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

The Mali and Guinea case studies

(10 January – 16 February 2002)

A study commissioned by the interim Science Council / CGIAR, FAO Rome

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Preface and Acknowledgements

This study on the impact of agricultural research results for the West and Central African region was conducted at the request of TAC, which together with the Syngenta Foundation for Sustainable Development, has provided the funding. The author would like to express his profound gratitude to TAC and particularly to Dr. Oumar Niangado (TAC member) and to the Syngenta Foundation for providing him the opportunity to conduct this study.

Also I would like to thank for the support received during the implementation of the case studies in Mali from Dr. Adama Traore (Chairman of the CORAF Executive Committee) and again Dr. Oumar Niangado, and in Guinea from Dr. Sekou Beavogui (DGA of IRAG) and Dr. Tareke Berhe (SG 2000). During the field visits in Mali and Guinea many people representing government, donors, research, development/extension agencies, private sector and NGO representatives, as well as producer organizations and individual farmers have all kindly spend time and shared their views on the impact question with me.

In preparation for the study, very instructive meetings were held in The Netherlands with staff from DGIS/Ministry of Foreign Affairs, ISNAR, Wageningen University and KIT; all have provided me with useful ideas and suggestions for which I would like to express my thanks.

The author has considered this study as a unique opportunity after having worked much of his professional career in close association with the West African region. Having graduated in 1969 as soil scientist from the Wageningen University (The Netherlands), he started as rubber agronomist in Liberia, with subsequent assignments as agronomist for ICRISAT in Burkina Faso and later for ISNAR and for KIT (Royal Tropical Institute – Amsterdam) as senior research officer on regular support missions to the NARS of Burkina Faso, Mali, Niger, Guinea and Ivory Coast. During the last few years he became involved with WARDA as an interim Director of Programs and with the National agricultural research institute (IRAG) of Guinea in designing a link between the national research and development/extension interventions through an on-farm/systems research program.

So all together, many institutions and many people have contributed in one way or another to this report.

Willem A. Stoop
Driebergen, 20 March 2002
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<td>Consultative Group on International Agricultural Research</td>
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<td>CMDT</td>
<td>Compagnie Malienne de Développement Textiles</td>
</tr>
<tr>
<td>CNRA</td>
<td>Comité National de la Recherche Agronomique</td>
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<td>CORAF</td>
<td>Conseil Ouest et Centre Africain pour la Recherche et le Développement Agricoles</td>
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<td>CRA</td>
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<td>Centre Regional de Recherche Agronomique (Mali)</td>
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<td>Directoraat Generaal Internationale Samenwerking</td>
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<td>Farmer Field School</td>
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<td>FPFD</td>
<td>Fédération des Producteurs de Fouta Djallon (Guinée)</td>
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<td>GDRN</td>
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<td>GTZ</td>
<td>Gesellschaft für Technische Zusammenarbeit</td>
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<td>ISNAR</td>
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<td>NARS</td>
<td>National Agricultural Research System</td>
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<td>National Agricultural Research and Extension System</td>
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<td>NGO</td>
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<td>Office de Niger (Mali)</td>
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<td>PASAOP</td>
<td>Programme d’appui aux Services Agricoles et Organisations Paysannes</td>
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<td>Acronym</td>
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<td>PNRA</td>
<td>Projet National de Recherches Agronomiques (Mali)</td>
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<td>PNSA</td>
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<td>PNSR</td>
<td>Projet Nationales des Services Ruraux (Guinée)</td>
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<td>PNVA</td>
<td>Projet National de Vulgarisation Agricole (Mali)</td>
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<td>POP</td>
<td>Promotion Organisation Paysannes</td>
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<tr>
<td>PSA</td>
<td>Projet Services Agricoles (Guinee)</td>
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<tr>
<td>R and D</td>
<td>Research and Development</td>
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<tr>
<td>RYMV</td>
<td>Rice yellow mottle virus</td>
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<td>SG 2000</td>
<td>Sasakawa Global 2000</td>
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<td>SLACAER</td>
<td>Service Locale Aménagement Equipement Rural</td>
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<td>SNPRV</td>
<td>Service National de Promotion Rurale et de Vulgarisation (Guinee)</td>
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<tr>
<td>SSA</td>
<td>Sub-Saharan Africa</td>
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<td>T + V</td>
<td>Training and Visit extension system</td>
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<td>URDOC</td>
<td>Unité de Recherche Développement Observatoire du Changement</td>
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<td>WARDA</td>
<td>West African Rice Development Association</td>
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Executive Summary

