43%. SSA is second in ranking also for the other three sectors crops, livestock and fish with values ranging between about 20% and 29%. The regional shares of LAC and CWANA are lower and range from 5% to 15% of the sector totals.

Table 6.4 - Regional Shares of CGIAR Sectors for the 2015 Base Model Calculations

Region	SSA	Asia	LAC	CWANA	CIS	Eastern Europe
Crops	29.3	56.4	8.0	4.9	1.3	0.2
Livestock	20.1	49.7	14.5	13.0	2.1	0.5
Forestry	40.4	43.5	10.1	4.6	0.7	0.7
Fish	25.4	57.1	6.0	9.0	1.2	1.3

Table 6.5 - Regional Shares of CGIAR Sectors for the 2010 Base Model Calculations

Region	SSA	Asia	LAC	CWANA	CIS	Eastern Europe
Crops	21.0	63.7	10.0	5.3	--	--
Livestock	21.8	48.9	14.6	14.7	--	--
Forestry	44.1	39.6	14.2	2.0	--	--
Fish	20.6	65.4	9.7	4.6	--	--

In comparing the regional sector shares in the 2010 and 2015 base models (in the two tables above), it is evident that the crop sector increases in SSA, by 8.3 percentage points, with a corresponding reduction in Asia. Similarly, LAC and CWANA also see their share of the crop sector reduced slightly. The regional shares of the livestock sector are roughly in the same order of magnitude for the two base models. For the forestry sector, there is a reduction from the 2010 base model values for the SSA and LAC regions with, respectively, 3.7 and 4.1 percentage points losses, while Asia increases by 4 percentage points and CWANA by 2.6 percentage points. Finally, the fisheries sector changes substantially with reductions in the regional shares of Asia and LAC, of 8.3 and 3.7 percentage points respectively, and increases for SSA (a gain of 4.8 percentage points) and CWANA (a gain of 4.4 percentage points). However, Asia continues to dominate.

6.1.6 Sensitivity Analysis on the 2015 Base Model

The base model can be manipulated to understand the effects of the variables in the poverty modifier on the modified values of production. Table 6.6 gives the results of this sensitivity analysis. The Human Development Indicator (HDI) and the Human Poverty Indicator (HPI) have been used as poverty modifiers in the sensitivity analysis (shown in the last two columns of table 6.6).

Table 6.6 - Regional Shares of Value of Production and Modified VOP in the Sensitivity Analysis on the 2015 Base Model

Region	2015 VOP	2015 Base	Gini coefficients	Income growth	Gini & growth	Income threshold	Poverty exponent	1-HDI	HPI
SSA	11.6	27.4	35.5	24.0	31.0	38.7	34.3	19.2	21.8
Asia	54.8	53.2	51.7	56.0	55.7	47.3	49.1	57.0	62.2
LAC	16.0	9.9	4.1	10.2	4.6	6.0	7.8	10.8	8.7
CWANA	7.7	7.6	7.3	7.4	7.1	7.0	7.4	6.8	7.3
CIS	6.5	1.5	1.0	2.0	1.2	0.5	0.9	4.4	--
Eastern Europe	3.4	0.4	0.5	0.4	0.4	0.5	0.5	1.9	--

Legend on sensitivity analyses:

1. Gini coefficients: Weight of the Gini coefficients reduced by 50%.
2. Income growth: Growth rates reduced by 25%.
3. Gini and growth: Combines 1 and 2 above.
4. Income threshold: Country income threshold reduced from PPP\$9,000 to 6,000.
5. Poverty exponent: Poverty exponent alpha raised from 2 to 3.
6. 1 – HDI: Weighting of production values using the complement to one of the Human Development Indicator.
7. HPI: Weighting of production values using the Human Poverty Indicator.

In the sensitivity analysis, the first parameters that were modified are the weights of the Gini coefficients of income distribution. The weights have been reduced by 50%, reducing the effect of the real skewness of income distribution on the base model calculations. The results show that the regional priority for LAC is considerably reduced while that of SSA increases strongly.

The second parameter that was tested in the sensitivity analysis was income growth. More conservative income growth projections have been used in this model, with growth rates reduced by 25%. The results show that the regional importance of Asia increases compared to the base model, while that of SSA is slightly reduced, and the share of LAC stays constant.

The combined effects of the changed Gini coefficients and income growth parameters produce results that are a combination of the sensitivity analyses carried out individually. The regional share of LAC reduces significantly to 4.6% of overall priorities, while SSA's regional share stays at 31%. Asia's share is more affected by the reduction in income projections than by the reduced Gini coefficients, and the results for this region are close to the shares resulting from the sensitivity analysis on income growth alone (56%).

The greatest effect in the sensitivity analysis is caused by a reduction of the income threshold to only 6,000 PPP \$ in 2015. This means that all countries that have incomes - adjusted for distribution by weighting with the Gini coefficient - above that threshold are excluded from the database calculations. Poverty is most striking in SSA and Asia, and under this scenario they

together make up 86% of the share for the CGIAR. There is only 8.6 percentage points difference in share between the two regions.

A further sensitivity analysis was carried out by changing the poverty exponent, which measures the depth of poverty, from 2 to 3. The results show, as compared to the 2015 base model, that the regional shares for SSA increase by 7 percentage points, while those for Asia and LAC drop by 4 and 2 percentage points respectively.

Weighting using the Human Development Indicator (HDI) further modified the values of production. The values are multiplied by 1-HDI, and thus the achievements in development in the countries are the only factor for weighting the values of production. In this analysis, the regional shares for SSA drop by 8 percentage points as compared to the base model, while those for Asia increase by 4 percentage points. Also LAC increases slightly, but the strongest effect is for the CIS region, where the regional share more than doubles from 1.5% in the base model to 4.4% in the HDI analysis.

Finally, by using the UNDP's Human Poverty Index (HPI) as weight (unfortunately, no data is available for this parameter for CIS and Eastern European countries) the results show the highest values for Asia of all the sensitivity analyses (62% of adjusted VOP), and the orders of magnitude for the other three regions are comparable to the results for the parameter 1-HDI.

The region least affected by changes in parameters in the sensitivity analyses is the CWANA region. Its values remain fairly close to the results of the base model (7.6%) and their range is slightly reduced, from 6.8% to 7.4%, depending on the variables tested.

6.1.7 Comparison of the 2010 and 2015 Base Model Sensitivity Analyses

The comparison of the two sensitivity analyses carried out on the data sets shows a broad congruence between the trends in the datasets (Table 6.7). The sensitivity analysis exhibits some differences when weighted by the two parameters of the Gini coefficient, or the exponent of poverty. In both cases SSA gained lower values in the sensitivity analysis in the 2010 base model and Asia had higher relative values. However, both datasets have a common trend - when poverty variables are increased in importance, the shares of SSA and Asia increase and the relative share for LAC decreases slightly.

Table 6.7 - Regional Shares of Value of Production and Modified VOP in the Sensitivity Analysis on the 2010 Base Model

Region	2010 VOP	2010 Base	Gini coefficients	Income growth	Gini & growth	Income threshold	Poverty exponent
SSA	14.6	26.5	31.6	24.2	28.1	39.8	31.4
Asia	58.5	55.1	55.5	57.7	58.7	50.9	52.3
LAC	18.6	11.9	7.1	11.4	7.2	4.4	10.9
CWANA	8.4	6.4	5.7	6.6	6.0	5.0	5.4

6.1.8 Comparison of the Two Databases with TAC Recommendations and Actual Expenditures

Table 6.8 shows the results for the two databases and compares them with TAC Recommendations in 1997, and actual expenditure in 1998 and 2002. The crop sector made up two-thirds of TAC's recommendations in 1997, and the actual expenditure was slightly higher for 1998. The values for the 2015 VOP and 2015 base model are similar, although slightly lower. The actual expenditures for the crop sector declined from 71% to 69%.

Table 6.8 Comparison of the Sector Results of the Two Databases with TAC Recommendations and Actual Expenditures (values represent shares)

Database	1997 run				2003 run		
	2010 VOP	2010 Base	TAC Rec.	Actual in 1998	2015 VOP	2015 Base	Actual* in 2002
Crops	51.9	50.4	66.2	71.0	50.3	50.0	69.0
Livestock	22.1	21.0	16.7	14.0	29.2	28.7	14.0
Forestry	19.9	23.1	12.2	12.0	8.7	10.9	12.0
Fish	6.1	5.6	4.9	3.0	11.8	10.7	5.0

* Taken from the TAC Commentary on the 2000-2002 MTPs (2002 "Plan"). More recent data is not available.

For the livestock sector TAC recommended an investment of about 17% of the total. This value is considerably lower than the results of the VOP and base model calculations for both databases. The actual expenditures stand at 14% and are lower than the recommended level.

The VOP of the forestry sector decreases in relative share when the two databases are compared. The TAC recommended investment in forestry and the expenditure are in line and stay at 12% of resources for all sectors. For the fish sector, there is an increase in the shares when the two data sets are compared. The 2015 VOP and base model calculations give values that are approximately doubled as compared to the 1997 dataset. The present expenditure on fish, about 5.0%, is in line with the 1997 recommendation for the sector (4.9%).

Table 6.9 Comparison of the Commodity Results of the Two Databases with TAC Recommendation and Actual Expenditures (values represent shares)

Database	1997 run				2003 run		
	2010 VOP	2010 Base	TAC Rec.	Actual in 1998	2015 VOP	2015 Base	Actual* in 2002
Banana & plantain	2.5	2.6	3.9	2.8	2.2	3.7	3.4
Barley	0.8	0.6	1.2	1.7	0.9	0.4	1.7
Pulses	3.8	4.5	9.5	11.7	2.3	3.2	10.2
Cassava	2.0	2.8	5.7	5.8	1.6	3.1	5.2
Coconut	0.7	0.7	0.8	0.2	0.7	0.8	0.2
Groundnut	2.8	3.2	2.8	2.0	2.4	3.0	2.2
Maize	5.8	4.6	7.1	7.3	5.7	4.0	7.1
Millet	0.7	1.1	2.5	1.8	0.6	1.2	2.5
Potato	1.9	1.6	4.5	6.4	4.4	2.7	6.2
Rice	17.7	16.9	15.9	16.5	15.2	16.4	16.5
Sorghum	1.1	1.3	2.1	2.3	0.7	1.1	2.3
Soyabean ³¹	3.5	2.5	0.5	0.6	3.0	2.0	0.7
Sweet potato	1.5	1.0	1.8	1.9	2.0	1.8	2.2
Other roots	0.6	1.0	1.4	1.0	0.4	0.8	1.1
Wheat	7.0	5.9	6.6	8.8	8.0	5.7	8.0

* Taken from the TAC Commentary on the 2000-2002 MTPs (2002 “Plan”). More recent data is not available.

Table 6.9 illustrates the shares of the commodities in the two datasets, together with the TAC recommendations in 1997 and actual expenditures for 1998 and 2002. It has to be kept in mind that the totals for all crops in the sector given in Table 6.9 are different in the datasets as compared to recommendations and actual expenditures. This difference is reflected in the increased shares for recommendations and actual expenditures.

Assessing individual crops, there appears to be overinvestment in pulses, potato and wheat when TAC recommendations are compared with 1998 actual expenditures. There is underinvestment in banana and plantain, groundnut, millet and yams. The comparison of 2015 baseline shares for crops and the 2002 actuals show that there is an imbalance of shares for pulses, cassava, maize, potato and wheat, that all have higher actual expenditure shares than their shares in the base model. The only crop where actual expenditures are inferior to the 2015 baseline values is coconut. For rice, the values for modified VOP and the 2002 actual expenditures are very close. However, again it has to be kept in mind that 2015 baseline crops add up to 49.7%, while actual expenditures add up to 69%.

³¹ This is a global value for soyabean. The CGIAR works on soya only in Africa, with about 4% of global total.

Table 6.10 - Comparison of the Results for the Regions of the Two Databases with Recommendations and Actual Expenditures (values represent shares)

Database	1997 run				2003 run		
Region	2010 VOP	2010 Base	TAC Rec.	Actual in 1998	2015 VOP	2015 Base	Actual in 2002
SS-Africa	14.6	26.5	--	41	11.6	27.4	43
Asia	58.5	55.1	--	32	54.8	53.2	32
LAC	18.6	11.9	--	18	16.0	9.9	15
CWANA	8.4	6.4	--	10	7.7	7.6	10
CIS					6.5	1.5	--
E-Europe					3.4	0.4	--

Table 6.11 Comparison of the Results by Regions and Sectors within Region for the Two Databases with Recommendations and Actual Expenditures (values represent shares)

Database	1997 run			2003 run		
Region and Sector	2010 Base	TAC Rec.	Actual in 1998	2015 VOP	2015 Base	Actual in 2002
SS-Africa	26.5	--	41	11.6	27.4	43
Crops	39.9			52.4	53.5	
Livestock	17.3			22.6	21.1	
Forestry	38.4			15.0	15.3	
Fish	4.3			10.0	10.1	
Asia	55.1	--	32	54.8	53.2	32
Crops	58.2			55.9	53.0	
Livestock	18.6			21.5	26.8	
Forestry	16.6			8.0	8.5	
Fish	6.6			14.6	11.7	
LAC	11.9	--	18	16.0	9.9	15
Crops	42.2			41.1	40.5	
Livestock	25.7			44.6	42.2	
Forestry	27.5			9.0	10.6	
Fish	4.5			5.4	6.6	
CWANA	6.4	--	10	7.7	7.6	10
Crops	41.3			37.2	32.1	
Livestock	47.8			45.9	48.8	
Forestry	7.1			5.6	6.3	
Fish	3.7			11.2	12.8	
CIS				6.5	1.5	--
Crops				38.9	44.6	
Livestock				44.2	41.4	
Forestry				7.9	5.0	
Fish				8.9	9.0	
E-Europe				3.4	0.4	--
Crops				31.9	21.8	
Livestock				49.1	31.3	

Forestry				5.2	16.0	
Fish				13.7	30.9	

In 1997, TAC gave no recommendations by regions and sector within region. Sector shares within region add up to 100 percent. The CGIAR financial information allows no breakdown for sectors by region.

6.1.9 Conclusions

Major differences emerging from the 2010 Baseline (1997 run result) and the 2015 Baseline (2003 run result) are:

Sector-shares

- Forestry share falls from 23.1% to 10.4%, a dramatic shift reflecting a large overestimation in the value of tree products in the earlier database (now corrected). Crops' share remains roughly the same (~ 50%).
- The gainers are livestock and fisheries. Livestock's share rises from 21.0% to 28.7%, and fisheries' from 5.6% to 10.9%.

The 2010 baseline results had a dominant influence on TAC's recommendations to the Group in 1997 about target investment shares across the Sectors. Another factor influencing the recommendation was the current expenditure shares. In many cases these diverged quite significantly from the baseline results (see Table 6.12 below). Thus, in the earlier exercise, TAC recommended that 66.2% of the System's resources be allocated to the Crops sector, compared with the baseline result of 50.4%. This was largely (but not only) in recognition of the fact that the current allocation (in 1997) was 71.0%, and time was needed for the transition. A similar picture held for the other sectors, which were 'under-subscribed', based on the 2010 baseline results. Livestock was in 1998 receiving only 14.0% of the System's resources. TAC recommended a more realistic 16.7% share of resources to bring it closer in line with the poverty-weighted value of production 2010 baseline figure of 21.0%. For fisheries, TAC's recommendation to the Group (4.9%) was more closely aligned with the 2010 baseline result (5.6%), whereas the current allocation at the time was considerably lower (3.0%).

Table 6.12: Sector Priorities and Allocation of Resources

	1997 run			2003 run	
	2010 baseline	Actual shares in 1998	TAC recomm.	2015 baseline	Estimated shares in 2002
Crops	50.4	71	66.2	50.0	69
Livestock	21.0	14	16.7	28.7	14
Forestry	23.1	12	12.2	10.4	12
Fish	5.6	3	4.9	10.9	5

Data are not currently available to examine to what extent actual expenditures have come in line with TAC's recommendation over the past few years. The last year for which actual expenditures on sector allocations were presented was 1999. However, based on the 2002 "plan" data in the 2000-2002 Financing Plan Report of the CGIAR Secretariat, there does not appear to be significant changes in expenditure patterns across the System. The expenditure share for Crops is slightly down (as TAC recommended), Fisheries is up (from 3% to 5%) and Forestry and Livestock remain unchanged. The divergence between the baseline run results and actual expenditures have widened for livestock and for fisheries, in fact, quite significantly. One could surmise that, if the SC were following a similar approach as TAC, the recommended shares of investment for livestock and fisheries would be considerably higher this time around, while those for crops (and maybe forestry) would be relatively lower.

Regional Shares

A comparison of the baseline results from 2010 (1997 run) and 2015 (2003 run) show a slight increase in investment share in SSA, from 26.5% to 27.4%, but a more significant decrease in investment share in Asia, from 55.1 to 53.2%. Interestingly, a relatively large percentage increase is shown for CWANA rising from 6.4% to 7.6% (an 18% increase), whereas LAC's investment share fell from 11.9% to 9.9%. Much of this is shaped by projections of population growth, income growth and declining incidence of poverty. It appears that Asia and LAC are expected to perform much better for these parameters relative to SSA and CWANA.

Over all, considering both the sector and regional aspects, the changes between these two period runs (1997 and 2003) are not really that great (with the exception of the forestry sector). The absence of any big changes is somewhat surprising, although new runs (e.g., using future prices, and making other adjustments - see comments below) could well bring about more fundamental differences.

Sensitivity Analysis

The results of the sensitivity analysis and the subsequent discussion highlight a critical aspect not to be overlooked in this type of analysis. The sensitivity analysis shows that results vary considerably depending on the way in which VOP is modified to arrive at the baseline result. Merely by lowering the income threshold to \$6,000 PPP (vs. \$9,000 PPP), the share of investment to SSA goes up from 27.4% to 38.7%. By substituting the HDI (human development indicator) modifier for the standard baseline modifiers, that same share falls to 19.2%! One could reasonably argue that the HDI modifier is an appropriate one to use, although the range of possible modifiers and combinations is wide. This highlights the importance of the SC systematically discussing the criteria that should be used, and identifying what the trade-offs (advantages) are in using one over another. Additional definitions will be required with respect to: what weight should be given to poverty (absolute numbers), commodity value of production, poor people's dependence on specific commodities, overall level of development, specific research opportunities and probabilities of success, strength of NARS, capacity of the private sector and other alternative suppliers, and so on. A systematic approach is needed.

Finally, thought needs to be given to how the results of the current congruence analysis can be factored into, and complement, the continuing stakeholder and scientists' consultation-based P&S exercise.

Qualifiers

The 2003 run used current prices. The use of 2015 projected prices will undoubtedly affect these results in a significant way, but it is not possible to say in which direction.

Crops still 'command' about 50% of the investment share, based strictly on the 2015 VOP and 2015 baseline results. One very important aspect not captured in this assessment is the degree to which other players, notably the private sector, have developed capacity to carry out research on crops. Three crops alone, rice, wheat and maize, account for almost 50% of the crop sector investment share, and these are crops for which considerable activity and capacity now exists in the private sector in developing countries. In subsequent runs, the SC might wish to consider modifying the importance of these crops accordingly.

An interesting result is that for fisheries the 2015 VOP is higher than the 2015 baseline reflecting the model's sensitivity to income levels. What must be born in mind, however, is that typically, the fisher folk are among some of the poorest in these countries. Hence, in future runs of the 2015 baseline, some sort of adjustment might be considered, perhaps a heavier poverty weighting for this sector.

6.2 Analysis of Trends in the CGIAR resource allocation: 1972-2003 and proposals for 2004-06

The four tables (6.13-6.16) in this section give the historical and current picture on the allocation of CGIAR resources to commodities, sectors, CGIAR research undertakings, regions of the world and CGIAR institutes for the years 1972 to 2003. This is important to understand how in the System there has been a change in direction of fund allocation to new activities, to new Centres joining the system, and to see how these tendencies have been reflected and driven by recommendations with regard to System priorities made by TAC.

6.2.1 Allocation to Commodities and Sectors

From the available information on allocation to commodities and sectors, a broad-brush picture is available for groups of commodities and detailed information only for the main staples rice, wheat and maize (Table 6.13). Cereals were the major recipient of funds in the earlier days of the CGIAR, when up to 50% of funds were concentrated on this commodity group from about 1972 to 1991. Rice is by far the most important single crop commodity that was receiving research funding, with a share of 20-25% over the same period. Rice research has been actively pursued since the early days of the CGIAR at several research institutes, namely IRRI, CIAT, IITA and WARDA, leading to this large share of investments for the commodity. The CGIAR is still putting the bulk of its resources into cereals research and the three main staples, as the comparison of 2002-2003 levels of investment with TAC's recommendations for the year 2000 shows.

Table 6.13 - CGIAR Resource Allocation, 1972-2003 by Sectors and Commodities
(Millions of current US dollars and percentages)

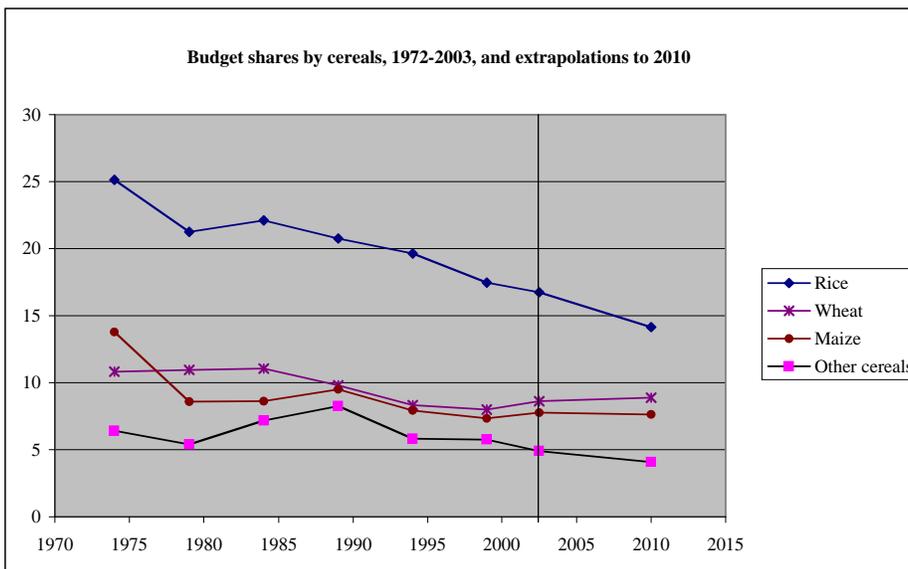
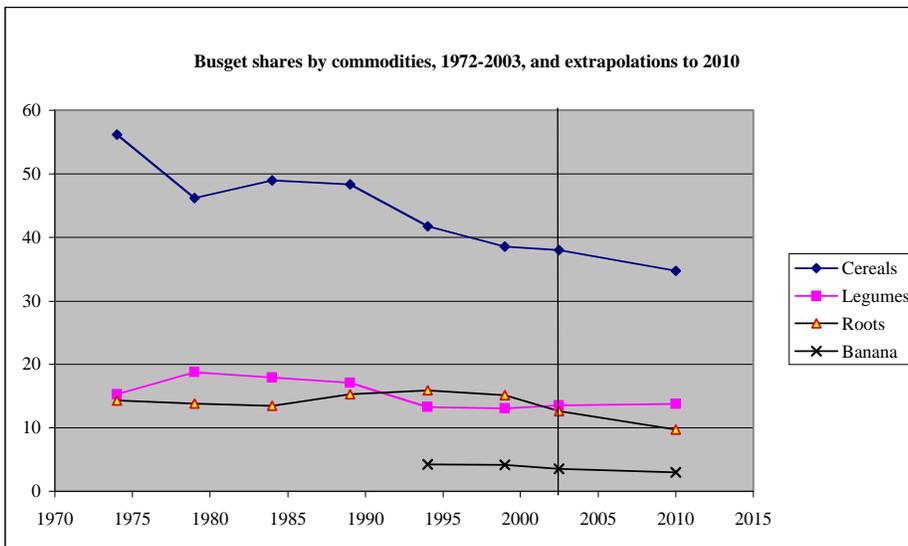
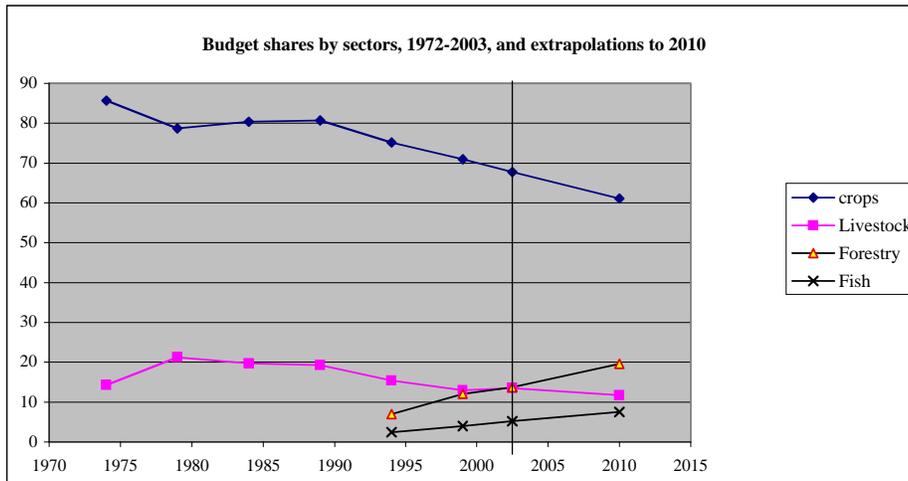
Sectors	Commodities	Cereals	1972-1976	1977-1981	1982-1886	1987-1991	1992-1996	1997-2001	2002-2003	Extrapolation*	TOTAL	TAC rec.
			\$	\$	\$	\$	\$	\$	\$	\$	2010	1972-2003
Crops			174	467	763	1045	1082	1036	401		4968	
	Cereals		114	274	465	626	601	563	225		2868	
		Rice	51	126	210	269	283	255	99		1293	
		Wheat	22	65	105	127	120	117	51		607	
		Maize	28	51	82	123	114	107	46		551	
		Other cereals	13	32	68	107	84	84	29		417	
	Legumes		31	111	170	221	191	191	80		995	
	Roots and Tubers		29	82	128	198	229	221	75		962	
	Banana/Plantain						61	61	21		143	
Livestock			29	126	187	250	222	190	80		1084	
Forestry							101	176	81		358	
Fish							35	59	31		125	
Total			203	593	950	1295	1440	1461	592		6534	
Sectors	Commodities	Cereals	%	%	%	%	%	%	%	%	%	%
Crops			86	79	80	81	75	71	68	61	76	66
	Cereals		56	46	49	48	42	39	38	35	44	35
		Rice	25	21	22	21	20	17	17	14	20	16
		Wheat	11	11	11	10	8	8	9	9	9	7
		Maize	14	9	9	9	8	7	8	8	8	7
		Other cereals	6	5	7	8	6	6	5	4	6	5
	Legumes		15	19	18	17	13	13	14	14	15	13
	Roots and Tubers		14	14	13	15	16	15	13	10	15	13
	Banana/Plantain						4	4	4	3	2	4
Livestock			14	21	20	19	15	13	13	12	17	17
Forestry							7	12	14	20	5	12
Fish							2	4	5	8	2	5
Total			100	100	100	100	100	100	100	100	100	100

*Extrapolations are linear over the 1992-96 to 2002-03 period, using 1994 as the base point.