The study was conducted at the request of TAC and in the context of the new Vision and Strategy of the CGIAR. A major element of this strategy is an increased emphasis on a regional orientation in research planning and implementation. This report aims at providing elements of a coordinated regional research approach for the West and Central African Region. The study has been financed jointly by TAC and the Syngenta Foundation for Sustainable Development.

The terms of reference for the study specified the following aspects:
- the appropriateness of currently available improved technologies given the agro-ecological and socio-economic conditions in the region,
- the efficiency of the present technology transfer mechanisms in widely reaching the producers,
- the bottlenecks (technical, institutional, organizational and cultural) that restrain the generation, dissemination and adoption of improved technologies, and
- the implications of the above issues for the new CGIAR regionalisation strategy, leading into recommendations towards an increased impact of its future research efforts.

The study is being implemented in two parts:
- at the level of international centers, active in the West and Central African Region (IITA, WARDA, ICRISAT, ICRAF and ILRI), and
- at the level of individual countries of the region in the form of case studies for Mali and Guinea.

This report deals with the latter. The field study started on 10th January 2002 in Bamako (Mali), which was followed by a stop-over in Dakar on the way to Conakry (Guinea) for the second part of the study. The fieldwork was concluded on 16th of February.

In organizing the “country” part of the study, the author has taken a comprehensive and qualitative view by considering the impact of agricultural research results in the wider context of agricultural development. Agricultural development depends on contributions by many different actors that together cover a complex range of interdependent issues. The actors have been grouped according to their respective (major) level of intervention:
- international: donor, research and development agencies
- national: government, national research and extension agencies; the private sector,
- provincial: decentralised, local government and national (regionalised) research and development agencies, NGOs, and producer unions
- local: producer organisations.

It is postulated that the impact of research results cannot be divorced from the **overall development context**, as created jointly by international and national policymakers, and involving educational, medical/health, infrastructural, commercial/trade, supply (input, credit) and other agricultural services facilities. Each of these facilities will affect the relevance of research results, whether these can be adopted by farmers, and ultimately what the impact will be on the national economy.

For the sub-region in general, the **agricultural development context** must be viewed simultaneously in terms of the progressive transformation from traditional, subsistence systems towards more permanent and intensified, commercial agricultural systems. Necessarily the latter will be more “knowledge-intensive”, and therefore the successfulness and speed of this transformation will obviously depend on the availability of the facilities mentioned above.

The considerable differences in **development contexts** between the individual countries of the region provide an additional and complicating factor. This is illustrated by the Mali and Guinea case studies. Moreover these studies show important differences in research impact for the major agricultural sectors being:
- the traditional staple crop – livestock systems
- the cash crop-based systems (cotton, coffee, irrigated rice)
- the non-traditional crop systems (vegetables)

Research impacts have been **least** for the traditional staple crops (by far the dominant system) and for the marginal agro-ecologies. Highly positive impacts have been achieved also, but these have been limited mostly to the introduction of new varieties in particular for the more favorable environments. Improved cultural practices have evolved naturally as the population pressures increased, but can generally not be attributed to the efforts by formal research. For the cash crop systems the situation is somewhat better, although again many recommendations for improved cultural practices were not, or only partly, adopted. As illustrated by the Guinea case, potentially large research impacts are possible in the non-traditional sector, provided the producers are well organised, as is the case in the Fouta Djallon (Moyenne Guinée).

This study concludes that the international donors and national policymakers, as well as the scientific community grossly underestimate the complexity of the progressive transformation of a predominantly subsistence into more commercially-oriented farming operations. This involves the development of an agricultural services and supply structure, as well as simultaneously raising the educational levels of (mostly illiterate) farmers to cope with the technical and financial/administrative demands of a commercial agriculture. This requires favourable enabling, international and national policy environments. The former has been relatively unfavourable for the agricultural sector of the various countries in the sub-region. With respect to the actual national policy environment, the conditions in Mali are obviously more favourable than in Guinea.
The international donor, research and development agencies have tried to bypass the above constraints and complexities by resorting to “blue-print” approaches and “magic bullet” type solutions. A notorious example of the former is the T+V extension system in the past, and presently the “Farmer Field School” and “demand / contract research” concepts; standardised technological packages based largely on improved varieties and agricultural chemicals are an example of the latter.

In view of the complexity of existing local farming systems in relation to the huge variability and diversity in agro-ecological and socio-economic / cultural conditions, it should not be surprising that many of these project-based interventions have failed. Then what should be the appropriate response?

The study concludes that to resolve these issues, research (international and national) and development/extension must be prepared to face paradigm shifts in strategic and operational (governance system) terms. Most importantly all of the major actors must face up to the implications of the diversity and variability for their respective intervention strategies:

1. the introduction of an intensified, sustainable agriculture cannot be resolved from "the top", except for 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,

2. the complexities, partly due to location-specific variations, are such that no single actor, operating by himself, can hope to resolve the situation in a sustainable way,

3. development / extension services (but also research) can only cope with this situation through flexibility in their approaches, e.g. by following a “process approach”, that emphasise 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.

In this part of the study, the national agricultural research and development / extension system (NARES) takes “center stage”. In that context a very first requirement is that the African governments recognise that the agricultural sector constitutes the main pillar of their respective national economies, directly impacting on the well-being of a large majority of the population, and therefore deserving active policy support. The present study concludes that the creation of an enabling policy environment for the agricultural sector is crucial for at least three aspects:

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

In view of the limited resources of all parties involved, the creation of a coordinated, regional research approach is fully justified. Such coordinated approach and collaborative program between the participating institutions needs to be based on the following principles:
- capitalising on the comparative advantages that flow from the major intervention level of the respective institutions,
- capitalising on the complementarities, that exist between intervention levels and between their respective mandates (international versus national research mandates; research versus extension mandates),
- being realistic about the opportunities for impact and the limitations associated with their respective mandates and the major intervention level at which they operate.

Both the Mali and Guinea case studies illustrate that these conditions are often not met adequately, leading to wasteful overlaps between actors. Thus a coordinated, regional research effort, applying a “bottom-up” perspective, would need to be based on three major components:

- **autonomous and sustainable NARES**, that are appropriately structured to cover a country’s major agro-ecological environments and the agricultural systems of major significance to the national economy and national food security. Such NARES would be ideally positioned to intervene at local levels and to cope with local demands through participatory approaches with farming communities and through coalitions with the other development actors (projects, NGOs, and private sector),

- **autonomous, regional coordinating institution: CORAF**, having the credibility and authority to represent the NARES of the 21 member countries in identifying major research issues that go beyond national capabilities. The issues would be of a common interest to at least several countries, whereas individual countries would lack the required professionalism, facilities and/or financial resources to resolve it. CORAF would have the responsibility for sub-contracting such research to International Centers, to other specialised institutions, or to a consortium of national institutes.

- **International Agricultural Research Centers (IARCs)**, would be working increasingly in direct response to concrete demands expressed through the NARES of the sub-region and coordinated through CORAF. Moreover, the IARCs should increasingly employ their core funds in conducting more fundamental research into the processes and mechanisms (ecological, technical as well as socio-economic) operating in agricultural production systems. As a result the IARCs research agendas could be adjusted to address strategic issues related to:
  - **efficiency of (external) input use**, thereby meeting environmental and production concerns as related to a more “knowledge-intensive” agriculture, and
  - **quality of agricultural outputs** as demanded increasingly by consumers.