Since the early days of the CGIAR, legumes and roots and tubers have continued to receive sizeable support. For legumes, this support increased in the late 70s and in the 80s, but then the funding declined and is now more in line with the recommendations made by TAC for the year 2000.

Evaluation of trends by sector shows that the CGIAR is, as a whole, slightly oversubscribing to the crop and forestry sectors, and that it is not fulfilling the recommended share for the livestock sector. Fisheries research has been undertaken in the CGIAR System since the early 1990s and has seen a substantial increase in funding. Present levels are almost in-line with the recommendations. Figure 6 illustrate these trends.

Figure 6. CGIAR resource allocations 1972-2003 by sectors and commodities



6.2.2 CGIAR Resource Allocation by Undertaking and Output

In Table 6.14 estimates are shown for the allocation of CGIAR resources to CGIAR research by type of undertaking and type of output, the latter for the most recent years. It can be seen that from the early days of the System, there has been a constant decline in the percentages allocated to productivity enhancing research, which was the main undertaking and had the lion's share initially, with about two-thirds and more of all resources. Consequently, over time the CGIAR has started to diversify research undertakings and to put more emphasis on research on policy issues, on protecting the environment and saving biodiversity. Strengthening national agricultural research systems, however, has always been a prominent part of the CGIAR undertakings and has achieved about 20 percent of resources since the earliest days and kept this level of funding almost throughout the whole period until the present.

It is interesting to note that the comparison of 1997-2001 funding levels for the undertakings and 2002-2003 funding levels for the CGIAR outputs are rather close to the TAC recommendations for the year 2000 on CGIAR research directions. Notably, the only undersubscribed undertaking is productivity enhancement (breeding) by 3 percentage points, while policy research and strengthening of NARS are slightly above the recommended outcomes of fund allocation. Looking at the classification of research by CGIAR output, again it is noted that germplasm improvement falls short by about 2 percentage points in funding, as does sustainable production (also 2 percentage points below target). In the years 2002-2003, policy research has reached 15 percent of resources allocated to the CGIAR, and is about 3 percentage points above the target set by TAC in 1997.

Table 6.14.1: CGIAR Resource Allocation 1972-2003 by Undertaking
(Millions of current US dollars and percentages)

Undertakings	1972-1976	1977-1981	1982-1886	1987-1991	1992-1996	1997-2001	TOTAL	
	\$	\$	\$	\$	\$	\$	\$	
Productivity	151	433	648	893	757	619	3,501	
Environment	12	56	93	98	245	317	821	
Biodiversity	1	15	33	55	140	179	423	
Policy		7	27	38	172	221	465	
NARS	40	106	220	338	349	378	1,431	
Total	204	617	1021	1422	1663	1715	6,642	

Undertakings	TAC rec. year 2000							
	%	%	%	%	%	%	%	%
Productivity	74	70	63	63	46	36	39	53
Environment	6	9	9	7	15	18	18	12
Biodiversity	0	2	3	4	8	10	11	6
Policy	0	1	3	3	10	13	12	7
NARS	20	17	22	24	21	22	20	22
Total	100	100	100	100	100	100	100	100

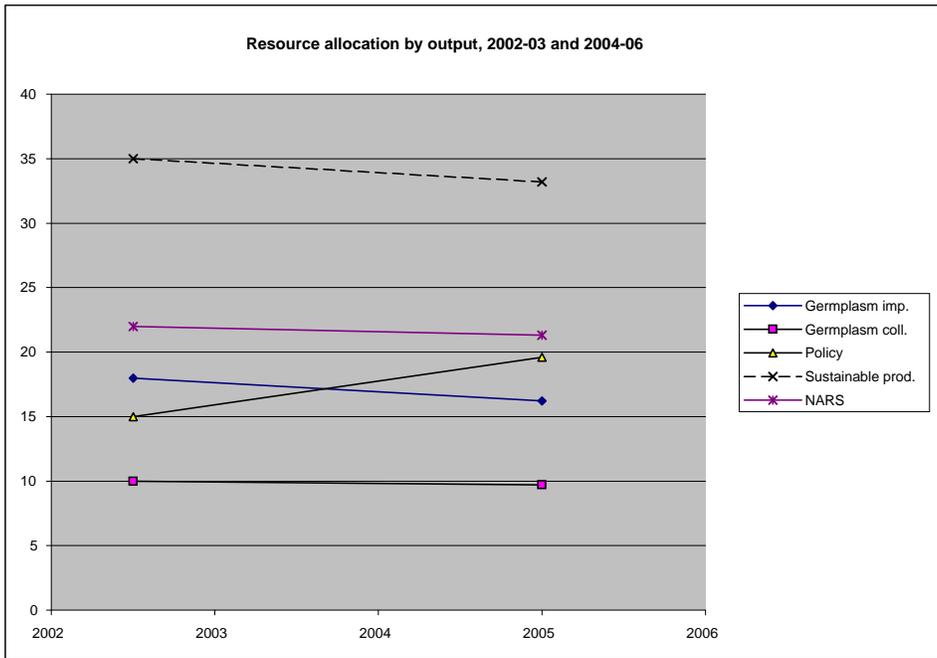
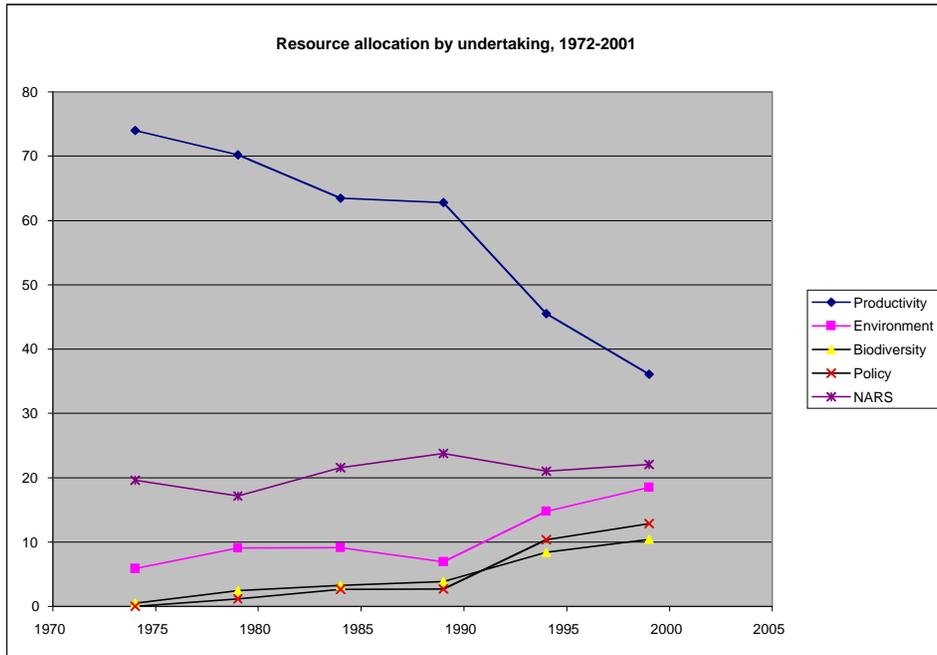
Table 6.14.2: CGIAR Resource Allocation 1972-2003 by Output

Output	2002-2003	2004-06	
	\$	\$	
Germplasm improvement	132	198	
Germplasm collection	73	119	
Policy	116	239	
Sustainable production	260	406	
Enhancing NARS	165	261	
Total	746	1221	

Output	TAC rec. year 2000		
	%	%	%
Germplasm improvement	18	20	16
Germplasm collection	10	11	10
Policy	15	12	20
Sustainable production	35	37	33
Enhancing NARS	22	20	21
Total	100	100	100

The two figures below give the evolution over time of the shares of investment by undertakings and outputs.

Figures 6.3 and 6.4



6.2.3 Allocation of CGIAR Resources to Regions of the Developing World

Table 6.15 shows the allocation of resources by region. Since the beginning of the CGIAR, the two regions of sub-Saharan Africa and Asia have received the main streams of resource flows in the CGIAR. Together, they make up about three-quarters of the resources, but they saw their importance slightly reduced in the early 1990s when Latin America and the Caribbean and West Asia/North Africa received almost a third of funds. Most recently, there has been again an increase in funds allocated to SSA, which received about 46% - or nearly half of all expenditures - for the 2002-2003 period.

Asia's levels of resource allocation are 'stable' around one-third of CGIAR funding, while the table shows a decline of funding for the LAC region in the most recent years. The LAC region now receives 13% of funds, down 4 percentage points from the 17% level in the 1990s. For WANA, there has also been a gradual decline in funding for the region that is now at 9% of resources allocated, down 4 percentage points from a maximum level of funding of 13% achieved in the late 80s and early 90s.

In 1997, TAC made no recommendations with regard to allocations by region.

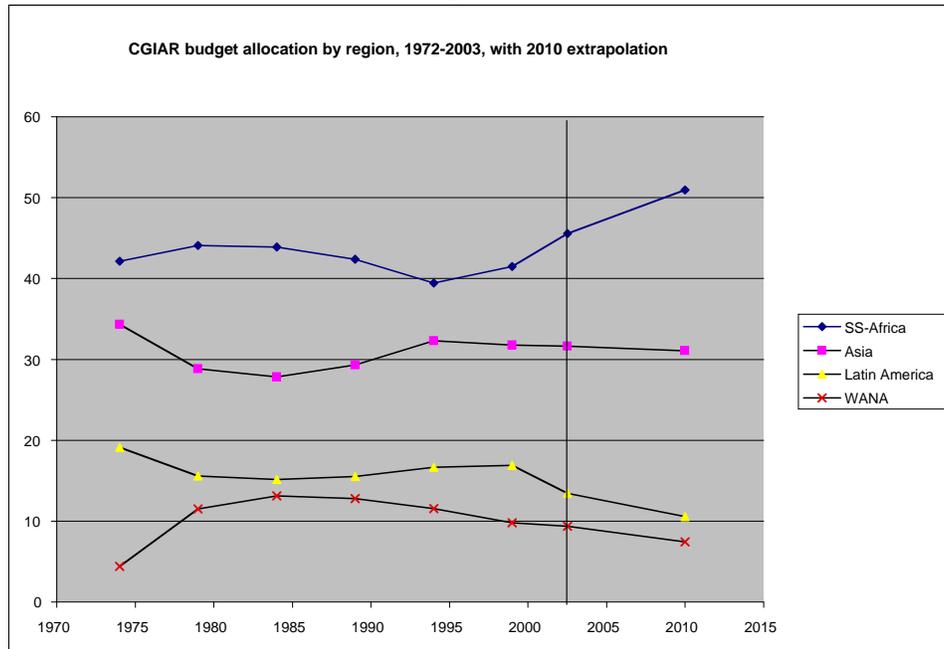
Table 6.15 - CGIAR resource allocation, 1972-2003, by region, and 2010 extrapolation
(Millions of current US dollars and percentages)

Region	1972-1976	1977-1981	1982-1886	1987-1991	1992-1996	1997-2001	2002-2003	Extrapolation 2010	TOTAL 1972-2003
	\$	\$	\$	\$	\$	\$	\$	\$	\$
Sub-Saharan Africa	86	272	449	603	656	711	335.1		3112.1
Asia	70	178	285	417	537	545	232.7		2264.7
Latin America/Carib.	39	96	155	221	277	290	98.8		1176.8
West Asia/N. Africa	9	71	134	182	192	168	68.9		824.9
Total	204	617	1023	1423	1662	1714	735.5		7378.5
Region	%	%	%	%	%	%	%	%	%
Sub-Saharan Africa	42	44	44	42	39	41	46	51	42
Asia	34	29	28	29	32	32	32	31	31
Latin America/Carib.	19	16	15	16	17	17	13	11	16
West Asia/N. Africa	4	12	13	13	12	10	9	7	11
Total	100	100	100	100	100	100	100	100	100

Extrapolations are linear over the 1992-96 to 2002-03 period, using 1994 as the base point.

Values from 2004 to 2006 are taken from the CGIAR Secretariat analysis of the 2004 CGIAR Financial Plan, 2004 are plan values, and 2005 and 2006 are proposals.

Figure 6.5



6.2.4 Allocation of Resources to CGIAR Centres

The allocation of resources to CGIAR Centres is shown in Table 6.16. Figure 6.6 displays this information in graphical form. Over time, the number of CGIAR Centres grew and consequently the absolute values for the shares of the early years of the CGIAR decreased as resources are spread over more Centres. However, the six Centres receiving most contributions over the 32 years (each 10 percent and more) are the large crop commodity research institutes (CIAT, CIMMYT, ICRISAT, IITA, and IRRI), that have been part of the CGIAR since its inception, and ILRI, the livestock research institute.

For many Centres the most recent allocation of resources to CGIAR Centres for the years 2002-2003 is close to the levels recommended by TAC for the year 2000. There are some differences of 1 percentage point and more between funding and recommended levels (IITA, IPGRI, and IWMI that are about 1 percentage point above, ICRISAT and ILRI that are respectively 1.7 and 1.6 percentage points below recommended funding levels). Other Centres that are “oversubscribed” - but at levels below one percentage point - are CIMMYT and IFPRI (with 0.9 percentage points), and ICRAF, with 0.8 percentage points. IRRI’s most recent funding is falling short from the recommended levels by about 0.7 percentage points, CIP’s funding by 0.8 percentage points. To describe these discrepancies in financial terms, it should be noted that one percentage point of the annual CGIAR budget represents about 3.8 million US\$, a value that corresponds to about one-fifth of the resources of a medium sized Centre with an annual budget of 20 million US\$.

Table 6.16 - CGIAR Resource Allocation, 1972-2006 by Centre

(Millions of current US million dollars and percentages)

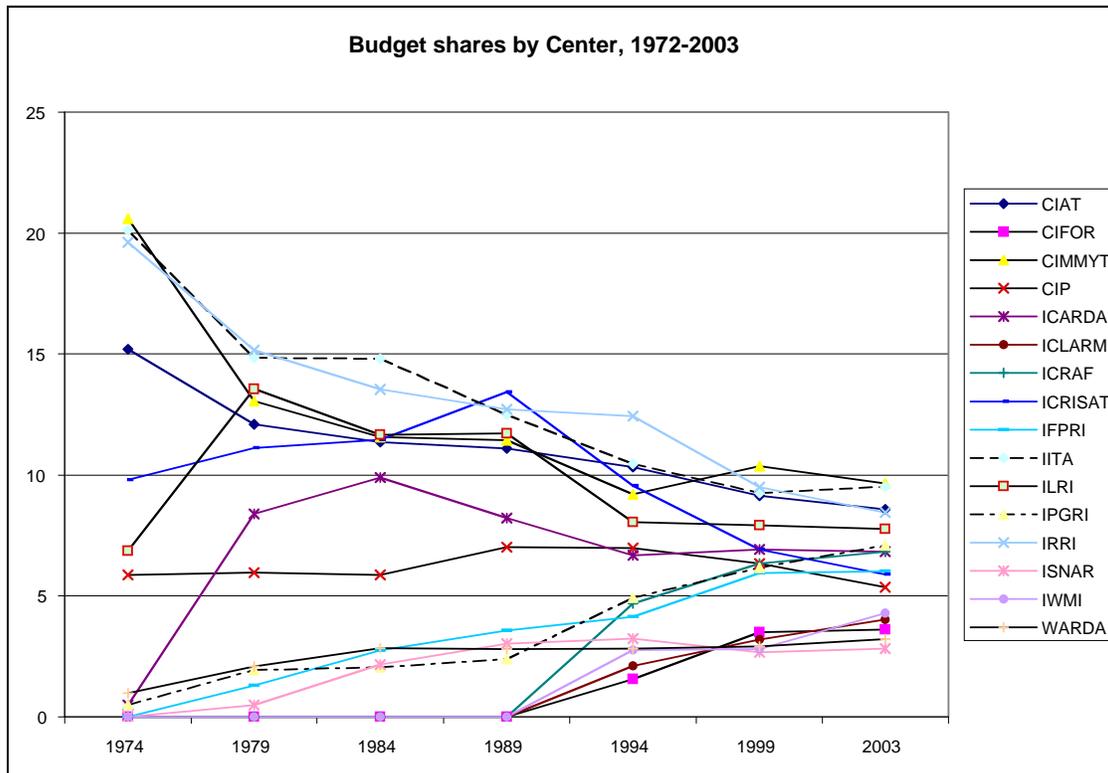
Centre	1972-1976	1977-1981	1982-1886	1987-1991	1992-1996	1997-2001	2002-2003	TOTAL	2004-06 plan	
	\$	\$	\$	\$	\$	\$	\$	\$	\$	
CIAT	31	75	116	158	172	157	64	773	103	
CIFOR					26	60	27	113	44	
CIMMYT	42	81	118	163	153	178	72	807	123	
CIP	12	37	60	100	116	109	40	474	68	
ICARDA	1	52	101	117	111	119	51	552	72	
ICLARM					35	55	30	120	48	
ICRAF					78	109	51	238	85	
ICRISAT	20	69	117	191	159	119	44	719	72	
IFPRI		8	28	51	69	102	45	303	114	
IITA	41	92	151	178	174	159	71	866	111	
ILRI	14	84	119	167	134	136	58	712	91	
IPGRI	1	12	21	34	82	106	53	309	97	
IRRI	40	94	138	181	207	163	63	886	97	
ISNAR		3	22	43	54	46	21	189	29	
IWMI					46	48	32	126	70	
WARDA	2	13	29	40	47	50	24	205	36	
Total	204	620	1020	1423	1663	1716	746	7392	1260	
									TAC Rec. year 2000	
Centre	%	%	%	%	%	%	%	%	%	%
CIAT	15	12	11	11	10	9	9	10	8	8
CIFOR	0	0	0	0	2	3	4	2	4	3
CIMMYT	21	13	12	11	9	10	10	11	9	10
CIP	6	6	6	7	7	6	5	6	6	5
ICARDA	0	8	10	8	7	7	7	7	7	6
ICLARM	0	0	0	0	2	3	4	2	4	4
ICRAF	0	0	0	0	5	6	7	3	6	7
ICRISAT	10	11	11	13	10	7	6	10	8	6
IFPRI	0	1	3	4	4	6	6	4	5	9
IITA	20	15	15	13	10	9	10	12	9	9
ILRI	7	14	12	12	8	8	8	10	9	7
IPGRI	0	2	2	2	5	6	7	4	6	8
IRRI	20	15	14	13	12	9	8	12	9	8
ISNAR	0	0	2	3	3	3	3	3	3	2
IWMI	0	0	0	0	3	3	4	2	3	6
WARDA	1	2	3	3	3	3	3	3	3	3
Total	100	100	100	100	100	100	100	100	100	100

Notes:

Non-agenda investments are assumed to be in the same proportions as agenda investments. Values include all overheads

Source: CGIAR Financial report 2001, Table A5.1, CGIAR financial database for 2002 and 2003 data, 2004 CGIAR Financing Plan for 2004 proposals and 2005 and 06 plan values.

Figure 6.6



6.3 2020 Projections: Critical Commodities for Food Security and Export Earnings

Congruence analysis uses the value of production as a criterion of the relative importance of crops in allocating research budgets. Poverty weighting increases the weight attached to the value of production where poverty is more prevalent. The approach, however, fails to consider the demand side. It may be that the value of production for a particular commodity is high, but that a country is running an increasing trade surplus in the commodity, suggesting that it is not a critical food security issue. To take the demand side into account, we can turn to IFPRI's projections for 2020. For the commodities considered, production and domestic demand are compared, and the corresponding trade surplus or deficit is calculated. This is measured in the base year 1997 and predicted for year 2020.

We give this information in Table 6.17. We report the trade balance for the commodity as observed in 1997 and as projected for 2020 using IFPRI's Impact Model.³² We also report the predicted value of production in 2020.

³² Rosegrant, Mark, Michael Paisner, Siet Meijer, and Julie Witcover. 2001. *Global Food Projections for 2020: Emerging Trends and Alternative Futures*. Washington D.C.: IFPRI.

Global Food Projections to 2020: critical commodities for food security and export earnings

1000metric tons		Trade 1997	Trade 2020	Production 2020	% Trade/Prod 2020	Critical for food security	Critical for cash crop
Beef	LAC	500	1986	21481	9		
	SS-A	11	-81	5202	-2		
	WANA	-377	-754	2377	-32	+	
	South Asia	158	-241	8084	-3		
	Southeast Asia	-197	-908	2599	-35	+	
	East Asia (incl. China)	-228	-1260	11336	-11	+	
All Developing World	-152	-1307	51106	-3			
All meats	LAC	311	2860	48552	6		
	SS-A	-153	-292	11138	-3		
	WANA	-946	-1751	11497	-15	+	
	South Asia	164	-503	15552	-3		
	Southeast Asia	-62	-544	18707	-3		
	East Asia (incl. China)	-289	-5937	105213	-6		
All Developing World	-1071	-6386	210801	-3			
Wheat	LAC	-7845	-2519	39655	-6		
	SS-A	-6580	-13519	5163	-262	+	
	WANA	-25908	-37934	74083	-51	+	
	South Asia	-5261	-18208	128501	-14	+	
	Southeast Asia	-7802	-12747	114	-11182	+	
	East Asia (incl. China)	-8628	-16212	142096	-11	+	
All Developing World	-62318	-101676	389611	-26	+		
Rice	LAC	-1357	-658	21128	-3		
	SS-A	-3798	-7136	15214	-47	+	
	WANA	-3069	-5394	8187	-66	+	
	South Asia	2931	-1088	159610	-1		
	Southeast Asia	5111	13141	126012	10		+
	East Asia (incl. China)	406	2058	159653	1		
All Developing World	-54	638	489816	0			
Maize	LAC	-2304	5675	125465	5		
	SS-A	-1578	-4010	46458	-9		
	WANA	-9703	-14578	13677	-107	+	
	South Asia	-102	58	18675	0		
	Southeast Asia	-3287	-7485	31420	-24	+	
	East Asia (incl. China)	-10478	-44863	212753	-21	+	
All Developing World	-27507	-65289	448470	-15	+		
Other grains	LAC	-3756	-6536	24410	-27	+	
	SS-A	-418	1402	63007	2		
	WANA	-6400	-16298	28100	-58	+	
	South Asia	-588	-511	27791	-2		
	Southeast Asia	-687	-997	466	-214	+	
	East Asia (incl. China)	-2590	-3504	18905	-19	+	
All Developing World	-14455	-26525	162682	-16	+		
All cereals	LAC	-15262	-3938	210658	-2		
	SS-A	-12374	-23263	129842	-18	+	
	WANA	-45080	-74204	124047	-60	+	
	South Asia	-3020	-19749	334577	-6		
	Southeast Asia	-6665	-8088	158012	-5		
	East Asia (incl. China)	-21290	-62521	533407	-12	+	
All Developing World	-104334	-192852	1490579	-13	+		
Potatoes	LAC	-394	53	24184	0		
	SS-A	-69	-272	4901	-6		
	WANA	345	-527	25295	-2		
	South Asia	-4	-47	56257	0		
	Southeast Asia	-259	-894	2887	-31	+	
	East Asia (incl. China)	-642	-2269	156345	-1		
All Developing World	-1052	-4025	210738	-2			
Sweetpotatoes and yams	LAC	30	341	4087	8		
	SS-A	6	-164	79225	0		
	WANA	4	21	328	6		
	South Asia	1	174	2035	9		
	Southeast Asia	8	214	6514	3		
	East Asia (incl. China)	20	-699	132816	-1		
All Developing World	68	-182	225979	0			
Cassava & other roots	LAC	221	-340	42174	-1		
	SS-A	49	1869	181609	1		
	WANA	-59	-14	273	-5		
	South Asia	-23	-220	8724	-3		
	Southeast Asia	12963	4345	41167	11		
	East Asia (incl. China)	-2534	-1796	57040	-3		
All Developing World	10624	3899	282160	1			
All roots & tubers	LAC	-143	54	70445	0		
	SS-A	-14	1433	265735	1		
	WANA	290	-520	25896	-2		
	South Asia	-26	-93	67016	0		
	Southeast Asia	12712	3665	50568	7		
	East Asia (incl. China)	-3156	-4764	237164	-2		
All Developing World	9640	-308	718877	0			
Soybeans	LAC	5151	15074	80929	19		+
	SS-A	-25	-297	1071	-28	+	
	WANA	-633	-1280	363	-353	+	
	South Asia	-22	-791	12180	-6		
	Southeast Asia	-1240	-3310	3090	-107	+	
	East Asia (incl. China)	-6346	-16413	26070	-63	+	
All Developing World	-3117	-7022	123703	-6			
Vegetables	LAC	3370	6441	47982	13		+
	SS-A	-369	-458	32676	-1		
	WANA	340	1932	108766	2		
	South Asia	176	-736	112063	-1		
	Southeast Asia	-129	626	35972	2		
	East Asia (incl. China)	2019	2139	383860	1		
All Developing World	5369	9788	721942	1			

We can use this to identify commodities that deserve attention in research resource allocation following the following two criteria:

Commodities critical for food security: major staple food that has a trade deficit in 2020, whose trade deficit is increasing between 1997 and 2020, and whose trade deficit represents more than 10% of the value of domestic production.

Commodities critical for foreign exchange earnings: commodities that have a trade surplus in 2020, whose trade surplus has been increasing between 1997 and 2020, and whose trade surplus represents more than 10% of the value of domestic production.

Table 6.17 shows the commodities thus identified as critical for food security and for foreign exchange earnings. We see the following:

Major staples commodities critical for food security:

Rice in SS-Africa and WANA.

Maize and other coarse grains in WANA, Southeast Asia, and East Asia.

Potatoes in Southeast Asia.

Soybeans in SS-Africa, WANA, Southeast Asia, and East Asia.

Low value fish in LAC, SS-Africa, and WANA.

There is an increasing wheat deficit in all regions except LAC.

There is a deficit in beef in WANA, Southeast Asia, and East Asia.

Major commodities critical as sources of foreign exchange earnings:

Rice in Southeast Asia.

Soybeans in LAC.

Vegetables in LAC.

Sub-tropical and all fruits in LAC.

High value and all fish in LAC.

These results are suggestive of the critical importance of non-traditional exports as sources of foreign exchange earnings for LAC. This indicates that the CGIAR will need look into the possibility of enhancing the productivity of these cash crops for work in Latin America when there are no other sources of research. This implies going beyond the traditional crops in the CGIAR's research portfolio toward high value crops and fish. The only other critical export crop is rice for Southeast Asia.

Many of the CGIAR's major commodities remain critical for country access to food. Rising food deficits in SS-Africa and WANA are important in rice, maize, soybeans, and low value fish. Wheat deficits are largely associated with rising urban consumption, and alternative sources of supply often exist. Deficits in beef in WANA, Southeast Asia, and East Asia are predicted to be important.

6.4 Projections to 2030 for food and agriculture

The FAO³³ has made projections of major commodity requirements in food and agriculture to 2030. Between 2015 and 2030 the human population of developing countries will increase by a further 1.05 billion. However, population growth rates for developing countries will reduce from a current aggregate level of around 1.7 per cent presently to 1.1 per cent between 2015 and 2030. Nevertheless, the population of sub-Saharan Africa will still be growing at 2.2 per cent in the same period. By 2040, India will rival China as the most populous country.

Cereal demand, which reduced in the 1990s, is projected to recover, rising to a growth rate of 1.4 per cent by 2015. Slowing population growth will reduce demand to 1.2 per cent over the period 2015 to 2030. *“Nevertheless, the production task facing world agriculture is massive. By 2030, an extra billion tonnes of cereals will be needed each year.”* The developing countries will become increasingly dependent upon cereal imports. By 2030 they could be producing 86 per cent of their own needs, with net imports amounting to some 265 million tonnes annually. The most serious imbalances for cereals will be experienced in wheat and coarse grains, in WANA, East Asia, and sub-Saharan Africa respectively. The primary means through which increased yields will be met is through increased intensification and technological efficiency in reducing yield gaps. For instance, average anticipated yields by 2030 are required to grow to 4.3 tonnes per ha for wheat in East Asia, 6.72 tonnes per ha for paddy rice in WANA and 6.39 tonnes per ha for maize, also in WANA.

Changes in the commodity composition of food are expected to occur in developing countries with a relative stabilization of per capita consumption of cereals, roots and tubers, and pulses (the latter somewhat in decline), and marked increases in vegetable oils, meat and milk and dairy products. There will need to be relatively large increases in the production of meat (beef and veal, mutton and lamb, pig meat and poultry meat) in developing countries. The trade imbalance in milk and dairy (including demand for these in feeds) for developing countries will be 39 million tonnes annually by 2030.

Fish consumption is likely to increase but there are uncertainties about the final level of production that can be attained. More modest projections of demand at 150-160 million tonnes per annum will still mean that fish consumption may stagnate or even decline in sub-Saharan Africa and WANA.

6.5 Conclusion

The various food models and projections discussed in this chapter provide important background indicators for priority setting, but none is sufficient to define an agricultural research agenda. Congruence analysis, based on value of production, looks at the supply side. The importance of commodities as a subject for research is modified by the number of poor. The constraints to supply, and the use of the individual commodities by the poor, is not examined by this method. Commodities within which there are segmented high- and low-value products and

³³ FAO/Earthscan (2003). World Agriculture: towards 2015/2030. An FAO Perspective. (Ed. J. Bruinsma), 432 pages. For statistical tables in the Summary Report see <http://www.fao.org/docrep/004/y3557e/y3557e13.htm#v>

markets are not distinguished. However, several of the Centres are in the process of making such analyses for their particular commodity or sector (e.g. ICRISAT, ILRI, WARDA), and priority setting can expect to become more nuanced as additional poverty and commodity data is examined in this fashion.

Analysis of the CGIAR's historical effort and resource use against the previous categorisation of commodities and sectors provides clear indications that production-related research has been falling, and more emphasis has been placed on integrated natural resource management research, policy, and the conservation of genetic resources with time. The CGIAR maintains a steady effort in the provision of capacity building support of national systems.

Population growth in developing countries through the plan period will ensure that demand for the CGIAR's traditional commodity and sector focus continues to grow. For most commodities, overall global requirements for production increases will have to be met by increases in intensification and production efficiency, as for the most part, little additional land will be available for agriculture. Although the path of individual countries to meeting food requirements may become more flexible depending upon global prices of tradable commodities, continuing research to secure the required production levels for developing countries in key areas of their food supply will be necessary. The IFPRI projections can be used to identify which commodities will be important in the future (by 2020) in terms of either meeting national food security requirements, or those which are traditionally beneficial for trade (the latter goal similarly being encompassed by the GFAR priorities). Commodities for which the value of production is high (such as livestock and fish products) are set to increase in importance on the basis of global demand and opportunities for assisting farmers reach new markets through diversification. Determining the dual requirements for CGIAR research in maintaining local supplies (the traditional staples of the poor, such as rice, cassava, and maize) and increasing competitiveness, (through the development of research on higher value vegetables, fruit, fish and livestock products), and the balance between these approaches, are key additional areas for continuing analysis. However, it is in these areas, and balancing production and associated sustainability questions, not available from the above models, in which the participatory consultation steps have played such an important part.

CHAPTER 7 –PRIORITIES FOR INCREMENTAL INVESTMENTS ARISING FROM THE CONSULTATION

This chapter reviews the research and associated priorities arising from the steps of the consultation and subsequent analysis, and consolidates these into individual areas for incremental investments in new CGIAR research. The scope of research anticipated for the new priority areas is described, and observations are made on the emerging priority setting process.

In the consultation process followed here, priorities have been developed without looking at the opportunity cost in using existing budgets. New projects are considered as though a given amount of *additional* monies were to be available to cover their costs. This is the nature of the recommendations derived from the consultation with stakeholders and scientists (approaches #8 and 9 as identified in Chapter 1), as well as use of *ex-ante* criteria for the selection of research projects (approach #2). It should be noted that not all the recommendations are for new undertakings, in terms of the CGIAR's past and current activities. Thus, some represent arguments for more of what the CGIAR is already doing, if additional funds are allocated. In this sense, this analysis of priorities for additional investment is consistent with the overall budget considerations. The difference is that previous approaches assumed a fixed existing budget, while the process described in this report examines the situation assuming additional resources are made available.

7.1 Issues and Research Needs Identified in the Stakeholder's Consultation (Steps 1A and B)

7.1.1 Some Results from the Dialogues Among Stakeholder Panel Members (Step 1A)

The contribution demanded from panels in Step 1A was to elaborate a list of activities within the five CGIAR Output categories. This list was then used for the open consultation, and subsequently as a starting point for the elaboration of a list of sub-activities by the thematic panels in Step 2A.

The dialogue sustained among panel members revealed shifts in perceptions about critical issues for research. Three observations are worth highlighting, as they illuminate the rationale for the recommendations made by the consultation.

i) The complexity of the technology-poverty relation: It consists in direct effects (on smallholders that adopt the innovation offered by research); indirect effects (on the landless, net-buyers, urban) through the price of main cereals lost to trade, but not other indirect effects through linkages and foreign exchange earnings.

ii) Systems/INRM research requires redefining the unit of analysis at different imbedded scales: from plot to ecosystem, watershed, community, commodity-chain.

iii) Solutions to difficult problems require integrated approaches:

- Use of high science.
- Holistic, systemic, interdisciplinary, territorial approaches.
- Partnerships with private sector, NGOs, development agents.
- Participatory approaches with government research organizations (GROs).
- Comparative advantage of the CGIAR in organization.

7.1.2 Main Results from Stakeholders Open Consultation (Step 1B)

Priorities expressed by respondents inevitably reflect their personal backgrounds and particular interests. Survey outcomes, measured as averages, are affected by the relative importance of different categories of respondents in the total number of respondents. It is consequently important to (1) characterize who responded, (2) provide results by category of respondents, and (3) use regression analysis to control for the effect of the other types of respondents in the survey on the score assigned by each particular category of respondent.

By region of expertise, a relatively small share of respondents from CWANA (7%) were obtained, and a large share from LA (33%). By institution, there was good representation of the CGIAR (28%), NGO/private sector (20%), NARI (17.8%), and universities (15%). The special efforts made to mobilize NGOs and the private sector were consequently successful. Among types of jobs, researchers dominated with 51% of respondents, followed by administrators and managers (25%), and extensionists and project managers (16%). Regarding discipline, two groups dominated: crop specialists (35%) and social scientists (32%). Finally, 71% of the respondents had their residence in the South compared to 29% in the North showing, again, success in reaching participants from, or located in, developing countries.

Results from the open stakeholder consultation indicated the types of issues stakeholders would like to see the CGIAR address. They have to be used with some caution due to:

1) The non-random character of the list of stakeholders invited to participate and the self-selection process of respondents

We corrected for this by using a regression analysis of scores as a function of respondents' regional expertise, type of institution, type of job, discipline, and residence in North or South. Predicted scores then become conditional on the combination of features of a particular category of respondents. We defined a base respondent (for each region separately) as a person who "works at the CGIAR * is a scientist * is a crop specialist * lives in the South."

The choice of a base respondent is arbitrary. The results allowed the calculation of scores for any combination of characteristics that define a respondent.

2) Scores represent a degree of “criticality” assigned by a respondent to an issue

Scores do not represent dollars. Hence, caution must be exercised when comparing the allocation of points (percentage scores) to the current dollar budget allocations (across outputs and across commodities for germplasm improvement, the only two breakdowns for which we have data on current budget allocations). However, when discrepancies between percentage scores and budget allocations are large, they do convey a message that indicates desire by respondents for adjustments in current budget allocations.

Table 7.1: CGIAR budget allocation across logframe outputs: actual and desired

Percentage allocations across outputs	Average respondent scores (desired)	Base respondent scores (desired)	Actual CGIAR budget allocation (2002)	Discrepancy: Desired average respondent – Actual allocation	Discrepancy: Desired base respondent – Actual allocation
Germplasm collection, conservation, and characterization	16	20	10	6	10
Germplasm improvement	16	22	18	- 2	4
Sustainable production systems and NRM	29	24	34	- 5	- 10
Policy and socio-economic research	19	14	16	3	- 2
Strengthening NARS and other rural institutions	21	21	22	- 1	- 1

Table 7.2: CGIAR budget allocation across logframe outputs by region: actual and desired

Base respondent scores by region	Germplasm conservation	Germplasm improvement	Sustainable production systems	Policy and socio-economics	Improving institutions
Global	20	24	25	12	20
Asia	20	22	25	14	19
CWANA	21	23	22	13	21
SS Africa	20	18	24	16	23
Latin America	18	22	24	15	22
Average desired	20	22	24	14	21
Actual CGIAR	10	18	34	16	22

Table 7.3: CGIAR budget allocation to germplasm improvement research by commodity: actual and desired

Germplasm improvement by commodity	Average respondent scores (desired)	Base respondent scores (desired)	Actual budget allocation (2002)	Discrepancy: Desired average respondent – Actual allocation	Discrepancy: Desired base respondent – Actual allocation
Cereals	24	28	67	- 43	- 39
Roots and tubers	17	17	19	- 2	- 2
High value and cash crops	16	13	6	10	12
Tree crops	14	11	1	13	13
Livestock	14	12	7	7	7
Fisheries	11	10	1	10	8
Other	5		0	5	
Total	100	95	100		

Table 7.4: CGIAR budget allocation to germplasm research by commodity and region: actual and desired

Base respondent scores by region	Cereals	Roots and tubers	High value & cash crops	Tree crops	Livestock	Fisheries
Global	31	17	16	14	12	11
Asia	29	18	18	12	13	9
CWANA	33	11	16	15	18	7
SS Africa	21	21	19	17	13	10
Latin America	27	19	19	14	13	8
Average desired	28	17	13	11	12	10
Actual	67	19	6	1	7	1

Remembering that these scores were given by different groups of individuals, each specialized in the corresponding region, a remarkable consistency was achieved.

There are several informative results deriving from the consultation that should be taken into account in considering the next steps of the process (i.e. Step 2).

1) Some large discrepancies exist between desired levels of attention and actual investment allocations to outputs

As Tables 7.1 and 7.2 show, there are large discrepancies between (i) the “criticality” scores of the average respondent, or of the base CGIAR scientist, characterizing how critical specific outputs are, and (ii) the current allocation of total investment across outputs, and across all regions. These discrepancies are remarkably consistent across regions. Largest discrepancies are:

- Insufficient attention given to germplasm conservation and characterization.
- Some excess attention given to sustainable production systems through INRM.
- Current investments in germplasm improvement, socio-economics and policy research, and strengthening institutions are near desired levels.

2) Some very large discrepancies exist between desired levels of attention and actual investment allocations to germplasm improvement by commodities

As shown in Tables 7.3 and 7.4:

- There are sharp differences across regions.
- There is unmet attention to germplasm research in high value and cash crops, tree crops, livestock, and fisheries.
- There is excess attention given to germplasm improvement in cereals.
- Research on roots and tubers is in balance with demand.

3) Highest demands for investment by activities within each output

According to the base respondent, the activities that received the largest demands for attention by output were:

1. Germplasm conservation - Ex-situ conservation (31% of scores assigned to the corresponding output).

2. Germplasm improvement - Commodities: Cereals (28% of scores assigned to commodities). Objectives: Abiotic stress (30% of scores assigned to objectives).

Location: Unfavorable agricultural lands (60% of scores between favourable and unfavourable lands).

3. Sustainable farming systems - Type of farming system: Crops production system (30% of score assigned to types of farming systems). Strategies for farming systems: IPM and IDM (27% of scores assigned to strategies).

4. Policy and socio-economic research - Impact assessment (11% of scores assigned to the corresponding output) and markets for inputs and outputs (10%).

5. Strengthening institutions - Training and capacity building of NARS (29% of scores assigned to the corresponding output).

4) Priorities not well identified for policy and socio-economic research

Policy and socio-economic research is the Output which has a less distinct (i.e. relatively flatter) profile of attributed scores. In this case, scores were quite evenly distributed across activities. This may indicate either that all proposed activities are important, or that the categories reflect a substantial degree of overlap.

5) Opinions differ quite widely by discipline

Origins of discrepancies between the base respondents lay mainly in differences in disciplines. This may reflect better information about one's own discipline, and/or vested interests. The inference therefore for future priority setting is that working with interdisciplinary panels is thus important, and there is a need to keep track of the disciplinary background of respondents in interpreting answers. Although the consultation with scientists is now complete in terms of quantitative results, it may be possible to gather from participants further examples of the lessons learned - both in terms of research priorities and future implementation of a participatory priority-setting methodology.

7.2 Main Results from Scientists Consultation (Step 2A & 2B)

The results from the Consultation can be analyzed at three levels:

1. Recommended allocations across CGIAR logframe outputs.
2. Major themes cutting across regions
3. Regional priorities.

7.2.1 Recommended Allocations Across CGIAR Logframe Outputs.

Table 7.5: CGIAR budget allocation across logframe outputs by region: actual and desired

Budget by output and by region: % allocation		Germplasm conservation	Germplasm improvement	Sustainable systems and INRM	Socio-economics and policy	Enhancing institutions	Cross-cutting sub-activities	Total budget	Total budget allocated (US\$/year)
CWANA	Step 1B	21	23	22	13	21	0	100	30265
	Step 2	14	24	28	15	19	0	100	
LA	Step 1B	18	22	24	15	22	0	100	29830
	Step 2	19	10	29	24	18	0	100	
SSA	Step 1B	20	18	24	16	23	0	100	47960
	Step 2	19	20	23	16	21	2	100	
Asia	Step 1B	20	22	25	14	19	0	100	30230
	Step 2	12	27	32	11	17	0	100	
Global	Step 1B	20	24	25	12	20	0	100	24590
	Step 2	23	17	17	27	16	0	100	
All regions	Step 1B	20	22	24	14	21	0	100	162875
	Step 2	17	20	26	18	19	1	100	
CGIAR	Actual	10	18	34	16	22		100	

The main lessons from the results in Table 7.5 are the following:

i) There was a great degree of consistency between stakeholder (Step 1B) and scientist (Step 2) recommendations. This may come from the fact that scientists were informed of stakeholders' demands in Step 1B.

ii) Three outputs received an allocation that is in balance with the desired allocation of additional resources. They are:

- Germplasm improvement
- Socio-economics and policy
- Enhancing institutions.

Consistent with Step 1B, two outputs have current budget allocations that differed from a desired allocation of additional resources. They are:

- Germplasm conservation, which, if the recommendations were followed uncritically, would receive a 73% increase in resource allocation compared to present expenditure levels.
- Sustainable systems and INRM, which would receive 23% fewer resources compared to current allocation.

iii) Regional panels gave more importance to research on sustainable systems and INRM (23 to 32% of additional resources depending on the region) than the global panel (17%). This is consistent with the observation that benefits of research on farming systems and natural resources are relatively more locally specific and appreciated. This suggests that disaggregating further at the sub-regional level may give greater weight to research on systems and NRM than when prioritized at the regional level.

iv) Among the CGIAR's five outputs, sustainable production systems and INRM is the category that consistently receives the largest share of additional resources in all four regions.

7.2.2 Major Themes Cutting Across Regions

There are several themes that dominated the suggested research agenda across regions and indicate demand for major research efforts. The results are given as headlines below, and presented more completely in Appendix 3 (which includes the rationales given by the scientific proponents of each sub-activity, including expected outputs). The lists of sub-activities were selected by three or more panels and are organized by CGIAR Output:

Output 1: Germplasm conservation and characterization

- i) *Ex-situ* conservation of annual and perennial crops for marginal environments beyond the current CGIAR mandate.
- ii) *In-situ* conservation of crop systems for marginal environments, paying particular attention to water use efficiency.
- iii) Expand the *ex-situ* conservation of crop wild relatives.
- iv) Identify important "orphan" foods or economic crops in regions, and initiate germplasm conservation of these crops.

v) Study of gene flows.

Output 2: Germplasm improvement

- i) Application of comparative genomics from CGIAR crops to improve vegetable and perennial crops important to NARS.
- ii) Use of wild species and other exotic gene pools as sources of novel alleles for adaptation.
- iii) Drought resistance: comparative genetics of drought tolerance across cereals, across legumes, and across roots and tubers.

Output 3: Sustainable production systems and integrated natural resource management

- i) Integrated crop management (water, nutrient, pest, weed, etc.) in risk-prone environments, and Genotype x Environment interactions
- ii) Increased water use efficiency: Scale effect on water use efficiency and conjunctive use.
- iii) Vegetables and fruit production in urban and peri-urban production systems.

Output 4: Socio-economics and policy research.

- i) Marketing innovations to link farmers to markets.
- ii) Policies and institutions to facilitate poor people's access to natural resources, especially land and water.

Output 5: Strengthening NARS and other rural institutions.

- i) Strengthening NARS capacity to address emerging challenges in markets, trade policy, the environment, and biotechnology, including intellectual property rights (IPR) and biosafety issues, among others.
- ii) Strengthening NARS capacity in strategic analysis and priority setting.
- iii) Empowerment of farmers' organizations: adjustment to the new agriculture.
- iv) Public-private partnerships for technology development and delivery.

7.3 Regional Priorities

Regional priorities established through this consultative process used as a starting point the priorities established by the region itself through its own regional organizations³⁴. The priorities identified by the regional panels are more diverse within a region and are listed in Appendix 3. They provide complementary information to that provided by the regions. The main contribution of the present CGIAR exercise is in providing consistency across regions by working with a unified set of activities and sub-activities.

³⁴ (see the Priorities and Strategies Consultation webpage where these are collected, at www.rimisp.org/cgi-ar-ps2).

(1) Asia

The Asia panel called attention to the following aspects of CGIAR research for the region:

- a) Focus on marginal environments,
- b) Focus on public goods, (for example the development of a rational global system of ex-situ conservation, and studies of gene flows)
- c) Focus on commodities beyond rice, reflecting concerns with agro-biodiversity as well as diet diversification.
- d) Focus on integrated crop management in varying environments (water, nutrient, pest, weeds, etc.)
- e) Concerns with agrochemical pollution and its health hazards.
- f) Focus on poverty.
- g) Focus on the search for new partnerships.

(2) CWANA

Priorities established through the consultation complement the particularly comprehensive regional priority setting exercise undertaken by ICARDA, AARINENA, and CAC in 2001/2. Priorities established here stress the following:

- a) Focus conservation efforts on wild relatives, marginal environments, and forage grasses and forage legumes.
- b) Focus on abiotic resistance: comparative genetics of drought tolerance across cereals, legumes, and roots and tubers and salinity tolerance.
- c) Focus on sustainable use of rangelands and integrated crop management in varying environments (water, nutrient, pest, weeds, etc.).
- d) Focus on the role of policies and institutions to enhance the adoption of new technologies and for sustainable natural resource management.
- e) Strengthening of NARS' capacity in social analysis
- f) Strengthening of local government institutions and farmers organizations.
- g) Marketing innovations to link farmers to markets.

(3) Sub-Saharan Africa

The Africa panel operated under a less binding resource constraint (in accordance with current CGIAR priority to Africa), resulting in selection of a relatively larger number of projects (detailed in Appendix 3).

- a) Focus on conservation of germplasm/biodiversity in marginal environments.
- b) Focus on conservation of forage grasses and forage legumes and of crops wild relatives.
- c) Focus on roots and tubers:
- d) Focus on yield losses due to parasitic weeds in cereals
- e) Focus on agroforestry
- f) Focus on livestock:
- g) Focus on integrated farming systems, including soil nutrient management, ecologically friendly IPM, weed control, and water management.