These adjustments would enhance the complementarity between NARS and IARC’s research programs, while providing at the same time, the basic inputs to support the modified approaches to extension/development (“participatory learning” and a “knowledge-intensive, integrated agriculture”), as well as to the national policies for “education” (including universities).

Each of the three components of a regional research structure would require fundamental adjustments in their respective strategies. Moreover, their human and financial management should be aimed at achieving continuity and flexibility in the implementation process. The present situation where many NARES are almost completely dependent on donor project funding leads to fragmented, non-coherent
and ad-hoc agendas for research/extension and creates a de-motivating atmosphere for program and personnel management. Autonomous NARES must in the first place be built on national government commitments to the agricultural and rural sectors. For the eventual development of a coordinated, regional research and development approach a strong CORAF is an obvious pre-requisite; unfortunately it has presently, neither the appropriate strategic vision and plan, or a sufficient number of professional staff to meet these challenges.

A final conclusion of the study is that the current international and national policy environments, and the bulk of the improved technologies presently proposed to the farmer communities, are not particularly favourable for alleviating poverty in the sub-region. This study has attempted to indicate possible alternatives to rectify this situation.
1 Introduction

1.1 Background

In the early 1960's at a time that China was exporting large quantities of food grains, many millions of its poor inhabitants died in a serious famine. This situation was brought about by a combination of faulty government policies and ideals (the “Great leap forward”) compounded by overzealous local officials setting unrealistic production targets for their respective districts. As a result the gap between theoretically planned food supply, and that which was actually available in the countryside was dramatically widened.

I am starting with this example, because some African regions and/or countries may currently well be moving into a similar direction. As this study shows there are large and fundamental communication gaps between major actors in the development process, and most notably between the macro/international level policymakers and those actors –first and foremost the farmers- who operate at local field levels.

Today’s “globalised” economy supported by unlimited communication means, the widespread drive towards ever-increasing material wealth and competition for “power” and prestige by individuals leads to serious discrepancies between officially stated political goals and promises in comparison with what is actually achievable in reality. Also agricultural research (international and national) and development seem to have entered such a viscous spiral of increasingly spectacular goals that will be evermore difficult (if not impossible) to realize at field levels.

The multifaceted complexity of agricultural development in much of Sub-Saharan Africa (SSA) is compounded by huge, local level diversity in agro-ecological, socio-economic and cultural conditions apart from other (external) policy factors in the domains of trade, education and health. These present obstacles to progress that we hardly have come to terms with. Not surprisingly and in spite of extensive dissemination campaigns through public, private and NGO development organizations, the impact of research on agricultural production in most countries in SSA, certainly for the marginal semi-arid zones, has remained modest, apart from some widely publicized successes.

Against this background it was attempted to analyze the reasons for the often limited and varied impact of agricultural research (national and international) on farming in the West and Central African region. Next lessons are drawn from this that may guide
the formulation of a coordinated and integrated, regional research effort that indeed effectively supports and complements the national efforts.

1.2 Structure of this report

Following a brief section on the “terms of reference”, the itinerary, the hypotheses and the approach in chapter 2, a critical review of agricultural development paradigms and concepts is presented in chapter 3. It is postulated that these concepts and paradigms have fundamentally influenced the common approaches to agricultural research and development.