- h) Focus on markets and policies
- i) Focus on people and their organizations
- j) Focus on strengthening NARS in the region

(4) Latin America

- a) Focus on ex-situ conservation for neglected species and environments.
- b) Focus on the use of alternative sources of genes, using wild species and other exotic gene pools as sources of novel alleles for adaptation
- c) Focus on institutional arrangements
- d) Focus on water use efficiency
- e) Focus on the private sector, agro industry, and market development.
- f) Seek new models for agricultural research (including means to strengthen NARS)
- g) Seek new approaches for rural development and increase the benefits the rural poor can derive from research and technological change

(5) Global

The Global panel attached high importance to germplasm conservation and to strengthening of NARS.

- a) Focus on valuation of CGIAR gene bank holdings
- b) Focus on drought resistance
- c) Focus on water use efficiency in farming systems
- d) Focus on forestry and diversification of farming systems into vegetable and fruit
- e) Highest priorities for policy and socio-economic research are institutional mechanisms to enhance sustainable natural resource management, and mechanisms to enhance the access of poor people to natural resources (especially water and land).
- f) Assisting the development of NARS capacity, particularly with a view to policy formulation.

7.4 “Gap filling” thematic areas provided by Senior Scientists and Science Council Members (Step 2C)

Armed with the above consensus, a further step was undertaken in which senior scientists were polled to review the overall and regional priorities. They were invited to confirm or highlight gaps in the sub-activity categories. More than a dozen top experts in the field of international agricultural research responded to a request for a statement about research priorities by making the following three categories of statements:

1. Responses confirmed the importance of the current Challenge Programs:

- Water use efficiency at different scales, from plant to basin-level.
- Functional genomics, in particular for enhancing drought tolerance (with emphasis on sorghum and pearl millet), reducing the water costs of transpiration, and increasing low fertility tolerance.

2. Responses confirmed several priorities established in Step 2 of the consultation:

- Conservation and characterization of crop wild relative and of orphan crops.
- Genomics for vegetable and perennial crops.

- Study of gene flows.
- Apply agroecology and INRM principles to enhancement of productivity and sustainability in farming systems, particularly in marginal and risky environments.
- Capacity building and strengthening of NARS (especially in strategic analysis and priority setting).

3. Responses suggested additional themes as follows:

- Climate change and food production in the South: prognoses and adaptation.
- Research on food safety and healthy foods.
- Higher investments in forest genetic resource conservation and characterization.
- Higher investments in fisheries management.
- Determining the present and future consequences of intellectual property rights (IPR) on CGIAR research.
- Biosafety and the management of associated IPR
- Global trade issues and changing opportunities for small holders in globalized markets.
- Pest phytosanitation in global markets.
- Research on promoting skilled labour-intensive agricultural and rural growth strategies.
- Research on open access and common property in small-scale coastal fisheries.

7.5 Main Conclusions on the overall outcomes of the Consultation (projects funded on incremental budgets)

In consolidating the outcomes of the consultation into incremental new research areas, the Science Council considered the outcomes of the several steps of the Consultation, the additional subjects proposed by eminent scientists, and the priorities of regional organisations and development agencies. In considering the means through which the priority areas for research would enhance the existing portfolio of CGIAR research, the SC:

- firstly, developed a conceptual framework examining the entry points for public goods research into poverty alleviation through agricultural research;
- secondly, considered the types of science and programme requirements to tackle the priority areas; and,
- thirdly, grouped the recommended research areas to enhance focus;

These steps are described in the subsequent sections.

Table 7.6 High priority areas for research arising from the Consultation (Step 2C)

High priority areas for additional new CGIAR research
(1) Water management
(2) Extended germplasm conservation for wild relatives, orphan crops
(3) Drought and salinity resistance
(4) Agricultural systems and INRM for unfavourable and risky environments
(5) High value added crops and systems, including animals and fish
(6) Indigenous livestock genetics
(7) Artisanal fisheries management and coastal margins
(8) Animal health and human food/health safety

(9) Increase production of staple foods, incl. maintenance research
(10) Sustainable use of rangelands (CWANA)
(11) IPR, IPG, and CGIAR research
(12) Increase access to assets for the rural poor, esp. by gender
(13) Biosafety and gene flows
(14) Agroforestry for food, fuel, and fodder
(15) Community forest management for marginal environments
(16) Food/water safety and more nutritious foods
(17) Vegetables and fruits production systems
(18) Adaptation to climate change
(19) Forest genetic resources
(20) Policies for sustainable NRM
(21) Global trade policies and opportunities for smallholders in globalized markets
(22) Policies and institutions to enhance adoption of new technologies
(23) Participatory farmer-breeder management of crop gene pools
(24) Integrated weed (IWM) and pest (IPM) management
(25) Empowering agricultural research with gender focus
(26) Reduce post-harvest toxicity
(27) Smallholder provision of environmental services
(28) Marketing innovations to link farmers to national and international markets
(29) Labor-intensive agricultural (indirect effects) and rural development strategies
(30) Post-harvest value added, commodity chains, new agriculture
(31) Enhancing public and private roles in research
(32) Germplasm distribution systems
(*) Strengthening producers organizations (strategy ³⁵)
(*) Strengthening NARS (strategy)

7.5.1 The Conceptual Framework

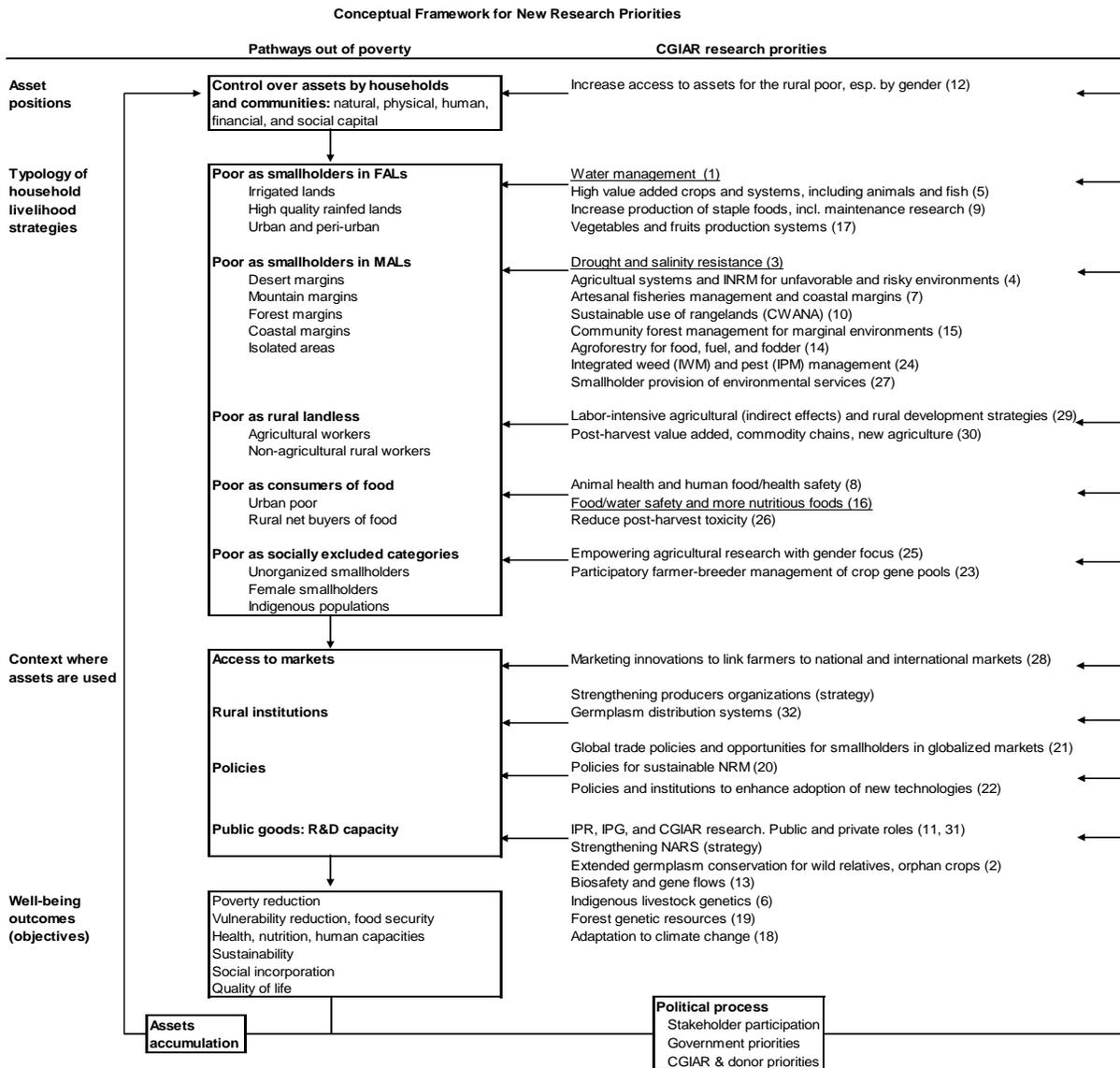
The conceptual framework depicted in Figure 7 is constructed on the basis of alleviating poverty through agricultural research. The framework focuses on assets, livelihood strategies and the context in which assets are used, to help define the research required to overcome constraints and to produce the outcomes desired by the CGIAR. The figure includes the recommended priority areas for research (also detailed in Table 7.6) and where they may act in this assets/outcomes sequence. Although not depicted here, it is also possible to place the approximately 200 current projects of the Centres (see Chapter 4) into the same framework. The classification of CGIAR project activities and the new areas of research (identified in this chapter) into a single typology (which is still in progress) will provide the basis for identifying and describing System Priorities in the future.

³⁵ Strong emphasis was placed during the consultations on the CGIAR role of strengthening NARS and the need to strengthen producers' organizations in the "new agriculture". The SC confirms these as key components of the CGIAR's strategic approach (see chapter 8), but did not include them in its scoring of potential priorities for research.

7.5.2 Describing what is new

There are *twelve major recommendations* that go beyond current Challenge Programmes and Systemwide or ecoregional programmes that derived from the consultation, and which figure (sometimes as components) in the consolidated themes. They are presented sequentially (by CGIAR logframe Output) in the flowing section, with indications of the types of research which may be envisaged:

Figure 7



Recommendation 2 - Conservation and characterisation of crops for marginal environments, and crop wild relatives and important "orphan" food crops

Strong support confirmed the continued importance of germplasm conservation. Key germplasm groups identified are 'orphan' crops, particularly those grown in marginal areas, that are important food sources but which have received little research attention, and the wild relatives of key CGIAR crops.

The wild relatives of crops provide a reservoir of untapped, potentially important genes for crop improvement. This is particularly so for genes for tolerance or resistance to biotic and abiotic stresses, but also for genes for other important adaptive traits. However, wild relatives are greatly under-represented in most of the CGIAR Centre collections. A concerted effort is needed to study the remaining distribution of such species and ensure that accessions are collected that adequately represent the broad range of genetic diversity within them. The material not only needs to be collected, but also conserved for the long-term and characterized, evaluated, and documented. Through appropriate wide-cross breeding techniques, the desired traits need to be transferred into breeding populations for further development (The use of wild relatives was also identified as a breeding priority and is elaborated on below in Recommendation 3).

Just as for the wild relatives of crops, there are many 'orphan' crop species that have been neglected by science but which, with appropriate research, offer the potential to contribute to sustainably improving the diets and incomes of poor people, especially those in marginal environments. Foremost in this respect are fruits, vegetables and oil crops, but the list also includes minor cereal crop species. The CGIAR has concentrated mainly on major food staples: wheat, maize and rice, food legumes and roots and tubers, and has essentially neglected many of the species that are important to key groups of poor people and contribute to dietary diversity. These include both mandated and non-mandated crops. A relatively modest, but sustained research and development effort with such species could have a major impact. The research needed would initially aim at identifying those species on which to concentrate, and then, together with partner institutions, efforts should be undertaken to develop representative collections that should be conserved and characterized. Promising subsets of the materials should be widely evaluated in different production systems and made available to genetic improvement programmes.

It is particularly important in all aspects of the work undertaken by the Centres that due regard be given to the legal status of the materials under study and development. Many, but by no means all, of the wild relatives will be included within the multilateral system of the International Treaty on Plant Genetic Resources for Food and Agriculture. In the case of 'orphan' crops, only a few will come under the multilateral system. Working in partnership with national institutions will be particularly important, as will due regard for access and benefit-sharing regimes.

The following broad sequence of activities is foreseen:

1. Identify key species of both wild relatives and 'orphan' crops, survey their eco-geographic distribution and assess the status of existing *ex situ* collection. Develop appropriate sampling strategies and assemble collections that represent the broad range of diversity within the species concerned, both through field collecting and through acquisition from other collections. At least

in the case of orphan' crops, it will not usually be necessary to maintain highly centralized collections – either at the Centre concerned or partner institution - as dispersed collections maintained collectively among a network of collaborating institutions would, in many cases, be a better approach.

2. Conserve, characterize, and evaluate the collections. Especially in the case of wild relatives, research may be needed to develop appropriate conservation techniques. Research may also be needed on germplasm health – to ensure that healthy materials are conserved and distributed. The collections should be well documented and the information made available through SINGER.

3. The materials are made widely available, subject, of course, to any legal obligations and restrictions. The wild relatives, with or without pre-breeding, should be made available to breeding programmes both at the Centres and in partner institutions. The 'orphan' crop germplasm should be made available not only to plant breeders, but also for direct testing and use in different production environments.

Recommendation 13 – Understanding gene flows

Senior scientists identified the need for a concerted and consolidated programme of genetic research on gene flows. This is because it is felt that genetic research in agriculture is being held back by biosafety issues and that insufficient information is available to evaluate the potential for, and the impact of, 'escape' of transgenes from varieties bred by GM. Gene flow is, of course, also important in the context of maintaining the genetic integrity of any variety. Unwanted gene flow could result in intellectual property problems, and consequently the ability of Centres to participate in appropriate public-private partnerships. This recommendation is also an integral part of GFAR's global programme No.2.

While the study of gene flows is important in all regions, it is particularly sensitive in areas of origin and diversity and where there are populations of wild relatives that are able to inter-cross with the cultivated species. Note that this applies to all cultivated varieties, not only those bred by GM. Similarly it is probable that gene flow issues will be most significant in crops that are predominantly out-breeding, such as maize (which is already receiving attention), certain millets, sorghum, a number of pulses (especially pigeon pea and faba bean), various roots and tubers, and many forage species.

Studies also need to look at the extent of gene flow among varieties of the same crop species under different agro-ecological conditions. Methods need to be devised for monitoring and preventing – or at least reducing to an absolute minimum – unwanted gene flows.

The following activities are foreseen and should be coordinated across Centres: (i) collating all information available to date; (ii) assembling regional data indicating where gene flow between cultivated varieties and wild relatives, locally maintained land races and other cultivated varieties is a possibility; (iii) designing and agreeing common protocols for use across crops and regions; and, (iv) quantification of gene flow and assessment of the agronomic and biological significance of gene flow events.

Recommendation 5 - Genomics for ‘orphan’ species. These include high value crops, especially vegetable and perennial crops, and for fisheries and livestock

A major deficit in research on germplasm improvement identified by stakeholders, scientists, and senior scientists was for basic genomic infrastructures for orphan species, including high value crops, particularly vegetables and perennial crops, and for fisheries and livestock. This corresponds to the strong message conveyed for the use of additional monies in germplasm improvement toward high value activities effective in combating poverty, and with the results of congruence analysis for 2015. A call for CGIAR research to increase crop productivity is the main recommendation of the World Bank’s OED meta-evaluation.

The CGIAR Centres have to be able to forcefully develop genetic improvement approaches through Challenge programmes on biofortification and abiotic stress based on access to international gene bank holdings in key crops, ongoing in-house programmes of improvement research, including functional genomics capabilities, and the establishment of appropriate international partnerships. To mount genomic studies of a wider range of key species/commodities, and to take advantage of horizontal genetic approaches particularly the opportunities offered by synteny and application of the genomic DNA sequences of rice and Arabidopsis, partnerships must be established between CGIAR Centres with a wide spectrum of partners and international consortia conducting genomics research in the same or useful model species. Prioritisation of the species/commodities to be tackled is an early requirement that would allow linkage with the orphan crops/wild relatives work to extend genetic possibilities in under studied, under collected commodities (see Recommendation 2 above). Basic genomics infrastructures will include genetic maps, second and third generation genetic markers, BAC libraries and ESTs. In the case of livestock and fish, *ex situ* collections are not maintained by the mandated Centres, and establishment of resource families for research and genetic evaluation by the CGIAR or consortium partners (e.g., for cattle, sheep, goats, carps and tilapia) would also be required.

Recommendation 3 - The genetics of drought and salinity tolerance.

Yield losses associated with abiotic stress, particularly drought and salinity, are likely to be the major constraint to food production over the next few decades. There is already considerable work on drought in the CGIAR, e.g. in the Generation CP, however the topic is so important that further resources should be applied. New genomics and comparative genetics approaches offer new opportunities for collaborations over crops and regions between CGIAR Centres, NARS and ARI and industry.

In particular, wild relatives of the cultivated crops represent a largely untapped resource. Genes, particularly for disease and pest resistance, from wild relatives have been put to good use in e.g. wheat and rice, breeding, however there remains tremendous potential in this approach for other CGIAR crops. Much of the motivation for this recommendation stems from the increasing focus on abiotic stress, particularly drought tolerance, and the fact that this secondary gene pool is expanding as embryo rescue and cytogenetic technologies advance to allow ever wider cultivated-wild crosses.

In crops where ploidy levels are do not present a complicating factor, breeders lines can often be obtained by straightforward backcrossing or QTL analysis followed by backcross assembly of ideal gene combinations. More complex, but often standard, cytogenetic solutions are required for bridging cultivated – wild species ploidy differences. All approaches (for abiotic stresses and other traits) will benefit substantially from application of marker-assisted selection, both for target genes and for backcross background.

Recommendation 24 - Integrated weed and pest management

Although this is a wide area which the SC generally endorses, the specific topic highlighted during the consultation was the comparative genetics of host plant resistance to striga. Striga is a debilitating weed in Africa and Asia and a major cause of revenue loss to small farmers. Many of some 41 *Striga* species are able to attack a range of cereals, which includes all the major tropical grass crops, and legumes. Much more knowledge of the genetic structure is needed, within and across species, of this key group of parasitic weeds. In addition genetic studies of host plant resistance will benefit from a comparative approach. Maps and genomic tools are well advanced in three key African and Asian cereals - maize, sorghum and pearl millet. Genetic analysis of resistance across species and alignment of chromosomal regions associated with resistance across genomes is likely to identify novel alleles that can be deployed in crossbreeding and novel genes that can be used in transgenic approaches.

Recommendation 6 - The genetics and genetic improvement of indigenous livestock breeds

Genetic improvement of livestock species usually is slow but can be highly economic. Unlike in Europe and the Americas there are hardly any modern breeding schemes in developing countries. Such schemes would also effectively conserve indigenous populations by making them more competitive. In developing countries genetic improvement schemes in larger farm animals will not get off the ground without some public support since it takes a considerable time, at least a decade for cattle, before a marketable product emerges.

Establishing a well adapted breeding scheme comprises the following steps: 1) Identification of a well defined regional population (worthy of conservation and improvement); 2) Determination of the breeding goals, which should be elaborated in collaboration with the target beneficiaries; 3) Working out the best adapted procedures; 4) Establishment of the necessary infrastructure and the performance and pedigree recording procedure; 5) Establishment (at a later stage) of the multiplication infrastructure. Such a regional genetic improvement scheme could have a considerable economic impact. In addition such a scheme with a pedigreed population would strengthen any conservation measure and would be a resource for additional studies in genetics, physiology and farm economics.

Recommendation 23 - Participatory farmer-breeder management of crop gene pools and comparisons with centralised breeding approaches.

Recent years have seen a move towards participatory breeding, ranging from farmer involvement in simple varietal selection to involvement in complex cross-breeding schemes and handling segregating material, in most of the CGIAR's crops. This represents a considerable

reassignment of the 18% of CGIAR budget spent on crop improvement. However, at the same time supporters of conventional breeding methodology remain sceptical.

Two activities associated with the participatory approach were recommended by the Panels. On the one hand participatory approaches should be more formalised for use with a range of cross and self-pollinated crops. At the same time, as these methods become 'mainstreamed', a global impact study comparing centralised and participatory methods should be carried out. It is possible that a 'best practice' comprising elements of both approaches could emerge, thereby reconciling the two breeding ideologies. However it is necessary to quantify the relative merits of the two approaches in order to make appropriate investments in the future

Recommendation 17 - Vegetable and fruit food production systems.

A major tenet of the new agriculture approach is that it will be necessary for small-holders to diversify the agricultural products they produce to spread risk, and to identify higher value products - compared with staples which may be locally over produced (e.g. wheat and rice in the Gangetic plain of India) or which are affected by other global factors causing a slump in world prices. The ability of small holders to increase returns from high value products such as vegetables, fruit, fish, livestock and non-food agricultural products provides a key opportunity for small holders to overcome income poverty in the first instance. The Consultation gave strong support to a new focus of the CGIAR on vegetable and fruit food production systems. These commodities have attraction because they can be seasonally or spatially integrated with existing farming systems in some cases or, when grown on smaller plots, can contribute to agriculture in urban or peri-urban settings. Local availability of fruit and vegetables can enhance nutritional security for producers and consumers.

Vegetables research to date has been focused on the CGIAR-associated AVRDC, but with relatively little work undertaken outside South East Asia. The first step therefore will be the requirement for a global evaluation and framework to prioritize vegetable research by region and its compatibility with existing farming systems.

While bananas are presently covered in the CGIAR (by IPGRI and IITA), other fruit crops are not - although tree crops have been included in some of ICRAF's cropping systems work and some research is being done under special project arrangements at CIAT. Fruit in general has a higher income elasticity of demand than vegetables, may have more specialized cultural requirements, be more demanding of improved marketing sector and infrastructure, and production may come in competition with exports from developed nations, etc. An initial survey will therefore be required to identify the fruits that could benefit small-holder production systems. Farm to market analyses will be required for the prioritized commodities, and ex ante assessments of the appropriate means of diversification made for any agro-ecosystem and region of choice, including local competition effects from adopters of similar technologies. It is anticipated that the program would subsequently focus on farming systems approaches for the introduction of viable production choices, to be augmented by the characterization of locally important germplasm and possible improvement of a small number of key species as a contribution to global IPG if this can be identified.

Recommendation 4 - Agricultural systems research from an agroecology, INRM, and sustainable livelihoods perspective, particularly for unfavorable environments

The three main instruments for the CGIAR to reduce world poverty through enhanced productivity and reduced vulnerability are: (i) Traditional breeding (following the approach of the Green Revolution, and now extended to enhancing biotic and abiotic stress resistance and reducing environmental damage); (ii) Biotechnology (including use of markers in breeding, wide crossings, and GMOs); (iii) Agricultural systems research from an agroecology, INRM, and sustainable livelihood perspective.

The first two are well represented in the CGIAR's research portfolio. The third requires continued evolution within the CGIAR to achieve its full potential. The implementation of an agricultural systems approach in the field has considerable local and household specificity, particularly as it is extended in the INRM and sustainable livelihoods dimensions. System-level research on agricultural systems therefore needs to be oriented towards the generation of IPG. This means focusing on methods, processes, measurement methods, best practices for implementation, and scaling-up methods. Regional and system-wide thrusts could be arranged as follows:

1. Work with priority farming systems. The types of farming systems that received most attention in the open consultation are, in decreasing order of importance: (i) Cereals-based systems, (ii) High value crops-based systems in urban and peri-urban environments, (iii) Livestock-based systems (pastoral), (iv) Integrated crops-livestock systems (agro-pastoral), (v) Agroforestry systems (sylvo-pastoral), (vi) Forestry systems (slash-and-burn and alternatives thereof), (vii) Integrated aquaculture-agriculture systems.

2. Work with mega-domains of application and types of households. Noting that an underlying assumption of the consultation was that cereal and root crop-based systems in high resource areas are well-covered in the current CGIAR portfolio, the major domains for agricultural systems research would be:

2.1. Agro-ecological contexts: Rainfed agro-ecosystems (especially in areas of low water-availability and/or poor soils areas- the previous TAC soil and water report found that some of these, in fact, may have reasonably high potential), forest margins, desert margins, mountain margins (highland, watersheds), coastal margins (coastal and artisanal fisheries, flood plains), and urban margins.

2.2. Regional contexts: The Four developing country regions and a global approach

2.3. Types of livelihood strategies: Specialized farming; multipurpose/multifunctional landscape use systems; gender and intra-households strategies.

2. Work on methodologies. Holistic approaches should be adopted in the research to integrated bio-resource flows, including nutrients, water, and carbon. Attention should be paid to IPM (integrated pest management), integrated soil fertility management, and Bio-economic modeling at different scales.

3. Work on approaches. An agricultural systems approach will include:

- Partnerships with producers' organizations and umbrella groups, in the NARI, private and NGO sectors.
- Best practices for the empowerment of farmers.
- Best practices for participatory approaches (participation in problem identification, in setting research priorities and in allocating research budgets).
- Participatory breeding, and in evaluation of systems alternatives.
- Participatory methods for the identification of local success stories, constraints, and opportunities.
- Integral territorial strategies to poverty reduction.
- Scaling up methods.
- Broadly inter-disciplinary teams.
- Short term (poverty reduction) and long term (sustainability) research objectives and logframes.

4. Work as catalyst of regional and world-wide coordinated approaches. Adoption of an agricultural systems approach at the global scale will require that the CGIAR provide a coordination function, provision of strategic inputs based on CGIAR science (using the evolving INRM approach), and attention to capacity building. Lessons as to how to set up this programme to pursue an holistic, eco-regional and regional approach to research may be derived from the Alternatives to Slash and Burn Systemwide programme.

Recommendation 12 – The rural poor: Access to assets, links to markets and institutions, and pathways out of poverty, with a special emphasis on gender

These are very under-studied areas from a policy perspective, but they hold considerable promise for achieving CGIAR goals. The sustainable livelihoods approach, complemented by institutional and market analyses, provides a useful integrating framework in designing this area of research. Improved access to assets is fundamental to reducing poverty, including natural, human, financial, physical, and social capital. Among these assets, land and water resources are the most important for agricultural production. Without explicit attention to the control over assets, the poor risk being bypassed by technological improvements or worse, having their access to resources restricted as land and water become more valuable. Along with technological interventions, due attention needs to be given to policy mechanisms to ensure the property rights of women, poor households, and other marginalized groups.

The value of assets in generating income and security depends on the quality of the context where they are used. Hence, to offer pathways out of poverty, access to assets must be accompanied by the development of a set of markets, institutions, public goods, and policies that service the poor and allow them to achieve competitiveness. Rapidly changing markets in the context of globalization, the penetration of supermarkets in food distribution, and agro-industrial transformation pose new challenges for small farmers that they need to address if they are not to be marginalized from accessing effective demand. Best practices need to be identified in setting up a quality context that will help the poor use their resources to escape poverty.

At the same time, small holders can seize opportunities to add value to their production by engaging in product differentiation (quality, labeling), post-harvest transformation, and arbitrage of production in time and space. Developing information systems, innovating post-harvest technologies, and promoting agro-industries based on small and medium rural enterprises are important for this purpose.

With reducing rural poverty an important component of the Millennium Development Goals and a central element of the new mission of the CGIAR, mounting a systematic research effort to identify and experiment with alternative strategies out of poverty based technological and institutional innovations could indeed be a major contribution made by the CGIAR.

Strategic priority - Strengthening NARS and developing new partnerships

There was high consensus in the consultation for the need to assist capacity development in NARS, broadly defined, to deal with emerging issues in genetics, research management, and policy formulation. The future strengthening of NARS will require considerable institutional change in the nature and the mode of operations of NARS. Several of the newly developed research technologies (such as many biotechnology tools) are expensive and out of reach of individual institutes, certainly in the smaller countries. In addition the pathway to impact requires intensive collaboration with organizations that have a better feeling for the issues at stake in the sector, or that have more potential to scale-up the use of new research results.

The development of capacity for the formation of partnerships is the most essential topic for strengthening NARS in the coming decade. Not only national agricultural research institutes, but the whole array of emerging actors in agricultural research, including the private sector and non-profit organizations, should be considered in the development of partnership-building capacity. Research is needed to identify new modalities to pursue strengthening of and partnerships with and in NARS. Three types of partnerships merit special attention: public-private partnerships, especially to increase chances for successful scaling-up of new technologies; partnerships with producer organizations to allow for research and technology dissemination agendas that reflect the grass root concerns; partnerships with public agencies from other sector to contribute to the solution of problems that cross over several sectors (such as environmental and health problems). Implementation of these modalities would require a major coordinated approach by the CGIAR as a whole. This recommendation is coincident with the World Bank's OED, with GFAR's global program No.3, and with priorities identified by Regional and Sub-Regional organizations.

Two other topics for strengthening NARS may be considered: dealing with new technologies and dealing with new questions. Regarding the new technologies, biotechnology and information technology stand out. While the CGIAR's role in strengthening the use of biotechnology tools is limited by its own investments in it, it may pilot collaborative models, such as the Bioscience Initiative in Nairobi, and it may support the implementation of adequate biosafety policy frameworks. In information technology, the competitive edge of the CGIAR and the ability to strengthen national organizations is less clear.

Regarding the new questions, two stand out. Firstly the need to add value to the productive efforts of small farmers by giving more attention to post-harvest issues and by

researching and promoting diversification. Secondly the need to enhance the sustainability and stability of production in marginal areas.

The CGIAR's efforts in strengthening NARS will increasingly build on collaborative models themselves, where in partnership issues are explored; solutions are developed, tested and made available through networks of collaborators. In these new partnerships, Regional and Subregional Organizations will be major partners.

The precise choice by region depends on the endowment, the income level and the degree of development of the countries that will be involved. Size of countries will also be an important criterion: effective biotechnology capacity is expensive and more in reach for large than small countries; small countries will be more interested in international value chains than in domestic value chains.

Strategic priority - Strengthening farmers' organizations and participatory processes

Originally ranked as the seventh priority arising from the consultation, the SC has considered this part of a strategic rather than research approach to help accomplish the CGIAR mission. The CGIAR must understand better how farmer organizations can be strengthened and how this contributes to sustainable agricultural development and enhanced technological and institutional change. This research of the CGIAR will need to focus on the two main roles that farmer organizations may play:

1. The increased bargaining power of farmer organizations allows them to influence the research and development agenda. In addition it may also influence pricing in agricultural markets, or the design of the public institutions concerned with the management of the agricultural sector.
2. The increased level of organization allows for the better distribution of new knowledge and technologies to the individual farmer.

While the effects of strengthened farmer organizations are well understood, it is more difficult to understand and predict when and how farmers are effectively able to organize themselves. Through participating in the strengthening of farmer organizations and through comparing the lessons from many cases, generic guidelines may be developed that contribute to the development of farmer organizations.

Further research will also be required on the design of participatory processes within farmer organizations, in order to benefit to the maximum from the existing organization and in order to understand the effect of the structure and culture of the organization on the sharing of new knowledge and technologies.

7.6 Summary - The focus of the new Priorities for Research

The SC has identified a smaller number of major thrusts to the recommendations for new research. Focussing the new priority research areas around major thrusts highlights the different approaches that may be utilised in a coherent approach for the System, allows the identification

of overlaps and boundaries between areas, and helps determine, at a strategic level, the types of research that will be required to alleviate constraints in the new areas. The SC has identified the major areas for focus and the implications for the CGIAR:

1. Consolidate a major focus on water management [priority # 1].

Implication for P&S: The water and food CP represents the major effort in this area, but the consultation revealed the requirement to effectively link this programme to emerging new initiatives such as to the genomics of drought resistance, prioritization of high value crops in different farming systems, natural resources governance policy and food safety.

2. Focus on extended efforts at ex-situ and in-situ conservation and characterization of germplasm: wild relatives, orphan crops, crops for marginal environments, indigenous livestock breeds, forest genetic resources and fisheries, [priorities #2, 6, 19].

Implication for P&S: Increase investments in ex- and in-situ conservation and characterization of wild relatives and orphan crops. CGIAR efforts in this field need to be funded by special provisions that shelter investments from short term fluctuations and competition with other demands on the repository centres. This corresponds to the major recommendation from the consultation.

3. Focus on new genomics (including marker-assisted breeding): providing the platform for research on resistance to abiotic and biotic stresses, biosafety, and food quality, [priorities #3, 16, 13].

Implication for P&S: Capitalizing on new technological possibilities justifies keeping a significant share of the CGIAR budget on its traditional food crops mission, including for maintenance research. This share should, however, be declining quite sharply for the major staple crops with the increasing roles of industrialized countries, NARIs, and the private sector in research on these commodities. The CGIAR should increase research on abiotic stresses and the products and practices of the new agriculture, in particular the genomics of high value and orphan tropical crops.

4. Focus on marginal lands and agro-ecological margins, [priorities # 4, 7, 10, 14, 15].

Implication for P&S: Organize a major coordinated effort, focused on well-defined expected achievements, that mobilizes the CGIAR as a whole. Securing high rates of return from investments in this area of research requires carefully identified research priorities and well specified logframes.

5. Focus on the production capacity of the poor and the potential of the new agriculture, [priorities#5,12,17,30,26,8].

6. Focus on staple foods and the role of agriculture for the urban poor and landless rural populations, [priorities # 9, 29, 32, 24].

7. Focus on globalization and market opportunities for the poor, [priorities # 21, 22, 11, 28]

8. Focus on empowerment of the poor, with a gender focus, [priorities # 23, 25, coupled with a strategic engagement to strengthen producers organizations].

Implication for P&S: Areas 5-8 provide an outline of a pro-poor agenda for research. It will gain from being planned and tackled programmatically as a system-wide effort. The CGIAR's supporting agenda in research on policy and socio-economics will need to remain broad and flexible. For example, the implications for the labour intensity of particular research investments need to be taken into account as an ex-ante criterion in selecting among research proposals.

9. Focus on the environment: provision of environmental services and dealing with climate change, [priorities # 20, 27, 18].

Implications for P&S: Broaden the focus of agricultural research from productivity gains to risk and vulnerability reduction in agriculture. Genomics for drought resistance is already part of the Challenge Program "unlocking genetic diversity in crops for the resource poor". Such an approach would link to other aspects of the portfolio dealing with improved water control, diversification of cropping patterns and sources of income etc. A system-wide effort could address the totality of the package of interventions needed to reduce risks and vulnerability.

10. Focus on regional programs and partnerships through public private partnerships and strengthening NARS [as a strategic consideration and priority # 31].

Implication for P&S: The CGIAR needs to maintain its investments in the strengthening of NARS and other rural institutions. Efforts to learn from past engagements in training are being made by SPIA. New forms of partnerships need to be experimented with as the configuration of actors in agricultural research changes and the role of intellectual property rights evolves, redefining comparative advantages for the CGIAR and how its research can be done and funded.

CHAPTER 8 - CONSIDERING STRATEGIES

8.1 Introduction

The SC-led priorities exercise has identified new as well as continuing areas for research as the CGIAR moves to develop System Priorities. The focussed areas represent research requirements and capacity building on several fronts. The mix of priorities is dictated both by the current and the expected future context for helping the poor through agricultural research. Some of the ongoing priorities remain on the list because research so far has not produced the results needed to take themes off the priority list; and some themes that were past priorities are becoming more urgent, such as the need for the CGIAR to address the agriculture priorities for poverty alleviation in Africa. All of these priorities - new and continuing - could be addressed in a number of different ways. The purpose of this chapter is to review the strategic considerations for addressing new and continuing priority research.

The CGIAR already has an interconnected set of Centre and Systemwide research programmes in place. However, as priorities shift and evolve, and as the opportunities and the context for agricultural research change, there is a need to revisit the current CGIAR strategies and to adjust them, where necessary, in order to make sure that a set of strategies is in place to implement research in the most effective and efficient manner possible. This applies both to strategies for meeting the new priorities as well as to strategies for overcoming the lack of significant progress towards agricultural related poverty reduction in other cases (such as, for example, in Africa). In fact, a major strategic element being considered in the CGIAR's current portfolio is a new approach to agricultural research in Africa, one that would complement the steady but insufficient advances made to date.

Chapter 2 characterizes the current context for identifying priorities. It also provides some context for defining a future science strategy for the CGIAR. There are a few additional elements, however, that must be incorporated into the mix of considerations leading up to a new Science Strategy for the CGIAR. The main contextual considerations are addressed in the following section. The implications for achieving the priorities are also discussed. Other subsections treat the specific strategic frameworks needed at the Centre, Systemwide and CP levels in order to most effectively address the priorities. The task force approach is reintroduced.

8.2 Contextual Considerations in Setting a CGIAR Science Strategy for the Future

Some of the main elements of the changing context for agricultural research have been covered in chapter 2. The major issues are briefly reviewed here to highlight their implications for a revised CGIAR strategy.

An emphasis on poverty alleviation

Requires that the type of research to be undertaken can contribute directly or indirectly to this goal, noting the need to reduce both rural and urban poverty. The extent to which a strategic focus on marginal lands will directly address rural poverty is raised.

Managing the natural resource base

Will require new institutional paradigms for multi-disciplinary research and not sector-by-sector management. It raises the profile of institutional research and governance issues, together with landscape level approaches to research at different scales. Resource conservation strategies will more explicitly target efficiency in water use and abiotic stresses like drought.

The globalization of agriculture

Raises the requirement in all countries to be more efficient and competitive in production and trade. This has implications for agricultural research strategy, for example causing shifts in policy research approaches (towards efficiency of production, trade and food safety, managing local opportunities and solutions through more global indicators, input and output markets). There are also implications for genetics research approaches (with a greater emphasis by developing countries wishing to exploit cash crops according to their national advantage). Identifying appropriate CGIAR assistance to this research requires that strategic approaches lead to the production of IPG. There is increasing urgency and need to formulate a strategy for the proper collection and conservation of the genetic diversity which serves agriculture.

New information

New information is becoming available from current international efforts in monitoring and assessment of agricultural and environmental perspectives. Such initiatives include the Millennium Ecosystem Assessment, the World Bank-led consortium reviewing science and technology applied to agriculture, the Global Ocean Observing System, and Global Coastal Observing System Projects of UNESCO etc.. Each of these systems of assessment is likely to lead to internationally accepted ideas and priorities for future actions, which should be reviewed for incorporation into CGIAR planning and priority setting as they become available.

New science

There are exciting new technologies in the biosciences (e.g. genomics, genetic characterisation and manipulation, expression and metabolic profiling) and in computing capacity (leading to such approaches as natural resources modelling, precision farming, applications of GIS, etc.), the strategic assessment of these new tools needs to be continually reviewed (as the TAC/iSC has done for other technologies like new breeding approaches) to examine how best they can be applied to the priority issues to be tackled by multidisciplinary research.

Evolution of private sector research

There are strategic opportunities to draw the private sector into assisting the global goals of the CGIAR. The major opportunity is expected to be through the application of private sector biotechnologies in germplasm enhancement. This demands that the CGIAR be fully aware of private sector progress, able to access relevant technologies through partnerships, and apply them to the requirements of developing countries, particularly the poor. Elements of a successful strategy need to be integrated from Centre to System level, and through active PPP research utilizing proprietary technologies.

Evolution of the IPR debate

Requires that the CGIAR adopts system strategies for dealing with IP, that accord with international criteria and which ensure freedom of action in public goods research. A strategy for

capacity building of partner institutions in developing countries with respect to IPRs in agriculture should also be adopted.

New ICTs

The new information and communication technologies have general implications in terms of using virtual approaches. There are major opportunities to enhance the planning and management of research in consortia and geographically distributed research, which form an increasing part of the CGIAR's strategic *modus operandi*.

Knowledge management

Utilising data and improved communication technologies both within centres, to develop targeted information for communities of practice across centres and sectors, to specifically inform policy makers, dissemination partners and farm-level users, requires strategic assessment and incorporation into the System's ways of working. It bears on research efficiency as well as Centre impact.

Economies of scale in new research areas

The CGIAR Centres and the system as a whole has opportunities for consolidation and partnering strategies (e.g. in the case of functional genomics, and the development of other task forces - see below)

The changing composition of NARS and ARIs

The rapid evolution and changing strengths of NARS (including their civil society partners) and ARIs, requires new strategic assessments of how research in partnership is best carried out. The System must place its research effort strategically to maximize outputs achieving the CGIAR goals, noting that 96 per cent of agricultural research is undertaken by non-CGIAR providers. It also raises the key issue for the CGIAR as to what parts of its current portfolio it can relinquish (now or in the next decade) whilst protecting the IPG nature of the fruits of system research. Understanding when the CGIAR needs itself to conduct research or achieve its goals through crystallization of issues, research formulation, facilitation and management will be a strategic question of increasing importance with time.

NARS priorities

The emergence of regional NARS bodies and the NARS apex body, GFAR have acted as a stimulus for the setting of regional and sub-regional priorities for agricultural research. Such consultative priority setting processes provide assistance to the CGIAR process in defining part of the demand side of priority setting for research. They also provide the basis for identifying the distribution of research or related efforts and roles with respect to major global or regional priorities, thus contributing to the CGIAR's strategic priority setting and implementation choices.

Strong support was given during the consultation on research priorities to enhancing the capacity of NARS to deal more specifically with the new issues in agriculture. As these issues are not research per se, they are considered (in section 8.9) as new strategic directions, which should help shape the CGIAR's priorities and activities for capacity building.

Participation

Participatory approaches (in planning, and the conduct, monitoring and evaluation of research) form a component of the strategic approach of the CGIAR leading to more holistic, appropriate and sustainable outcomes.

Empowerment

Given the relative complexity of effecting agricultural research for the alleviation of poverty, the CGIAR should adopt the principle of empowerment of its stakeholders and extension partners, and farmer/fisher/forester organisations, as the most efficient means of maximising investment and the impact from research.

A territorial approach to rural development and poverty reduction

It has become increasingly evident that most rural households are engaged in more than agriculture. Their sources of income tend to be quite diversified, including wage earnings in non-agricultural manufacturing and services activities, self-employment in micro-enterprises, and remittances from migration. As a consequence, rural poverty cannot be attacked through agriculture alone. At the same time, many of the non-agricultural activities in a particular region may be driven by agriculture through forward and backward linkage effects, and through demands for non-agricultural products and services that originate in the expenditure of agricultural incomes. A rural poverty reduction strategy for rural areas consequently needs to look beyond agriculture at these other activities, as well as at activities that have no relation to agriculture. This requires a territorial approach that is all encompassing of the activities and sources of income in a particular region. In this approach, regional development includes consideration of economic projects with potential for creating employment and incomes in the region. Rural development, as a poverty reduction strategy, is then concerned with linking the poor in the region to the employment and investment opportunities offered by regional growth. Agricultural technology has a fundamental role to play for both regional and rural development. However, for maximum effectiveness, it needs to be coordinated with the other investments and interventions that characterize the regional and rural development strategies for a particular territory.

Linkage between regional priorities and other development agents

The foregoing indicates that there are many opportunities to bring research and development programmes into closer alignment at the regional level. Whilst the CGIAR requires to extend these forward and backward linkages with development agencies, and with regional networks and services, the CGIAR should be cogniscent of the placement of its agricultural and sustainability research for maximum benefit, given the separate roles of the other actors.

Changing donor support for agricultural research

This fact requires that the system develop flexible strategies in moving from the identification of priorities to implementation. More strategic and sustained awareness building of the goals, and requirements of the CGIAR research agenda in the wider donor community are required.

8.3. Implications for Addressing Evolving Priorities

If the outline analysis offered above is generally correct, the changing context for agricultural research has strategic implications for the system. These include:

Shifts in scientific expertise needed in the system: These changes may need to be in different directions (i) towards the acquisition of upstream genetic science and the establishment of platforms to relate to the private sector, (ii) integrators of natural resources management research and policy development, (iii) policy and legal affairs - e.g. governing IPR and the use of genetic and other technologies at the system level and amongst NARS, (iv) increased capacity in effecting institutional change, (v) new social science capacities (or linkages) in poverty analysis, and market analysis and global trade, (vi) post harvest management and linkages to production chain expertise, (vii) research management at the consortium level integrating system skills in ITC.

Do we require greater or lesser Systemwide activity in the context of the new priorities? Inter-Centre, Systemwide or task force approaches have the clear advantage of bringing together the system's expertise and research capacity around major global and regional issues. They enhance the programmatic approach of the system to global problems. They are therefore to be encouraged as a strategic mechanism. Increasingly the priority issues are not just research, but in building common frameworks for all players (CGIAR, NARS and other partners) to conduct research in a cooperative and efficient manner. This helps the CGIAR and the component Centres, but is also increasingly geared to enhancing capacity for NARS of developing countries to assist themselves and their national priorities in the future. The strategic issue for the Centres, is how best to join and support initiatives in relation to the continuing heartland portfolio within their commodity, sectoral, or regional mandate. On the basis of its continuing review processes, the SC is best placed to comment on the efficiency, impacts and current support to existing Systemwide initiatives. It could therefore provide guidance on when some activities may be terminated - to be replaced with new high priorities - or the possibility of incorporating aspects of the new priorities into existing programmes.

Strategic choices in dealing with the "other 96%", e.g.:

- **Dealing with the private sector** - CGIAR-private partnerships make sense largely in the application of proprietary technologies to germplasm enhancement research. Untested cooperations on environmental issues may be worthy of pilots. The emphasis in the consultations on addressing issues in biotechnology and IP are relevant to creating better PPP and should therefore be pursued as a priority.
- **Dealing with strong vs weak NARS** - This is an important area in which SC guidance is required. CGIAR Centres work with selected NARS in their regions, and share information with many more globally. However, it is very difficult to develop a uniform interaction given variability in the NARS and the biophysical and human variability of the states concerned. Is there an appropriate CGIAR strategy, e.g., does the CGIAR increasingly disengage from countries and regions with strong NARS, or

alternatively does it work aggressively with them with the idea that they will eventually take over the role of supporting weaker NARS in their regions?

- **New linkages with ARIs** - there are, increasingly, opportunities to source relevant research (basic or more specifically commissioned) from non-CGIAR providers. The SC may wish to consider whether there are strategic guidelines to be offered (such as the requirement to maintain the IPG nature of the outputs from collaborative research), or whether the range of possible interactions is likely to be too large for such guidelines to be formulated. In general, outsourcing of research or for example, capturing food safety, market chain knowledge and post harvest expertise from others, is to be welcomed as part of the principle of developing new science partnerships.

Resource requirements: The priorities developed by the consultation are intended to be implemented through incremental additional budget. Achieving the intended outcomes through the most cost effective procedures and mechanisms is required. The CPs have been able to capture some sources of new funding (new Government environmental funding, or major support from non-traditional sources like Foundations) but they will still require substantial bi and multilateral support from the CGIAR's traditional donors to complete their anticipated work plans effectively. However, the budget for the research agenda in 2004 is substantially increased, and this does not include all CP-related funding. The SC may wish to provide encouragement in the first instance to priorities which can be more directly incorporated into existing Centre or small task force approaches, rather than as additional CPs.

8.4. Implications in Terms of Centre Science Strategies

It is apparent from chapter 4, that each of the Centres currently has substantial project portfolios, and each strategically reviews their content at appropriate intervals. New priorities emerge for Centres from interactions with their partners and stakeholders in the course of their research. The question for the SC therefore will be how to guide inclusion of the new priorities into the System's overall portfolio and the agreed research agenda. For some Centres, priority research has been developed during the last couple of years in the context of discussing possible CPs, and effort is being spent on means to implement them. Some of these inevitably involve consortia in which more than one Centre is involved.

Some key considerations in promoting the incorporation of the new priorities would include the following:

In general, issues which affect the working of the whole system, like genetic resources policy, IPRs etc. should be given greater emphasis.

Encouragement should be given to work that can add value to existing initiatives (such as the genomic investigations of other crops, trees, livestock and fish, which may be exercised through continuation of existing capacities and projects or additional partnerships around existing themes; or to the incorporation of agroecological systems approaches to existing ecoregional programmes).

New priorities that would require substantial planning and reorientation of Centre activities, such as increasing work on orphan crops, should be encouraged when the appropriate lead Centre is equipped to enter into the necessary transactions and/or can capitalize on the initiatives of others (such as the GFAR initiatives).

Centres should make evolutionary not revolutionary changes in their science strategies. Past experience has shown that when changes are made too rapidly and dramatically, serious problems can result for the Centres involved.

Centres are encouraged to be proactive rather than reactive in making their changes, looking not only at the shifting CGIAR priorities, but also looking at the priorities of their partners and, in the case of regionally focused Centres, the priorities as identified in regional consultations.

8.5 Implications in Terms of Systemwide Programmes

Some of the new and ongoing priorities identified by the Consultation can most effectively and efficiently be addressed through Systemwide action, where a number of Centres and other partners join together in a collective effort, or a Systemwide programme, to deal with the priority research needs in the most efficient and effective manner possible. The conditions that call for a Systemwide science strategy in addressing a particular priority include but are not limited to the following:

- The identified priority research is a common priority for two or more Centres;
- There is a shared requirement for knowledge of an issue and gains from adopting system-wide approaches, operational applications and responses;
- Complementarities exist among Centres in terms of their comparative advantages and capacities to address a priority need;
- It is possible to gain economies of scale in addressing the priority;
- There are overlapping regional presences of two or more Centres;
- A priority need can best be addressed by blending a wide range of sciences in a broader, coordinated research programme to address an issue in the context of specific regional needs.

System-wide initiatives can be rather heterogeneous in their subject matter and make up, ranging from ecoregional research initiatives to programmes focused on administrative or organisational issues common to CGIAR Centres.