Chapter 4 presents the mission’s major findings from the discussions and interviews with the various development stakeholders and the field visits conducted in Mali, Guinea and Senegal. The discussion in Chapter 5 contrasts the findings in the two previous chapters, thus leading into a vision towards a desirable future regional agricultural research capacity composed of complementary contributions by NARES and by an integrated regional IARC program. This chapter is complemented by a number of (institutional and organizational) recommendations and suggestions that may guide the establishment of such an integrated regional program (Chapter 6).
2. Terms of reference; Itinerary and Approach

The aim of the study (terms of reference presented in Appendix A) is to arrive at
guidelines and steps for the development of an integrated regional research capacity
for the West and Central African region. Therefore, the present study was oriented
towards the following issues:
- the appropriateness of currently available improved technologies given the agro-
  ecological and socio-economic conditions in the region,
- the efficiency of the present technology transfer mechanisms in widely reaching
  the producers,
- the bottlenecks (technical, institutional, organizational and cultural) that restrain
  the generation, dissemination and adoption of improved technologies, and
- the implications of the above issues for the new CGIAR regionalisation strategy,
  leading into recommendations towards an increased impact of its future research
efforts.

The study started on 10th January 2002 in Bamako (Mali) with three weeks in the
field, visiting four regional Centers/Stations of IER; this was followed by a three-days
stop-over in Dakar on the way to Conakry (Guinea). In Guinea a one-week field visit
was conducted and major sections of the report were written; return travel to Holland
was on 16/17th February (a detailed itinerary is presented in Appendix B).

Essentially, the nature of this type of study is “qualitative”. Such studies demand
considerable preparatory efforts and structuring in advance to achieve an acceptable
degree of accuracy and reliability (Mason, 1996). Thus for each of the above issues a
number of hypotheses were developed to guide the study. The hypotheses deal with:
- the process of agricultural development,
- the contributions of research to agricultural development,
- the process of information dissemination and its role in adoption of new
  technologies,
- how these processes function at the field level.

The field studies approached the issues from two different angles and used a matrix
structure to organize the information:

a from a stakeholder / actor perspective: donors, policymakers, research
  administrators, public sector research and extension workers, development/NGO
  personnel, (local) producer organizations and individual producers (see fig. 1; and
  Appendix C).

b from an agricultural commodities perspective: traditional agro-sylvopastoral
  systems and their major staple crops (sorghum, millet, rice), cash crop-based

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systems (cotton, coffee) and non-traditional crops-based systems (vegetables) (see Appendix D).

The resulting information was complemented by a review of relevant documents. For reasons of time and financial constraints the study was focused on Mali, with a verification visit to Guinea. The stop-over in Senegal has permitted feed-back from ISRA and to share the missions’ findings with CORAF.

The framework presented in figure 1 has been used to analyze the Mali and Guinea cases; this figure also underscores the large number of issues involved and the need to view these in the context of an “agricultural development continuum”. Obviously the available time has been too short to cover all the aspects raised. As a result the analysis may at times be superficial; yet it also has forced the author to focus on a limited number of major issues/obstacles that need to be considered in developing a realistic and effective “coordinated, regional agricultural research approach”.
Figure 1: Analytical framework

<table>
<thead>
<tr>
<th>Intervention levels</th>
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<th>MACRO-National</th>
<th>MESO-REGIONAL</th>
<th>MICRO-Local</th>
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<td>Development constraint</td>
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<td>CORAF + Network</td>
<td>Intern. R+D Centers</td>
<td>Decentr. Regional Research (RRC)</td>
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<td>Nation. governm.</td>
<td>NARES (research)</td>
<td>Regional Extension</td>
<td>Private sector</td>
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In preparing for this study, the author has developed an analytical framework and has formulated some concepts against which the results from the case studies can be analyzed.

### 3.1 Agricultural development

Agricultural development first and foremost concerns “people and policies”. It therefore cannot simply bypass the interdependence between “policy”, “education” (in the broadest sense), “research” and “extension” (Eicher, 1999). In the past the emphasis has been, however, mostly on technologies, without due attention to educational, administrative and organisational aspects: development of irrigation facilities without attention for maintenance requirements, depreciation costs and local farmer organisation, or seed multiplication campaigns without simultaneous concerns about storage, marketing and quality control facilities. So for guiding or supporting agricultural development effectively a holistic perspective is a first prerequisite.