8.6 Implications in Terms of Task Forces

The concept of Task Forces (or at least the phrase) is currently used less in the CGIAR than the accepted and new concepts of Systemwide and Challenge Programmes (see sections 8.5 and 8.7). However, it is recognized that the complexity of the poverty and food-security challenges in the coming decades is such that research problems will become increasingly complex in terms of their demands on science, and increasingly urgent in terms of the need for *rapid* response and effective impact on the poor. No single institution will possess the range of

instruments and flexibility needed to tackle such problems effectively. For this reason the idea of a task force approach has been accepted by the CGIAR as one of the planks of the System's Vision and Strategy. The task force approach was defined as follows:

“The CGIAR will adopt a task force approach to address major, clearly identifiable problems where there is an opportunity for an impact to be made and/or where there are intractable problems that need a concerted approach by multiple actors and agencies within and outside the CGIAR System.”

Such task forces need to be managed and to have clearly defined objectives, outputs, scientific and financial resources, timeframes and accountability mechanisms.

It should be remembered that the task force concept was but one plank in a set of five strategic initiatives to enhance the efficiency and (programmatic) effectiveness of the CGIAR (the others were the regional approach to research, defined regional responsibility of some Centres, new partnerships in science and development, and a catalytic role in developing solutions). These strategic choices all remain valid today.

The task force approach has many similarities to the system-wide approach but there is an emphasis on their rapid application to specific emerging problems that have well specified outputs and are time bound. There exist in the CGIAR several communities of practice, such as the INRM Group, the System-wide Genetic Resources programme, CAPRI etc., which could form the basis for action research initiatives, organized with their partners as Task Forces. Policy research initiatives, capacity strengthening and regional pilots of global initiatives (such as contained in the newly emerging priorities) may all lend themselves to Task Force approaches.

8.7 Implications in Terms of CPs

In contrast to SWPs that are more inwardly focused on linkages within the CGIAR System, CPs are particularly well suited for addressing priorities that require strong partnering and involvement with research entities and partners outside the CGIAR system. They are meant to bring in a wider set of actors as well as to stimulate non-traditional sources of funding.

The strategic questions governing CPs relate to their:

Content: The three CPs already being implemented are responding to some of the fundamental major themes identified as priorities during the consultations. It would make strategic sense for the consortium management of these CPs to review and evaluate the possibility of incorporating complementary new priorities that were identified during the consultation process. The key strategic question centres on whether the SC sees any of the new priorities warranting implementation in the form of a new CP. In general, most of the recommendations can be accommodated by adding to the existing regional, Centre-led research initiatives, and policy work developed through smaller consortia (formed as suggested in section 8.6). Similarly, the SC requires to define the role to be played by the potential CPs that are currently at the proposal stage, in the light of the current priorities emerging from the new priority-setting process.

Evolution: As with the programmes of individual Centres, the competitive research approach to incremental projects, and changes in funding opportunities, could lead to drift in the work plans of the CPs. CPs must be monitored for modifications in CP goals and objectives, and possible scope, based on the new set of priorities identified by the SC.

Size: As has been noted by the meta-evaluation of the CGIAR (and its Challenge Programmes) conducted by the OED of the World Bank, starting a new CP is similar in funding terms to the creation of a new Centre. It is unlikely therefore that additional recurrent funds to support several new CPs will be forthcoming. For this reason alone, smaller, more cost effective means of tackling the new priorities should be entertained as a strategic priority.

Governance: From the point of view of the SC, the strategic needs related to the CPs focus on SC involvement in oversight, monitoring science quality and relevance in the CPs, and definition of the evaluation procedures that need to be put in place.

8.8. Strategic interpretation of recommendations from the consultations

Based on these considerations, the SC suggests that the recommendations arising from the Consultation may be implemented through the following modalities:

Recommendations from the consultation	Potential science strategies
Recommendation 1 - Water management	Linkage of CPs (Water and food, Diversity) to other programmatic aspects of research through Task force
Recommendation 2 - Collection, conservation, and characterization of germplasm for crop wild relatives and orphan food crops	Coordinated programme by centres with most proximate germplasm collections
Recommendation 3 – Focus on new genomics (including marker-assisted breeding): providing the platform for research on resistance to abiotic and biotic stresses, biosafety, and food quality	Linkage of Diversity CP to complementary Centre approaches through broader Systemwide programme or Task force
Recommendation 4 - Agricultural systems research from an agroecology, INRM, and sustainable livelihoods perspective, particularly for unfavourable environments	Systemwide programme
Recommendation 5-8 – The rural poor: Access to assets, links to markets and institutions, and pathways out of poverty, with a special emphasis on gender	Systemwide programme

8.9 Strategic interpretation of recommendations from the consultations – strengthening NARS

The results of the consultation for strengthening NARS and rural institutions were:

5. Strengthening NARS and other rural institutions

NARS capacity to deal with emerging issues	1	1	1	1	1	5
NARS capacity in strategic analysis & priority setting	1		1	1	1	4
Farmers organizations & new agriculture	1	1	1	1		4
Public-private partnerships in technology development	1	1	1	1		4
NARS capacity in social analysis	1	1	1			3
Strengthening farmers organizations	1		1	1		3
Innovations to link farmers to markets.	1		1	1		3
Empowerment of women and marginalized groups	1		1	1		3

Given the sharing of roles and responsibilities required in more flexible, tailored solutions to the emerging agriculture and natural resource problems, it will be important to consider the best means by which the CGIAR can assist NARS and NARES build new capacities. Rather than create completely new vehicles for such priorities it would be most effective to link them with existing or potential CGIAR research activities (as per section 8.8).

Recommendations from the consultation	Potential capacity building strategies
Recommendation 1 - Augmenting NARS capacity to deal with emerging issues	Linkage as specific component of science recommendation 11 (see section 7.5)
Recommendation 2 – Augmenting NARS capacity in strategic analysis & priority setting	Task force
Recommendation 3 - Farmers organizations & new agriculture	Complements/supplements science recommendation 4 and Centres' continuing programmes
Recommendation 4 - Public-private partnerships in technology development	Systemwide program or specific syntheses arising from science recommendation 3

8.10 The relationship between setting priorities and structure

Finally, it is appropriate to examine the strategic considerations as the CGIAR builds on the experience of the consultation and examines overall system priorities.

Each system priority should respond to a clear definition of the problem and the goal of international agricultural research, and will specify the timeline for achieving the goal and annual objectives and milestones, using a logframe approach. Performance evaluation of each centre and each priority area will be based on the extent to which the milestones are achieved. Each of the System priorities, and the related activities, would be pursued, as appropriate, by the relevant centres and other collaborating institutions. In order to avoid excessive overhead and transaction costs, and to derive the benefits from small and nimble research implementing agencies, the research implementation and governance would be left with the collaborating centres. No new

steering and governance structures would be created for the System priorities, except periodic meetings by scientists from collaborating research institutions. Activities requiring System action, such as selected IPR matters, would be undertaken by existing or new System arrangements.

In order to promote innovative ideas and exploratory research and to leave flexibility for research of interest to individual centres that is not included in the System priorities, each centre would have the freedom to pursue research outside the System priorities. However, it is expected that the large majority of the CGIAR funding would be channelled to the System priorities.

The system priorities should be selected exclusively on the basis of expected impact. They should be forward looking, taking into account the time it takes to complete research. Structural questions should not enter into the selection of priorities. Thus priorities requiring multiple centres should not necessarily be given priority over priorities that could be dealt with by one or two centres. The number of collaborators from outside the CGIAR should not be viewed as relevant to the choice of priorities. It is critically important that the programmatic needs determine structure. Thus, questions such as: "How many centres should the CGIAR have?" will be answered after the programmatic priorities have been identified, not before.

CHAPTER 9 - INSTITUTIONALIZING THE PROCESS OF PRIORITY SETTING

9.1 Lessons Learned from the Current Exercise

First of all, we want to thank the many participants to the demanding consultative priority setting exercise that was followed. Many participants have accompanied the Science Council willingly through the different steps of the process. We are particularly grateful to the leaders of the three thematic panels and the five regional panels for the quality of their work and the many innovations they made in the process of implementation, and to the 75 panel members who persisted in providing ideas and feedbacks all the way to the final round of scoring. We want to acknowledge the many useful suggestions that were received to improve and complement the consultative process for future use of the approach.

9.1.1 The Priority Setting Process

The priority setting process was innovative, because of large reliance on electronic correspondence and discussion. Because it was new, it had to be incrementally modified during the process, to take account of new insights that were arising continuously and to integrate the constructive feedback that participants were giving. The innovative nature of the electronic priority setting process was complemented by use of more traditional approaches, which were particularly helpful to review and reshape the CGIAR's commodity portfolio or resource management emphasis. These approaches, summarized in Figure 1 of Chapter 1, are to be used in a complementary fashion, and the SC needs to learn how to optimise the contribution made by each to priority setting.

The consultative process used is so new that, at this moment, it would be unwise to speak of a method. It is better to call the process an approach from which, in the future, a method may be distilled. What is required to do so is to take stock of the strengths and weaknesses of the process, and to identify the opportunities that the approach provides for new insights and new ways of science management. For this purpose we will first highlight in this section the essential difference of the electronic priority setting processes over other approaches and we will then draw a series of lessons. The lessons have been categorized into four groups:

1. Process management lessons, to understand better the pathway that was followed to arrive at outcomes
2. Methodological lessons, that will help to understand to what extent the approach arrives at solid and replicable results in a systematic manner
3. Participation lessons, that will help to understand how the extent and the type of participation has influenced the outcomes
4. Follow-up lessons to understand to what extent the outcomes of the exercise can be implemented and to understand what other implications may be drawn.

9.1.2 What was Special about the Electronic Priority Setting Process?

The approach designed by the Science Council differed from other approaches in some notable ways. The first main difference is that there was not much attention to the methodology for comparing alternatives. There was no definition of measurement scales in achieving goals. People were basically comparing each other's opinions that may have been based on many personal criteria but that were not made explicit.

On the methodology, there was an important innovation. The process was not used to compare research options on a one by one basis to arrive at something of a ranking. Rather, respondents designed portfolios of research projects under a budget constraint. The research alternatives most frequently selected in the portfolios of the different participants were then combined into a "priority portfolio" at regional or global level.

A second main difference is that the approach was very participatory and allowed large groups of people to be involved in the discussion. The selection of participants and the ability to raise their enthusiasm to the extent that they would remain active through the exercise became important management elements of the procedure.

A third main difference is that participants were not together, but participated in the discussion from their home or work base, through e-mail. They could access background information from their bases, and contribute to the discussions and the final voting. Because people were not giving exclusive attention to the exercise, and because they live and work in different time zones, the speed of the process is a lot less than if real workshops would have been held.

9.1.3 Process Management Lessons

Low cost. A special feature of the approach is its low costs. More than 70 people were engaged in the process in each of Steps 1A and 2. The costs of bringing these people together would have been very high, in terms of travel costs. In addition the time investments of the participants would probably have been a lot higher. The low cost make the approach very attractive for future applications. Ad-hoc panels may be called on specific topics; and further elaboration of the approach will not immediately be prohibitive in costs.

Unstructured creative nature of the process. A large number of research alternatives were developed on the basis of the discussion papers, the first round panels and the personal experience of the participants. The research alternatives were not generated based on a shared assessment of the research domain or a shared constraint analysis. The unstructured nature of the generation of research alternatives had several consequences. First of all, there was room to come up with truly refreshing ideas. But secondly, for many participants, it was not always clear what the different ideas responded to, making it difficult to evaluate them. Thirdly, the research alternatives were not all equally well defined, which made the portfolio selection process something of a gamble.

Discussion. Especially in step 1 there was ample discussion of the issues for international agricultural research. The discussions in several of the panels were rich and inspiring and contributed to a process that had more the nature of reshaping the agenda than of reducing the number of research alternatives to be implemented. At the same time these discussions did not carry on equally well in every panel, possibly creating some difference in quality and relevance of the final outcomes by region.

Facilitation needs. Whereas in a conventional workshop the facilitator concentrates on the group interaction, and the intellectual leadership may be with one of the group members, the facilitation needs in the current exercise were somewhat different. The facilitator is largely the first point of synthesis and reflection and must have the subject matter depth to guide the process. At the same time electronic facilitation requires different skills from workshop facilitation. Attention levels are lower than in paper workshops, the ability of workshop participants to hide themselves at the receiving end of the list server is very good. Initiating the panel discussion is maybe most critical.

Time management. Estimating the time required for sensible interaction between the participants is not easy. In step 1, time was relatively ample, allowing for a substantial discussion. In step 2, time availability was very limited. As a result several people could not participate. Another consequence was that it was difficult to stick to the agreed procedures and deadlines. In step 2, it was difficult for many people to submit their first round of votes in time, thereby complicating the next steps in the voting procedure.

Type of outcomes. At the end of step 2 of the process, a research portfolio for the different regions and for a global programme had been formulated. The possible projects in the research portfolio were not very defined, and will require more elaboration as well as scientific scrutiny before they can be implemented. There are however also many insights to be gleaned from the type of topics that were selected and from the relative importance of the five main outputs (germplasm improvement, germplasm conservation, sustainable farming systems, policy and socio-economic research, strengthening institutions). The pattern that emerges is one of a rapidly evolving agenda; other issues than productivity have taken a major role, with increased emphasis to marginal areas, resource scarcity, institutional change, market oriented research and poverty alleviation. While it remains to be seen if the overall pattern or the specific project priorities will be the more valuable output of the exercise, it is undeniable that the exercise points to new directions and is contributing to the strategic thinking within the CGIAR.

9.1.4 Methodological Lessons

Versatility or lack of rigor? The method to assess research alternatives is very simple, principally based on the combination of expert opinions. There were no criteria, no measurement methods, and no efforts to collect secondary data in support of the assessments. The quality of the outcome then depends on the quality of the opinions. At the same time, the approach allows comparison of whatever type of alternative is considered. This is very different from the comparative ability of economic surplus methods or congruence methods, that are well able to deal with possible research topics that can be linked with statistical indicators (such as value of production), but do not deal well with outcomes that are less easily quantified or ascribed to research (e.g., on NRM, policy and institutions). In the consultative process that the Science

Council applied, a project designed by a participant for an arising issue may be of greater relevance because it highlights the issue, than for the size of the problem that the project seeks to address. This versatility is a great strength but also a great risk, because it may lead to an agenda without “feet on the ground”. The link with the congruence analysis is one way of overcoming this. Another idea may be to commission the elaboration of the top 15 project ideas, to assess their feasibility in more depth. A third way around the possible lack of rigor may be to interpret and cluster the proposed research projects into “major new directions” and to use these “new directions” as the principal guidance that comes from the exercise. Such a clustering process would typically require the expertise of the Science Council, and might be a good way to close the current process.

Choosing a portfolio. While in most priority setting exercises alternatives are ranked based on a set of criteria, the present approach requests participants to build a portfolio under a budget constraint. The results may be quite different because participants start balancing different concerns. While, for example, a participant may consider that the four best individual research alternatives are found in the policy analysis category, he or she may prefer to combine the two very best policy research alternatives with two alternatives from other categories to arrive at a more balanced portfolio. The portfolio approach enhances the “tendency to compromise” that characterizes many decision-making processes. With multi-objective programming methods it is also possible to choose a portfolio instead of arriving at a ranking, but most decision makers find the approach too complex to rely on. One observation must be made however: when the portfolios of the different participants are aggregated and the votes for each individual project have been counted, the result is not necessarily as balanced as in the individual portfolios. In the Latin American panel, for example, the votes in the institutional strengthening category tended to go to the same projects, but the votes in the NRM category were widely spread. As a result, after the first voting round, there were few NRM projects among the selected projects. In the second voting round participants then tried to make up for the under-representation of activities in the NRM category.

Incremental or zero budget based priorities? The assumption at the start of the process was that priorities would be set for the use of additional resources. While this was not a fully realistic assumption it may have facilitated an open discussion, where participants did not feel the need to be defensive. At the same time, outsiders may ask what the relevance of the exercise is if no additional resources are available. And the other question is how different the results would have been if the exercise would have concerned the overall allocation of the CGIAR portfolio, starting from a zero based budget. It is hard to believe at this stage that the outcomes of the current exercise will not provide directions for some re-allocation of the overall CGIAR portfolio.

Discipline in the application of the methodology. The approach combines centrally led steps with decentralized panel consultations. While there were guidelines developed by the core team on the management of the panel discussions, the outcomes of the panels were still rather diverse. After the first round some panels arrived at rather detailed prioritized project ideas, whereas other panels provided more conceptual output. In the second step the different panels may have interpreted the voting procedures in slightly different ways, and the core team had to invest considerable time to ensure compatibility of the different outcomes. While this is difficult to avoid in a first exercise, it is important that the different facilitators apply the same method.

Guidelines may be further elaborated, or an imaginary example may be developed that shows how the process should be applied and what type of outputs should be obtained.

Dealing with crosscutting issues. Several participants complained that the approach was not suitable for dealing with research alternatives that combine different categories. While in the second step, there was room to add crosscutting initiatives in a sixth category, the contributions that were made to this category never made it to the priority lists. This may be due to the fact that these initiatives were identified too late in the process to be understood by the other participants, but it could also be that participants did not consider them of sufficient value. While the concern with the crosscutting issues is a legitimate one, it is almost impossible to define priorities without providing a categorization. Priorities happen to be for a certain category of research over other research, and if research is not categorized (and characterized) it is difficult to prioritize. Nevertheless, if more time is provided for the creative identification of new research alternatives, more crosscutting issues may be identified and possibly considered in the priority portfolio. This must be a field of attention for the next exercise.

Links between global and regional issues. Global issues will be derived from the exercise in two different ways. Firstly, the global panels have been exploring the issues, principally at the scientific frontier, that may have future relevance independent of location. Secondly research alternatives that were selected by several regional panels may best be treated in a global manner and might be candidates for inclusion in Systemwide programmes or the building of future challenge programmes. The fact that these possibilities for global interaction were not identified in step 2 itself, is not a concern. It is typically a task for the synthesis step of the process.

9.1.5 Lessons on Participation

Ownership and buy-in. The rounds of consultations with stakeholders were well received. Many indicated their satisfaction with being consulted and having a chance to influence the CGIAR's choice of priorities. The wide buy-in to the process increases the chance that the outcomes will influence the direction of research in the CGIAR system and that the results will influence discussions at other levels, such as the strategic planning of the Centres.

Low threshold to participation. By eliminating the need for physical travel and for a dedicated time slot in the agenda of the participants, it became much easier for people to join the process. Several participants travelled while being part of one of the panels, and kept on participating. Other participants attended workshops and meetings in the day time while contributing to the panel outside of their standard office hours. The low participation threshold had one other consequence: there was a number of "observers": people that were following the discussion but that decided not to contribute.

Self-selection of participants. The Science Council put a lot of effort into selecting balanced panels of participants in both rounds. Of the selected participants, only about half of the people participated actively in the panels. The careful balance that was aimed for was thus not achieved. Several disciplines were over- and others under-represented. In the LAC panel for example NRM scientists were over represented in relation to germplasm improvement specialists. Since panel members tended to vote by discipline, the self-selection may have biased the

outcomes. While the composition of the group tends to influence the results also in a workshop process, the chance that people withdraw from voting processes is more reduced. This increased inclination to self-selection is something that must be overcome in the future. Two possibilities may be pursued: to develop more active mechanisms for involving all the panel participants; to strengthen validation mechanisms at the end of the exercise.

Future iterations. The electronic consultation process should be looked at as the beginning of an institutional learning process. Future implementations will benefit from errors made this time around. A first idea would be to put in place a continuous priority-setting process that uses updated projections and congruence analysis, maintains a dialogue between CGIAR, stakeholders, and NARS scientists, is based on open consultations on priorities, and integrates priority setting with the outcomes of evaluation and impact analysis processes. To combine the potential for institutional learning with the current emphasis on results-based management it may be important if more emphasis is given to the identification of possible research results and the conditions under which they can be achieved. Two possible approaches can be pursued. A long-term panel of stakeholders + NARS scientists + CGIAR scientists can be put in place for sustained dialogue on priorities through recurrent open consultations. In further developing this idea it may be required to revisit priority setting in the way it is done at the moment. Large-scale exercises such as the one managed by the Science Council cannot be repeated year after year without losing intensity, and without losing sight of what has changed and how the CGIAR could respond. The second approach is to bring together more ad-hoc task forces that will pursue similar but smaller scale processes on specific topics, thereby complementing other sources of expert advice to the Science Council.

9.2 Towards integrating impact analysis, monitoring and evaluation, mobilizing scientific capacity, and priority setting into an adaptive management and institutional learning framework

The novel exercise in consultative priority setting, described above, was in the nature of an experiment that needs to be improved, complemented, and institutionalized in the work of the SC. The following is a proposal to achieve this purpose, and to integrate priority setting with the development of a science strategy. It is provided to SC for discussion and deliberation.

The SC assumes the functions for the System of impact analysis (SPIA), monitoring and evaluation of current performance (SPME), setting priorities and strategies (SPPS), and mobilizing global scientific capacity (SPMS). These four functions need to be closely integrated into a process of knowledge management and institutional learning with several outcomes, one of which would be an on-going capacity to set System priorities, enabling a learning-based management of continuity or change in priorities.

There is an initiative in the CGIAR, with Rockefeller Foundation, BMZ, and IFAD support, to introduce a process of Institutional Learning and Change (ILAC).³⁶ Adopting this approach for priority setting and science strategy development could be initiated as a joint effort

³⁶ On use of the ILAC approach by the CGIAR, see: J. Watts, R. Mackay, D. Horton, A. Hall, B. Douthwaite, R. Chambers, and A. Acosta. "Institutional Learning and Change: An Introduction". ISNAR, October 2003.

between SC and the inter-Centre group of scientists carrying the effort forward on behalf of the Centres. Some of the guiding principles would be as follows:

Impact analysis can be done for accountability to donors, and also as part of a process of institutional learning leading to change. The two can be made to be compatible and mutually reinforcing, but special procedures are needed for this integration to work, and they are largely still to be defined. The accountability purpose is what has mainly guided the past work of SPIA. Impact analysis has to this date been done to evidence high rates of return from investment in agricultural research and for audiences outside the programs themselves. Impact analysis for institutional learning requires that:

- A subset of indicators that are intended to measure impact be jointly defined by the institution (a Centre) and the external evaluator (SPIA). Additional indicators may be used for the two specialized functions of accountability and learning. These indicators need to be defined before projects are initiated in order to provide optimum input for institutional learning and adaptation.
- Measurement of change in the indicators should be carried out largely by the institution as in-house data, but these measurements must be verifiable by external auditors if they are to serve for accountability.
- In spite of lags in research outputs, results from impact analysis must be available sufficiently in time that they can be used by the institution to learn and adjust its activities (just-in-time impact analysis).
- The institution must participate actively to the evaluation and put into place a mechanism for results-based management and institutional learning that uses the results of just-in-time impact analysis.
- To do this, the internal capacity of Centres to carry impact analysis would in most cases need to be reinforced.

Evaluation of current performance can also be conducted for purposes of accountability and of institutional learning. EPMRs have this dual purpose, although they have been mainly designed and used for accountability purposes with, as a result, a bias toward the positive. Use of self-evaluation and CCERs have the purpose of not only assisting the EPMR process, but also of providing information to support an internal learning process. The process to make use of this information is, however, still largely to be constructed.

The recent reform in external evaluation proposed by iSC shifts the balance in the role of evaluation from *accountability* to *institutional learning*, without compromising the accountability purpose. While information for evaluation is largely generated internally, it has to be verifiable and complemented by an external EPMR team.

Priority-setting and science strategy development at the Centre level has been done by the Centres themselves in consultation with their stakeholders and partners. Centre priorities and medium-term science programme strategies are reviewed annually by TAC/iSC/SC when MTPs are submitted, but this review is insufficient to help achieve coordination among Centre research portfolios. Centre priorities are shared with other Centres and presented at AGM, but coordination among Centre priorities remains weak and informal, with the exception of SWPs

and CPs. The process set up helps identify important themes, but does not provide relative priorities, and does not give guidelines as to what to take out in order to accommodate new activities. Nor does it provide us with the necessary background to look at the broader strategy issues related to how the System as a whole might fit better into the overall agricultural research enterprise globally.

As seen above, System-level priority setting had, in the past, been largely top-down, narrow, and mechanical, using a modified congruence approach to identify funding gaps. Discrepancies identified in this analysis have, however, largely lost their planning role as the World Bank abandoned its function of “donor of last resort”. Centres have been consultative of their stakeholders and partners. However, systematic and broad consultations have not been used to establish System-level priorities that can then be used to provide guidance and boundaries for Centre priority setting in the context of their respective roles within the whole of the CGIAR. This is what the Members have demanded from SC, and what the consultative process used in 2003 was intended to correct. Lessons need to be derived from this experience and a process for priority setting in the future needs to be put into place.

A logical approach to future priority setting is to link the exercise to the process of institutional learning to be put into place at the levels of (just-in-time) impact analysis and performance evaluation (built on self-assessment and CCER). This approach can be underpinned by ongoing strategic and prospective studies, and analysis of advances in global science.

The proposed approach to System-level priority setting and System-level science strategy development would consequently consist in the following:

1. Developing data bases and information, and updated congruence analysis: Updated FAO and Centre projections; poverty mapping and overlays with agroecological features and local determinants of poverty; congruence analysis based on value of production for commodities, adjusted by other criteria such as poverty, vulnerability, the role of the private sector and other suppliers of research, and likelihood of success; continuously updated position papers by field of science, region, and Centre.
2. Establishing task forces (forward looking stripe studies) and panels of experts (focus group meetings with people who understand what the real problems are and people who know what science can contribute to solving them) on emerging research issues, in a process managed by SC.
3. Coordination among Centres in priority setting: information sharing, and search for synergies and duplications across Centres (new process to be defined); SC reviews of Centre MTPs could serve as an explicit instrument for coordination.
4. Dialogue between CGIAR, stakeholders, scientists, and visionaries using long-term panels for sustained interactions on issues and priorities (institutionalization of Steps 1A and 2, with a process of revolving panel membership to be defined).
5. Open consultations with stakeholders on issues and needs (institutionalization of Step 1B) and on research priorities identified by scientists. Consultations with stakeholders on

issues and needs would precede research project formulation and prioritization by scientists, as done in this first experiment. Consultations may also follow project formulation and prioritization by scientists to establish stakeholders' own priorities among these projects.

6. Integration of priority setting with ex-post impact assessment and evaluation of current performance, in the context of a process of institutional learning and change (ILAC process to be defined at the System level).

It should be noted that, while this discussion has focused on a priority setting process, and how it can benefit from integration with the ex-post impact assessment and the current performance evaluation activities of SC, there are similar benefits to be gained in these latter two activities from closer integration of the four SC functions. The SC needs to take full advantage of the synergies that can be established through close linkages between impact assessment, current performance evaluation, mobilizing global science, and priority setting (including knowledge management and institutional learning).

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Appendices

Appendix 1: Results of the Consultation – List of sub-activities by Output

Appendix 2: Generic categorisation of Centre Projects from MTPs 2004-2006

Appendix 3: Results of the Consultation - the priorities identified by the Regional Panels

Appendix Table. Titles of the sub-activities proposed by the thematic panels

Output 1: Germplasm conservation	
Activities	
1. Ex-situ conservation of crops	
	Subactivities
	1.1 DNA marker data - Complement descriptor data and augment phenotypic genebank data with genotypic and
	1.2 Development of DNA and DNA sequence banking technology
	1.3 Storage protocols for neglected and underutilized species
	1.4 Cryopreservation protocols
	1.5 Application of low moisture drying as a substitute to low temperature storage of germplasm
	1.6 Viability of reproductive material in gene Banks
	1.7 Valuation of gene bank holdings
	1.8 Development of a rational global system of Ex Situ Conservation
	1.9 Illustrated germplasm databases
	1.10 Conservation of crop wild relatives (see also 1.2.1 in <i>in situ</i> and 2.7.2 in improvement section)
	1.11 An <i>ex ante</i> survey of all crops to understand whether more crop species should be mandated
	1.12 An initiative to collect representative accessions of economically important plants from their centres of origin
	1.13 Identify important "orphan" food or economic crops in regions, and initiate germplasm conservation of these crops
	1.14 Forage grasses and forage legumes
	1.15 Improvement of yield of sago palms
	1.16 Annual and perennial crops for marginal environments
	1.17 Pharmaceutical Crops
2. In-situ conservation of crops	
	2.1 Conservation of wild relatives (see also 1.1.10 in <i>ex situ</i> and 2.7.2 in improvement section)
	2.2 Conduct erosion risk studies on endemics in or around areas of mining, pipelines or other interventions like gas or oil
	2.3 Dynamic gene pool management of distinct breeding populations in mega-environments
	2.4 Crop systems for marginal environments, paying particular attention to water use efficiency
	2.5 Valuation of <i>in situ</i> and on-farm conserved and management plant genetic resources, including the associated
3. Livestock	
	3.1 Molecular characterisation of diversity within and between local breed-groups in the developing world and maintenance of reference DNA samples for future studies.
	3.2 Investigation of the genetics of resistance to disease and environmental stress in locally adapted breeds of livestock.
4. Forestry	
	4.1 Eco-geographic valuation of genetic diversity in populations of key forest species
	4.2 Meta-analysis in use of forest genetic resources databases across regions
	4.3 Community forest management in the semi-arid region
5. Aquatic	
	5.1 Documenting and valuation of farmed and wild stocks of aquaculture species
	5.2 Development of new candidate species for aquaculture
	5.3 Use of cryopreserved milt for conservation and genetic improvement
6. Microbes & insects	
	6.1 Ex situ conservation of beneficial pathogens of pest arthropods
	6.2 Characterization of, and enhanced access to, fungal, insect and rhizobial collections, with a view to establishing new collections of, say, entomopathogens, viruses, mycorrhizae
	6.3 Ex situ conservation of beneficial arthropods for use in insect, mite, weed control
7. International agreements	
	7.1 Getting economically important outliers into the multilateral system for crop germplasm exchange
	7.2 Beyond CBD and IT. Developing national and regional legislative and regulatory options to maximize the benefits flowing to the country/region while respecting obligations under international treaties (WTO, CBD, UPOV, IT-PGRFA etc) and developing Global Plans of Action (GPA) for Agro-Biodiversity at large
	7.3 Comparative studies of the legislation, implementation mechanism and policies of various NARS on PGR (CBD,
	7.4 Ensuring plant genetic resources (PGR) multilateral system ensuing from International Treaty (IT) work:
8. Other: New generic areas of study	
	8.1 Study of gene flows
	8.2 'Allele mining' software and technologies
	8.3 Development of 'association genetics' as a CGIAR tool
	8.4 Setting up a formal exchange programme for scientists between CGIAR and ARI:
	8.5 Strategic alliances with ARIs
Output 2, Germplasm improvement	
Commodities	
1. Cereals:	
	1.1 Global virulence/pathogenicity survey of wheat rusts and breeding durable rust resistance (new activity)
	1.2 Fusarium head blight (FHB) control in wheat (new activity)
	1.3 Exploitation of existing translocation / addition / substitution lines in wheat
	1.4 Durum Wheat to replace barley
	1.5 Perennial Barley for biomass

1.6 Characterize variability across Asia, Africa and the Americas in populations of <i>Sclerospora graminicola</i> , the biggest constraint to the adoption of genetically uniform improved crop cultivars in pearl millet (<i>Pennisetum glaucum</i>) in Africa and Asia, but does not yet cause disease on this crop in the Americas
1.7 Rice genetics and breeding of durable (field) resistance to rice blast
1.8 Genome based study on allelopathic potential of rice
1.9 Screening of traditional <i>O. glaberrima</i> and <i>O. sativa</i> accessions from West and Central Africa for adaptive and quality traits for deployment in cultivar development.
1.10 Study of the population dynamics and identification of resistance genes for thee three key pathogens of rice in West Africa: rice yellow mottle virus (RYMV), bacterial leaf blight (BLB) pathogen and Rice Blast Fungus.
1.11 Assessment of variability across Asia and Africa in populations of <i>Striga</i> sp.
1.12 Comparative genetics of host plant resistance to <i>Striga</i> sp. across maize, sorghum and pearl millet
1.13 Comparative genetics of host plant resistance to stem borers in cereals
1.14. Nutritional improvement: Vitamin A, Fe, Zn content enhancement in rice and maize
2. Roots and tubers
2.1. Improving cassava to the point where it moves beyond a security crop to a cash crop for income generation.
2.2. Investigate the genetics of potato late blight & screen collections for useful alleles.
2.3 Develop resistance to bacterial wilt in potato
2.4 Developing clean and efficient germplasm distribution systems
2.5 Quality improvement from post harvest losses
3. High value and cash crops
3.1. Use of within-cultivar genetic heterogeneity to reduce the vulnerability of hybrid crop cultivars to pests and diseases
3.2. Genetic improvement of oil content and oil quality in small-seeded annual oilseed crops, including sesame, sunflower, safflower, castor and brassicas
3.3 Application of comparative genomics from CG crops to improve vegetable and perennial crops important to NARS
3.4 Genomics and breeding of cotton hybrids for small-farmer income generation in the semi-arid tropics and subtropics of
3.5 Genomics and breeding of storage pumpkins as an easily stored dietary source of beta-carotene
3.6 Improve resistance to aflatoxin contamination in groundnut
1.7 Increased levels of sulphur containing amino acids in chickpea and pigeonpea
4. Tree crops
4.1. Evaluation of molecular diversity in walnut (<i>Juglans regia</i>)
5. Livestock
5.1 The genetics of indigenous livestock breeds (probably with an Africa focus)
5.2 Genetic improvement of well characterized livestock populations initiated
6. Fisheries/Aquaculture
6.1. Estimation of genetic variation in, and determination of prospects of selection for, disease resistance in Carp
6.2. Development of improved strains of the Freshwater Prawn (<i>Macrobrachium roosebergii</i>)
6.3. Estimation of genetic parameters and possible identification of genes of large effect in production traits in Tilapia
7. Other
7.1 Reach System-wide agreement on the IPR arrangements relating to CGIAR improved germplasm (including a study of the impact of the present IP regime if necessary)
7.2 Use of wild species and other exotic gene pools as sources of novel alleles for adaptation.
7.3 The basis of reproductive barriers among species and within species
7.4 Participatory farmer-breeder management of crop gene pools
7.5 Development of 'synteny maps' for all CGIAR crop plants
7.6 EST programmes and BAC library provision for all mandate crops
7.7 Novel uses GM technologies to add value in farming systems
7.8 High methionine chickpeas
Objectives
8. Yield
8.1 Efficacy of marker-assisted BC procedures for yield enhancement
8.2 Research on yield barriers to C3 crops with a view to converting C3 to C4 (e.g. for rice, wheat)
8.3. The basis of fertility in cereals
8.4 Comparative genomics to understand and modify photosynthate partitioning in starchy staples
9. Biotic stress
9.1 Pyramiding of transformation-based and conventionally-bred mechanisms for host plant resistance to <i>Helicoverpa</i> and other lepidopterous pests in order to extend their combined economically useful life
9.2 Managing BT-crops in small land holdings
9.3 Use of insect and insect pathogens as sources of novel insecticide molecules, all crops
9.4 The genetics of 'indirect crop defence', e.g. enhancing the ability of plants to exploit natural enemies of parasites and
9.5 Investigation of soil and root health diseases in semi arid and tropical areas (particularly of cereals, legumes)
10. Abiotic stress
10.1 Drought: comparative genetics of drought tolerance across cereals, across legumes, and across roots and tubers
10.2 Comparative Genomics of Barley and Wheat
10.3 Genetic analysis of sympatric populations of landraces and wild relatives grown in drought prone environments
10.4 Comparative genetics of acid soil tolerance and the ability to acquire nutrient P from poorly soluble sources
10.5 Salinity tolerance
10.6 Water-logging tolerance in cereals other than rice, including comparative approaches
10.7 Interspecific transfer of genes for adaptation to stress environments

10.8 Enhanced ability to acquire poorly-soluble soil nutrients
11. Nutrients
11.1 Reducing grain phytate content to improve micronutrient availability, without reducing grain P content and seed
11.2 Enhancing levels of nutritionally available iron and zinc in staple food grains
11.3 Reducing the goitrogenic properties of pearl millet grain
12. Other
12.1 Improved systems for limiting outcrossing in cereals including sorghum and pearl millet
12.2 Improved seed quality in all crops
Output 3, Systems and Strategies
Systems
1. Crop production systems
1.1 Augmenting SOM
1.2 Integrated crop (water, nutrient, pest, weed etc) mgt in varying environments, and GxE
1.3 Conservation tillage including cover crops
1.5 Capturing N from BNF & growth-promoting organisms incl diversified legume/cereal systems
1.6 Targetting fertilizer use & weed mgt and precision farming
1.7 Increase agro-biodiversity
1.7 Enhance the utilisation of minor crops
1.7 HIV/AIDS-tolerant cropping systems and techniques
2. Livestock production systems
2.1 Sustainable use of rangelands
2.2 Pasture improvement
2.3 Develop effective fodder production systems incl rotational grazing system
2.4 Strategic animal nutrition and feeding systems (also for peri-urban holders)
2.5 Animal waste recycling
2.6 Effective vaccine for paracitism/animal health
2.7 Scaling-up of indigenous knowledge on veterinary medicine
2.8 Interactions between livestock traits, environment and production systems, (including wildlife herding)
3. Integrated crop-livestock production systems
3.1 Closing nutrient cycles/Management & utilization of crop, animal & household (organic) by-products
3.2 Developing and promoting sustainable use of food-feed crops
3.4 Conservation tillage
4. Agroforestry systems
4.1 The place of trees in landscapes and fields
4.1a Trees for bio-drainage and salinity control, part. in lowlands
4.1b Shelterbelts, erosion & trees in and around fields
4.1c Agroforestry and biodiversity conservation and other eco-system services
4.2 Role of trees (incl. Indigenous legumes) in soil fertility maintenance
4.3 Agrofostry for food, fuel and fodder
4.4 Trees for honey, silk and medicine, ecosystem service
4.5 Domestication & mgmt of new tree crops
4.6 Set up farmer training institutions and programs
5. Forestry systems
5.1 Fragmentation and forest margins use
5.2 Secondary forest mgt.
5.3 The place of trees in watersheds (4.1)
5.4 Sustainable forest harvestation
5.5 Forest as providers of environ serices incl wild-life conservation
5.6 Develop participatory, decentralized forest monitoring and mgt. systems (incl.Riparian, dryland, etc)
6. Urban & peri-urban systems
6.1 Landless livestock/dairy production
6.2 Production/marketing of small or non-conventional animals
6.3 Vegetables and fruit production systems
6.4 Agroforestry in urban and peri-urban belts
6.5 Utilization of liquid and solid wastes for healthy food production/assessment of impact on public health
7. Aquatic resources sstems
7.1 Semi-intensive aquaculture sysems and artisanal fisheries
7.2 Integrated agric-aquaculture incld rice-fish systems improvement
7.3 Enhancing role of coastal aquaculture
7.4 Rehabilitation of degraded fish habitats
7.5 Restocking knowledge and technology
7.6 Improved fisheries governance/Internat. fish trade & domestic food security (different issue - suggest present
8. Other
8.1 Spatial agroecosystems analysis tools
Strategies
9. IPM and IDM and SPC
9.1 Identification and opportunities to provide IPM and IDM interventions in crop and livestock
9.2 Protection stored grain

9.3 Botanical pesticides formulation for the poor
9.4 Increase (agro) biodiversity (above and below-ground) for IPDM of key pests and diseases
9.5 Develop mating disruption strategies
9.6 Develop/disseminate an EWS (early warning system) on pests, mitigations/ prophylactics, where possible
10. Soils & Integrated Nutrient Mgt Systems
10.1 SOM loss, nutrient mining and land degradation at different scales
10.2 Strategies for INM including micronutrients, biofertilizers and efficient fertilizer use
10.3 Salinity mgt. and reclamation/utilization of saline lands
10.6 Cover crop mgt.
10.4 Characterisation and better utilization of below-ground diversity, soil biology
10.5 Develop sustainability indicators
10.6 Portable information tools for extension/DSS for INM/IPDM
11. Watershed management
11.1 Landscape analysis, land use planning and watershed mgt incl. tools to locate hotspots of unsustainability
11.2 Develop systems of stakeholder involvement/institutional design for 11.1
11.3 Land mgt. impacts on hydrology (incl land leveling)
11.4 Biodiversity conservation at watershed level
11.5 Assess trade-offs between production efficiency and ecosystem health
11.6 Optimize fish/water productivity
12. Water use efficiency
12.1 Land use and cropping system design for optimum water productivity
12.2 Develop models and DSS to intensify cropping systems
12.3 Scale effect on water use efficiency and conjunctive use
12.4 Managing deficit irrigation
12.5 Water mgt. and crop/animal health
12.6 Agrochemical pollution and its health hazards
12.7 Equitable water distribution systems
13. Climate change & sustainable production systems
13.1 Regional impact assessment on current and potential production systems
13.2 Design carbon conserving systems in forestry and agriculture
13.3 Design Crop systems resilient to climate change
13.4 Alternative efficient sources of energy
14. Other
14.6 Participatory systems diagnostics
14.7 Stakeholder mobilization in feedback and diffusion processes
Output 4: Policy and socio-economic research
1. Governance & development policy
1.1 Participation of Ministries of Agriculture in rural policy framing and formulation
1.2 National and sub-national intergovernmental relations for agriculture and rural development
1.3 NARS governance and linkages with farmers and others beneficiaries
1.4 Institutional and Governance approaches to rural development
1.5 Transition policies and institutions in the rural sector toward trade and market integration in the frame of trade blocks
1.6 International Science and Research Policy Unit
2. Markets for inputs and outputs
2.1 Uncertainty of international markets, price stabilization schemes and productions responses
2.2 Seed and soil fertility input systems: Availability of technology and the distribution of benefits
2.3 Marketing innovations to link farmers to markets
2.4 Developed and developing country trade policies and WTO agreements: Impacts on the rural poor
3. Institutions in support of competitiveness of the rural poor
3.1 Delopment of rural financing schemes
3.2 Public and private roles in the supply of technology, technology exchange and upgrading
3.3 Production of Optimal Level of Public Goods by and for CGIAR system
3.4 Technology adoption tracer study to gather concrete information and develop an inventory about what has worked and what has not worked. Approach would be based on gender-sensitive, qualitative consultation with farmers, to develop a profile of information about why some CG-developed technologies have been adopted and others have been rejected.
3.5 Privatization Effective functioning of extension services Certification systems and payment for environmental services
3.6 The limits of technological fixes to rural poverty
4. Opportunities for post-harvest value added and processing
4.1 Policies for the promotion of rural agroindustries
4.2 Policies for integration along agrifood chains
4.3 Public and private roles in enhancing grades and quality standards
4.4 Agribusiness development and market integration
4.5 Perspective analysis on post-harvest loss in developing countries
5. Policy and institutions related to NRM and sustainable agriculture
5.1 Basic bioeconomic research on the impact of trade-offs between resource-conserving and high-input technologies on agricultural competitiveness, environmental quality and territorial development
5.2 Elaborate natural resources accounting practices for agricultural development projects, so that economic analysis take into account both agricultural competitiveness an environmental quality

5.3 Coordinate sectorial policies and institutions for sustainable rural development based on territorially available resources and knowledge, by bringing together a range of actors for creative interaction
5.4 Develop territorial information systems that expose interested parties to the complexities of real socioeconomic systems
5.5 Incentive policies and strategies for sustainable NRM
5.6 Institutional mechanisms to enhance sustainable NRM at different scales
etc).
5.8 Access by poor people to natural resources, especially LWR and FWB water: there are two sub-areas – designing water supply systems so they serve multiple uses (currently they are usually designed for single purposes like domestic or irrigation); and policies and institutions that will effectively support scaling up and out of known micro-technologies (Rainwater harvesting, soil fertility measures, micro-irrigation, etc). controlled access to natural resources (in order not to have degradation)
5.9 Institutional and regulatory factors affecting the development of environmental service markets.
6.1 Household management of price and climatic uncertainty risk
6.2 Managing of uncertainty risk associated with new technologies
6. Understanding rural households livelihood strategies
6.3 Using knowledge of household livelihood strategies to target agricultural research investments
6.4 Policies and institutions to enhance the resilience of household livelihood strategies
6.5 Policy & institutions to enhance adoption of new technologies
6.6 reforms for policy of households & community strategies
7. Poverty maps and determinants of poverty
7.1 Poverty diagnostics and causal analysis
7.2 Enhancing poverty impacts from agricultural research investments
7.3 Using poverty analysis to inform national and regional poverty strategies
8. Approaches to rural development
8.1 Spatial aspects of rural development. Developing territorial competitiveness
8.2 Rural development policies in developed and developing countries
8.3 Institutional issues in rural development
8.5 Analysis of the potential for ICTs to provide relevant agricultural information to poor farmers. Development of a set of information modules on issues like pest control, soil management, market strategies, etc.
and evaluate novel policy instruments in support of rural innovation using approaches related to impact assessment for learning and change (ILAC)
9. Forecast of future of food, agriculture, natural resources, & rural societies
9.1 Natural resources degradation: impact on world food production
10. Intellectual property rights and poverty reduction
10.1 Cost/benefit analysis of alternatives IPR aspects (patent protection, PBRs, etc) on plant genetic innovations
10.2 Analysis of existing experiences at creating public-private partnerships for the exploitation of genetic resources technology interventions
11.2 Understanding technology innovation processes and impact pathways
11. Research on impact assessment and evaluation
11.3 Institutional learning and change (ILAC)
11.4 Ex post impact assessment for natural resource management research
11.5 Measuring externalities in impact studies
12. Outreach to policy makers
12.1 Policy dialogue seminars
12.2 Policy brief on selected themes
12.3 Strengthening linkages between policy research and policy formulation
13. Other
13.1 Identifying countries and regions that are vulnerable to man-made or natural disaster; Rebuilding agriculture and livelihoods after disaster, crisis, and relief;
13.2 Health issues and agricultural development
13.3 Rebuilding agriculture and livelihoods after disaster, crisis, and relief
Output 5: Strengthening NARS and other rural institutions
1. Training & capacity building in NARS
1.1 Comparative analysis of NARS Research Capacity (including forestry and Nat resource related research)
1.2 Strengthening NARS capacity to deal with emerging issues in markets, trade policy, the environment, and biotechnology, including intellectual property rights (IPR) handling, and biosafety issues, among others
1.3 Strengthening NARS capacity in strategic analysis and priority setting
1.4 Strengthening NARS input in policy dialogue through partnership with policy think tanks
1.5 Strengthening of NARS capacity in social analysis. (This could be done through workshops led by CGIAR social scientists and further enhanced with a social research grants competition for NARS scientists, as well as by strengthening partnerships between NARS and universities with stronger social science.)
1.6 Exploring research spill-overs for NARS design
2. Empowerment of farmers, their organizations, and communities
2.1 Strengthening local government institutions and Farmers organizations
2.2 Marketing innovations to link farmers to markets. Enhancing the performance of livestock marketing systems and competitiveness of smallholder livestock producers Options for expanding market opportunities for smallholder producers; Improving participation in domestic and regional markets by smallholder producers

2.3	Developed and developing country trade policies and WTO agreements: Impacts on the rural poor. Evaluating poverty and domestic market impacts of globalisation and trade policy changes on smallholder producers; Assessing the impacts of meeting food safety and sanitary and phyto sanitary (SPS) measures on the smallholder producers
2.4	Links between ag research and empowerment of women and other marginalized groups
2.5	Farmers organizations: adjustment to the new agriculture
3. Public-private partnerships	
3.1	Optimizing partnerships in technology development and institutional governance
3.2	Private participation in institutional governance
3.3	Institutional mechanism for understanding technological demands from the private sector
4. South-South collaborations; regional and sub-regional partnerships	
4.1	Identifying common research problems and opportunities
4.2	Identifying common research problems and opportunities
5. Rural and agricultural knowledge and information systems	
5.1	Facilitating access, sharing and synthesis of data, analysis, best practices, and lessons learned. Linking databases
6. Outreach to civil society	
6.1	Public awareness and constituency building
6.2	Integrate the urban areas
7. Other: Improving Agricultural Innovation Systems at the sub-national, national, sub-regional and global levels.	
7.1	Conceptualize and analyze the agricultural innovation system at the global through national innovation sub-systems.
7.1	Financial sustainability in NARS
Output 6: Cross-cutting sub-activities	
1. Enhancing livelihood security	
1.1	Design integrated farming systems resilient to climate change
2. Biosecurity	
2.1	Integrate Biotechnology, Biodiversity and biosafety
3. Peri-urban food	
3.1	Comprehensive analysis and development of peri-urban food production and delivery systems

Appendix 2: Generic categorisation of Centre Projects from MTPs 2004-2006

	Centre Project Title	Subject/ group
Centre		
CIAT	1. Conservation and Use of Tropical Genetic Resources (SB-2)	Conservation and use of biodiversity
	2. Bean Improvement for the Tropics (IP-1)	Commodity improvement (beans)
	3. Improve Cassava for the Developing World (IP-3)	Commodity improvement (cassava)
	4. Improved Rice for Latin America and the Caribbean (IP- 4)	Commodity improvement (rice)
	5. Tropical Grasses and Legumes (IP- 5)	INRM (grass and legumes)
	6. Tropical Fruits (IP- 6)	Commodity improvement (tropical fruits)
	7. Integrated Pest and Disease Management (PE-1)	Farming systems (IPM)
	8. TSBF/Overcoming Soil Degradation (PE-2)	INRM (soils)
	9. Communities and Watersheds (PE-3)	INRM (watersheds)
	10. Land Use in Latin America (PE-4)	INRM (land use)
	11. Confronting Global Climate Change (PE-6)	Climate change
	12. Rural Agro-enterprises Development (SN-1)	Rural enterprise/Markets
	13. Participatory Research (SN-3)	Participatory research
	14. Information and Communication in Rural Communities (SN-4)	Knowledge management
	15. Impact Assessment (BP-1)	Impact assessment
	16. Soil, Water, and Nutrient Management (SW-2: SWNM)	INRM (SWP)
	17. Participatory Research and Gender Analysis (SW-3:PRGA)	Participatory Research (SWP)
	18. Biofortified Global Challenge Program (CP-1:BCP)	Genetic enhancement (crops) (CP)
CIFOR	1. Forests Society and People (FSP)	INRM (Forestry)
	2. Sustainable Forest Management (SFM)	INRM (forests)
	3. Adaptive Collaborative Management of Forests (ACM)	Policy research (Governance of Forests)
	4. Plantation Forestry on Degraded or Low Potential Sites (PLT)	INRM (forests)
	5. Biodiversity and Managed Forests (BIO)	Conservation and use of biodiversity
	6. Forest Products and People (FPP)	Rural enterprise/Markets
	7. Research Impacts, Priorities and Capacity Evaluation (IAP)	Impact assessment
	8. Policies, Technologies and Global Changes (GLC)	Policy (globalization, forests)

CIMMYT	1. Maize and wheat genetic diversity for humanity	Conservation and use of biodiversity (maize and wheat)
	2. Livelihoods and risk in rainfed, stress-prone, food grain systems	Farming systems (livelihoods, grain systems)
	3. Food security, markets, and livelihoods in Africa	Rural enterprise/Markets
	4. Ensuring food security, sustainable intensification in densely inhabited areas	Farming systems
	5. Improving livelihoods, conserving natural resources in tropical agro-ecosystems	Conservation and use of biodiversity
	6. Policies and institutions that maximize research impact	Policy (grains, research impact)
	7. Sharing and managing knowledge	Knowledge management
CIP	1. Impact enhancement	Impact assessment
	2. Genetic resources conservation and characterization	Conservation and use of biodiversity (potatoes)
	3. Germplasm enhancement and crop improvement	Commodity improvement (potatoes)
	4. Integrated crop management	Farming systems
	5. Natural resource management	INRM
	6. Health and agriculture	Health and agriculture
	7. Vitamin A for Africa (VITAA)	Genetic enhancement (crops) (CP)
	8. Global mountain program (GMP)	INRM (mountains)
	9. Urban harvest	Farming systems (peri-urban)
	10. Consortium for the sustainable development of the Andean ecoregion - CONDESAN	Ecoregional network/programme
	11. Global initiative on late blight (GILB)	Commodity improvement (against disease)
	12. Country and regional network projects	Ecoregional network/programme
ICARDA	1. Barley Improvement	Commodity improvement (barley)
	2. Durum Wheat Improvement	Commodity improvement (durum wheat)
	3. Spring Bread Wheat Improvement	Commodity improvement (bread wheat)
	4. Facultative Bread Wheat Improvement	Commodity improvement (bread wheat)
	5. Food Legume Improvement	Commodity improvement (legumes)
	6. Forage Legume Improvement	Commodity improvement (forages)
	7. Integrated Pest Management	Farming systems (IPM)

	8. Agronomic Management	INRM
	9. Sown Pasture and Forage Production	Commodity improvement (forages)
	10. Native Pasture and Rangeland Management	INRM (pasture,rangelands)
	11. Small Ruminant Production	Commodity improvement (livestock, small ruminants)
	12. Water Resource Management	INRM (water)
	13. Land Management and Soil Conservation	INRM (land, soil)
	14. Biodiversity Conservation	Conservation and use of biodiversity
	15. Agroecological Characterization	INRM
	16. Socioeconomics of NRM	INRM (socioeconomics)
	17. Socioeconomics of Production Systems	Farming systems
	18. Policy and Public Management Research	Policy research
	19. Strengthening of National Seed Systems	NARS capacity building-emergency relief project
ICRISAT	1. Harnessing Biotechnology for the poor (GT1)	Genetic enhancement (crops)
	2. Crop improvement, management and utilization for food security and health (GT2)	Farming systems
	3. Water, soil and agro-biodiversity management for ecosystem resilience (GT3)	INRM
	4. Sustainable seed supply systems for productivity (GT4).	Commodity improvement (crops)
	5. Enhancing crop-livestock productivity and systems diversification (GT5)	Farming systems (crop-livestock)
	6. SAT Futures and development pathways (GT6)	Farming systems (modelling)
	7. Impact Assessment Office (GT7)	Impact assessment
IITA	1. Preserving and enhancing germplasm/ agrobiodiversity with biotechnological tools	Conservation and use of biodiversity/germplasm enhancement
	2. Biologically-based pest, disease, and weed management options, and conserving biodiversity	Farming systems (IPM)
	3. Assessing impact, formulating policy options, and systems analysis	Impact assessment/policy research
	4. Promoting enterprise development/ production of starchy and grain staples in E and S Africa	Rural enterprise/Markets
	5. Livelihoods, NRM in various agricultural systems in humid/sub-humid W and C Africa	INRM
	6. Intensifying grain-based systems in the West African savanna	Farming systems (savanna)
IFPRI	1. Markets and Trade: Public Policies, Development of Local, Regional, and Global Markets (MP1)	Markets/globalisation
	2. Property Rights and Collective Action for Natural Resource Management (MP11)	INRM (property rights)

	3. Macroeconomic Policies, Growth and Food Security (MP12)	Policy research (food security)
	4. Urban Challenges to Food and Nutrition Security (MP14)	Policy research (food security)
	5. Gender and Intrahousehold Aspects of Food Policy (ends in 2003) (MP17)	Policy research (food security)
	6. Policies for Biotechnology and Genetic Resource Management (GRP1)	Policy research (IP)
	7. Global and Regional Trade: Issues within the Overall Context of WTO (GRP2)	Markets/trade/globalisation
	8. Priorities for Public Investment in Agriculture and Rural Areas (GRP3)	Policy research
	9. The 2020 Vision for Food, Agriculture, and the Environment Initiative (GRP4)	Policy research
	10. Sustainable Development of Less-Favored Lands (GRP5)	Policy research (marginal areas)
	11. Biofortified Crops for Human Nutrition (GRP6)	Genetic enhancement (crops) (CP)
	12. Water Resource Allocation: Productivity and Environmental Impacts (GRP22)	Policy research (water)
	13. Institutions and Infrastructure for Market Exchange (GRP23)	Markets/trade
	14. Diet Quality and Diet Change (GRP24)	Policy research (nutrition)
	15. Nutrition Policy Process (GRP25)	Policy research (nutrition)
	16. Pathways from Poverty (GRP26)	Poverty research
	17. Participation in High-Value Agricultural Markets (GRP27)	Markets/trade
	18. Large-Scale Interventions to Enhance Human Capital (GRP28)	NARS capacity building
	19. Networks for Policy Impact (GRPGSP1)	Policy research (networks)
	20. Spatial Patterns and Processes in the Agriculture, Environment, and Poverty Nexus (GRPGSP2)	Poverty research
	21. Communications and Impact Assessment (PP20)	Knowledge management/impact assessment
ILRI	1.Targeting opportunities	Poverty research/sectoral analysis (livestock)
	2.Enabling Innovation	Participatory research
	3.Market opportunities	Rural enterprise/Markets
	4.Biotechnology	Commodity improvement (livestock) conservation and use of biodiversity
	5.People, livestock and the environment	INRM (livestock)
	6.System-wide livestock program	Livestock (SWP)
IPGRI	1. Strengthening national plant genetic resources	Conservation and use of

	programs and networks in the Americas	biodiversity
	2. Strengthening national plant genetic resources programs and networks in Asia, Pacific and Oceania	Conservation and use of biodiversity
	3. Strengthening national plant genetic resources programs and networks in Europe	Conservation and use of biodiversity
	4. Strengthening national plant genetic resources programs and networks in the Sub-Saharan Africa	Conservation and use of biodiversity
	5. Strengthening national plant genetic resources programs and networks in C/West Asia and N Africa	Conservation and use of biodiversity
	6. Capacity-building for plant genetic resources conservation and use	NARS capacity building
	7. Global forest genetic resources strategies	Conservation and use of biodiversity (forests)
	8. Commodity chains research to promote sustainable livelihoods.	Rural enterprise/Markets
	9. Locating, assessing and monitoring plant genetic diversity	Conservation and use of biodiversity
	10. Plant genetic resources conservation strategies and technologies	Conservation and use of biodiversity
	11. Laws and policies wrt conservation, use/exchange of genetic resources for food and agric.	Conservation and use of biodiversity (law)
	12. Agricultural biodiversity management and production systems	Conservation and use of biodiversity
	13. Livelihoods and institutions: social, cultural and economic aspects of agricultural biodiversity	Conservation and use of biodiversity
	14. Plant genetic resources information management and knowledge sharing	Knowledge management (biodiversity)
	15. Understanding and communicating the value and impact of plant genetic resources	Impact assessment
	16. <i>Musa</i> genetic resources management	Conservation and use of biodiversity (musa)
	17. Genetic improvement of <i>Musa</i>	Commodity improvement (musa)
	18. <i>Musa</i> information management and sharing	Knowledge management (musa)
	19. Regional support to <i>Musa</i> research	Conservation and use of biodiversity (musa network)
	20. Supporting global genetic resources conservation and use through the SWGRP	Conservation and use of biodiversity (SWP)
IRRI	1. Germplasm conservation, characterization, documentation and exchange	Conservation and use of biodiversity (rice)
	2. Functional genomics	Genetic enhancement (rice)
	3. Genetic enhancement for yield, grain quality, and stress resistance	Commodity improvement (rice)
	4. Managing resources under intensive rice-based systems	Farming systems (rice)

	5. Enhancing water productivity in rice-based production systems	Farming systems (rice/water)
	6. Integrated Rice Research Consortium	Commodity improvement (rice)
	7. Genetic enhancement for improving productivity and human health in fragile environments	Genetic enhancement (rice)
	8. Natural resources management for rainfed lowland and upland rice ecosystems	INRM (rice)
	9. Consortium for unfavourable rice environments	INRM (rice)
	10. Understanding rural livelihood systems for rice research prioritization and impact assessment	Farming systems /impact assessment
	11. Ecological sustainability/ improving livelihoods through ecoregional approaches for INRM	INRM (ecoregional research)
	12. Facilitating rice research for impact	Impact assessment
ISNAR	1. Institutional Change	NARS capacity building (institutional change)
	2. Organization and Management	NARS capacity building (management)
	3. Innovation in Biotechnology	NARS capacity building (biotechnology)
IWMI	1. Integrated Water Management for Agriculture	INRM (water)
	2. Smallholder Land and Water Management	Farming systems (water)
	3. Sustainable Groundwater Management	INRM (water)
	4. Water Resources, Institutions and Policies	Policy research (water)
	5. Water, Health and Environment	INRM (water)
	6. Comprehensive Assessment (CA) of Water Management for Agriculture	Policy research (Sector analysis - water)
	7. System-wide Initiative on Malaria and Agriculture (SIMA)	Farming systems (water and health) (SWP)
	8. The Challenge Program on Water and Food	INRM (water) (CP)
WARDA	1. Sustainable Intensification of Lowland Rice Based Systems	Farming systems (rice)
	2. Stabilization of Upland Rice Based Systems Under Shortened Fallow	Farming systems (rice)
	3. Applying Watershed Management Methods to Optimize Resource Use in Inland Valleys	INRM (watersheds)
	4. Creating Low Management Plant Types for Resource Poor Farmers	Commodity improvement (rice)
	5. Development of Environment Specific Breeding Approach for Drought Resistant Rice Varieties	Commodity improvement (rice)
	6. Characterization Blast Fungus Genetic Diversity/Development of Donors with Durable Blast Resistance	Genetic enhancement (disease)
	7. Integrated Management of Iron Toxicity in Lowlands	INRM (rice)

	8. Improvement of Resource-Use Efficiency in Irrigated Rice-Based Systems	INRM (rice)
	9. Profitable Land/Water Use - Preventing Soil Degradation in Sahelian Rice Irrigated Systems	INRM (rice, water)
	10. Integrated Management of Rice Yellow Mottle Virus in Lowland Ecosystems	Farming systems (rice)
	11. Technical & institutional change and rice-based livelihoods	Farming systems (socioeconomic assessment of change)
	12. Policy environment and rice market development	Policy and markets (rice)
	13. Sustainable natural resources management strategies for rice development	INRM (rice)
	14. Participatory technology exchange and partnership building	Participatory research
	15. Réseau Ouest et Centre Africain du Riz (ROCARIZ)	Ecoregional networks/programme
	16. The Consortium for the Sustainable Use of Inland Valley Agro-ecosystems	Ecoregional networks/programme
	17. The African Rice Initiative	Commodity improvement
ICRAF	1. Integrated soil fertility management for improving rural livelihoods (LP1)	INRM (soils)
	2. Soil and water conservation for maintaining productive agricultural landscapes (LP2)	INRM (soils and water)
	3. Vegetation management for increased system productivity and reduced human vulnerability (LP3)	Farming systems
	4. Land management interventions for reaching the poorest landusers (LP4)	Farming systems
	5. Market analysis and support to tree product enterprises (TM1)	Rural enterprise/markets (trees)
	6. Sustainable seed systems and management of genetic resources of agroforestry trees (TM2)	Conservation and use of biodiversity (trees)
	7. Tree domestication with intensification of tree cultivation systems (TM3)	Commodity improvement (trees)
	8. Farmer-led development, testing and expansion of tree-based options (TM4)	Farming systems (trees)
	9. Strategies to enhance watershed functions (ES1)	INRM (watersheds)
	10. Wise use and conservation of biodiversity (ES2)	Conservation and use of biodiversity (trees)
	11. Climate change mitigation and adaptation for rural development (ES3)	Climate change
	12. Policies to harmonize rural development and environmental stewardship (ES4)	Policy research (INRM)
	13. Research systems and institutions (SI1)	Policy research (research systems)
	14. Development systems and institutions (SI2)	Policy research (development)

	15.Educational systems and institutions (SI3)	Policy research (educational systems)
	16.Inter-institutional collaboration and knowledge management (SI4)	Knowledge management
	17.System-wide collaboration for alternatives to slash and burn (SW1)	INRM (slash and burn agriculture) (SWP)
	18.Ecoregional collaboration for the African highlands initiative (SW2)	Ecoregional research (SWP)
	19.CGIAR Gender and Diversity Program (SW3)	Gender and Diversity (SWP)
Worldfish	1.Conservation of aquatic biodiversity	Conservation and use of biodiversity (fish/ aquatic systems)
	2. Mitigation against adverse impacts of alien species	Conservation and use of biodiversity (fish/ aquatic systems)
	3. Genetic improvement and breeding	Genetic enhancement (fish)
	4. Strategies and options for realizing gains from sustainable freshwater aquaculture systems	Farming systems (aquaculture fish)
	5. Freshwater fisheries in an integrated land and water management context	INRM (fisheries)
	6. Increased and sustained coastal fisheries production	INRM (fisheries)
	7. Restoration and protection of coastal habitats	INRM (coastal regions)
	8. Knowledge bases and training for improved management of coastal resources	Knowledge management (coasts, coral reefs)
	9. Economic, policy and social analysis and valuation of aquatic resources in developing countries	Policy research (aquatic resources)
	10. Aquatic resources planning and impact assessment	Impact assessment
	11. Legal and institutional analysis for aquatic resources management	Policy research (governance of fisheries, aquatic habitats)
	12. Improved partnerships and capacity building among developing country NARS	NARS capacity building
	13. Access to information for sustainable development of fisheries and aquatic resources	Knowledge management (fish)

Appendix 3: Results of the Consultation: The priorities identified by the Regional Panels.

There are several themes that clearly dominate the suggested research agenda across regions and give interesting leads for major research efforts. The Table shows the summary of sub-activities (arranged by Outputs) selected by three panels or more. The individual results of the regional panels are given by region below.

Table 7.6. Final results: Sub-activities selected for funding by region

Outputs	Sub-activities	CWANA	LA	SSA	Asia	Global	All regions	Code in consultation
1. Germplasm collection, conservation, and characterization								
	1. Collection, conservation (ex-situ and in-situ), characterization, and use of germplasm from crops for marginal environments, crop wild relatives, and important orphan food crops	1	1	1	1	1	5	1.16, 2.4, 1.10 & 1.13 + 7.2 from germplasm improvement
	2. Understanding gene flows			1	1	1	3	8.1
2. Germplasm improvement								
	3. Genomics for high value crops, especially vegetable and perennial crops, and for fisheries and livestock	1		1	1	1	4	10.1 & 10.5
	4. Genetics of drought and salinity tolerance		1		1	1	3	3.3
	5. Comparative genetics of host plant resistance to striga	1		1			2	1.12
	6. Genetics of indigenous livestock breeds	1		1			2	5.1
	7. Participatory farmer-breeder management of crop gene pools and impact studies of participatory and centralized breeding methods			1	1		2	7.4
3. Sustainable production systems and Natural resource management								
	8. Agricultural systems research from an agroecology, INRM, and sustainable livelihoods perspective, particularly for unfavorable environments	1	1	1	1		4	1.2
	9. Water use efficiency, optimum water productivity, managing deficit irrigation	1	1		1	1	4	12.1, 12.3 & 12.4
	10. Vegetable and fruit production systems			1		1	2	6.3
4. Policy and socio-economic research								
	11. Marketing innovations to link farmers to national and international markets	1	1	1	1	1	5	2.3 & 2.2 from strengthening rural institutions
	12. Access by the poor to assets and pathways out of poverty, with special emphasis on gender	1		1	1	1	4	5.8
	13. Developed and developing country trade policies and WTO agreements: Impacts on the rural poor			1	1		2	2.4
	14. Incentive policies and strategies for sustainable NRM	1		1			2	5.5
	15. Understanding technology innovation processes and impact pathways			1		1	2	11.2

Regional Priorities

The selection of regional priorities established through this consultative discussion process used the priorities established by the region itself (through its own regional organizations - see iSC webpage) as a starting point. The main contribution of the present exercise is in providing consistency across regions by working with a unified set of activities and sub-activities (identified by numbers in the following section).

(1) Asia

The Asia panel called attention to the following aspects of CGIAR research for the region:

a) Focus on marginal environments, in particular:

In-situ conservation of crop systems for marginal environments, paying particular attention to water use efficiency (2.4).

Ex-situ conservation of annual and perennial crops for marginal environments (1.16).

Comparative genetics of acid soil tolerance and the ability to acquire nutrient phosphorus from poorly soluble sources (10.4).

b) Focus on public goods, in particular:

Development of a rational global system of ex-situ conservation (1.8).

Study of gene flows (8.1).

c) Focus on commodities beyond rice, reflecting concerns with agro-biodiversity as well as diet diversification, in particular:

Resistance to aflatoxin contamination in groundnuts (3.6).

Cotton, orphan crops, minor crops, fisheries, horticultural crops.

d) Focus on integrated crop management in varying environments (water, nutrient, pest, weeds, etc.) (1.12)

e) Concerns with agrochemical pollution (12.6) and its health hazards, giving priority to research on botanical pesticides and similar innovations.

f) Focus on poverty, which reflected in priority to:

Access by poor people to natural resources, especially land and water (5.8).

Linking farmers to markets (2.3).

g) Focus on the search for new partnerships indicated by priorities to:

Farmers organizations and their adjustment to the new agriculture (2.5).

Optimizing partnerships in technology development and institutional governance (3.1).

(2) CWANA

Priorities established through the consultation complement the particularly comprehensive regional priority setting exercise undertaken by ICARDA, AARINENA, and the CAC sub-region in 2001/2. Priorities established here stress the following:

a) Focus conservation efforts on wild relatives (1.10, 2.1), marginal environments, and forage grasses and forage legumes (2.4).

b) Focus on abiotic resistance: comparative genetics of drought tolerance across cereals, legumes, and roots and tubers (10.1) and salinity tolerance.

c) Focus on sustainable use of rangelands (2.1) and integrated crop management in varying environments (water, nutrient, pest, weeds, etc.) (1.2).

d) Focus on the role of policies and institutions to enhance the adoption of new technologies (6.5) and for sustainable natural resource management (5.5).

e) Strengthening of NARS' capacity in social analysis (1.5).

f) Strengthening of local government institutions and farmers organizations (2.1).

g) Marketing innovations to link farmers to markets (2.3 in output 4 and 2.2 in output 5).

(3) Sub-Saharan Africa

The Africa panel achieved a great deal of unanimity in its first round of voting. The panel operated under a less binding resource constraint (in accordance with current CGIAR priority to Africa), resulting in selection of a relatively larger number of projects.

a) Focus on conservation of germplasm/biodiversity in marginal environments: This is seen in priority given to:

Ex-situ conservation of annual and perennial crops for marginal environments (1.16),
Conservation through community forest management in the semi-arid region (4.3).

b) Focus on conservation of forage grasses and forage legumes (1.14) and of crops wild relatives (1.10).

c) Focus on roots and tubers:

Institutional mechanisms for germplasm distribution of roots and tubers (2.4).

Improving cassava to the point where it moves beyond a security crop to a cash crop for income generation (2.1).

d) Focus on yield losses due to parasitic weeds in cereals: comparative genetics of host plant resistance to *Striga* especially across maize, sorghum and pearl millet (1.12)

e) Focus on agroforestry

Agroforestry systems for food, fuel, and fodder (4.3)

f) Focus on livestock:

Genetics of indigenous livestock breeds (5.1).

Landless livestock dairy production (6.1).

Scaling-up of indigenous knowledge on veterinary medicine (2.7).

g) Focus on integrated farming systems, including soil nutrient management, ecologically friendly IPM, weed control, and water management. Participants have stressed the importance of holistic, participatory approaches, based on comprehensive local diagnostics of constraints and opportunities (1.2).

h) Focus on markets and policies

Marketing innovations to link farmers to markets (2.3 in Output 4 and 2.2 in Output 5).

Incentive policies and strategies for sustainable NRM (5.5).

Strengthening linkages between policy research and policy formulation (12.3).

Impact on the rural poor of developed and developing country trade policies and WTO agreements (2.3 (Output 5)).

i) Focus on people and their organizations

Links between agricultural research and empowerment of women and other marginalized groups (2.4).

j) Focus on strengthening NARS in the region

Strengthening NARS capacity to deal with emerging issues in markets, trade policy, the environment, and biotechnology, including intellectual property rights and biosafety issues (1.2).

Strengthening NARS capacity in social analysis (1.5).

(4) Latin America

a) The Latin America panel sent a clear message regarding the need for greater efforts in ex-situ conservation for neglected and underutilized species (1.3) and for important orphan food or economic crops in the region (1.13), and for in-situ conservation of crop systems for marginal

environments (2.4), with particular attention to water use efficiency. Stress in conservation is thus on the neglected species and environments.

b) Focus on the use of alternative sources of genes, using wild species and other exotic gene pools as sources of novel alleles for adaptation (7.2).

c) Focus on institutional arrangements

Beyond CBD and IT: Developing national and regional legislative and regulatory options to maximize the benefits flowing to the country/region while respecting obligations under international treaties 7.2 (Output 1).

Reach System-wide agreements on IPR arrangements relating to CGIAR improved germplasm 7.1 (Output 2).

d) Focus on water use efficiency (12.3)

e) Focus on the private sector, agro industry, and market development. This is seen in the following recommendations:

Public and private roles in the supply of technology, technology exchange and upgrading (3.2).

Institutional mechanisms for understanding technological demands from the private sector (3.3 (Output 5)).

Policies for the promotion of rural agro industries (4.1).

Marketing innovations to link farmers to markets (2.3).

f) Seek new models for agricultural research

Strengthening NARS capacity to deal with emerging issues (1.2).

Strengthening NARS capacity in social analysis (1.5).

g) Seek new approaches for rural development and increase the benefits the rural poor can derive from research and technological change

Empowerment of farmers' organizations to help them adjust to the new agriculture (2.5).

Seek new approaches to rural development, focusing on spatial aspects and the promotion of territorial competitiveness (8.1 (Output 4)).

(5) Global

The panel chairs note the great degree of importance attached by the Global Panel to germplasm conservation and to strengthening of NARS. They highlight the following in their conclusions:

a) Focus on valuation of CGIAR gene bank holdings (1.7): There is a high preponderance of genetic analytical and conservation sub-activities based on the CGIAR's own germplasm holdings as well as wild relatives and forest species.

b) Focus on drought resistance (10.1): The clearest priority for germplasm improvement is the study and development of drought resistant varieties in cereals, legumes, and roots and tubers.

c) Focus on water use efficiency in farming systems (12.3). They note that despite identification of drought as a priority for germplasm improvement, only six per cent of the proposed portfolio (at least under the INRM theme) is committed to water efficiency and productivity.

d) Focus on forestry (5.5) and diversification of farming systems into vegetable and fruit (6.3).

e) Potential priorities for policy and socio-economic research are scattered amongst several sub-activities. However, highest priorities were accorded to institutional mechanisms to enhance

sustainable natural resource management (5.6) and mechanisms to enhance the access of poor people to natural resources (especially water and land) (5.8).

f) Assisting the development of NARS capacity, particularly with a view to policy formulation (1.2), was the most clear-cut priority arising from this exercise.