There can be no doubt that African agricultural production systems have changed considerably during the past 30 years. Much of it has come about through farmer innovations resulting from increased population pressures and shortages of suitable farming land, but also from changing trade and policy environments. There is, however, a continuous debate whether the direction of this change is positive or negative; as well as which factors and which actors carry major responsibility for it. The “optimists” emphasize the positive developments such as the “more people less erosion” perspective of Tiffen, et al. (1996) which is in line with the Boserup thesis (1965). The “Malthusian doom thinkers” see widespread evidence of impending catastrophes due to climatic change / desertification and accelerated land degradation from erosion and soil fertility mining being the combined effects of a decreasing annual rainfall and increasing population and livestock pressures. However, the latter seem to bypass the effects of the important rural out migration (notably by young males) in search of urban salaried jobs. It could well be that in Africa this factor contributes even more to the stagnating yields, than does land degradation.

So the debate is full of controversies, but mainly because it is often conducted from a technology-biased point of view that bypasses general development aspects of crucial importance in a technology adoption process:
- easily accessible schooling and education facilities for the rural population,
- strong and autonomous local producer organizations able to defend farmer interests and to provide collective services (storage, transformation, marketing, input
supplies and credit) that are of common interest to the community of commercial producers, and
- primary health care facilities

Poor adoption rates and concerns about equity and sustainability have also greatly affected the research and transfer process over the past 20 years, causing important changes such as (see also Rhoades, 1989):
- introduction of a “farming systems” perspective and its emphasis on farmer participatory approaches and on indigenous knowledge within the research sector,
- increased emphasis on interdisciplinary approaches by including the socio-economic/anthropological disciplines in the research and development process,
- recognition of organisational and institutional aspects in the development and transfer process.

Another interesting and on-going move seems to be a shift from “formal” (i.e. policy and project guided) to “informal” (spontaneous, locally initiated) development processes, as a pragmatic response to the presence or absence of certain development partners or services. An increased awareness of “informal” processes will permit to stimulate dissemination in vast areas that are thinly covered by formal agricultural services, as is commonly the case for the region. Therefore one needs to accept that adoption is not necessarily a linear or an easily predictable process, and that the origin of many changes may not always be obvious.

In this study the various factors affecting agricultural development have been associated with different (intervention) levels. These range from the macro, international and national levels to the meso-intermediate and finally the micro-local level. Moreover, the levels are associated with different types of intervention that can be roughly subdivided into those of a policy and institutional, of an organisation and management, and of a technical / biological nature (see table 1).

Against this background the present study views adoption of new technologies and adjusted practices as evolutionary processes. These depend on inputs by many different actors, operating at different intervention levels (see figure 1: stakeholder matrix); as a result the conditions for farming evolve continuously. Hence a holistic perspective and a “process approach” which by definition is of an “iterative” nature, are required when evaluating the impact of research results. In orienting such an approach the “indigenous knowledge” and a confidence in “farmer rationality”, or more generally a people’s focus, are important starting points.

### 3.2 Evolving agricultural systems

A large part of the dynamics in agricultural development results from factors over which we have hardly any control. As population pressures increase and land availability decreases a number of changes is automatically set in motion. With land use becoming more permanent, farmers must change their practices (e.g. in water and soil fertility management) to ensure the sustainability of their operation. Next with the introduction of a market and monetary economy, profit maximization and intensification through the use of external inputs lead to further profound changes in
agricultural systems. The result is that farmers become increasingly dependent on factors that are beyond their direct and immediate control and hence the need for them to get organized among themselves. So in terms of farming systems there tends to be a logical—though not always equally desirable—evolution from:

- **Subsistence, often shifting, agriculture**: supposed to be primitive, small-scale, resource-poor, hand labour, low-yielding, and non-sustainable (at least beyond a certain population pressure),

- **Modern, commercial and permanent agriculture**: large scale, mechanized, high-yielding, depending on reliable agricultural services and a functional marketing sector for external inputs and as outlet for the surplus production.

The continuous adjustments in farming practices are a condition sine qua non for a sustainable agriculture so that the possible detrimental effects of certain practices (but also policies) can be counter-balanced timely, and before irreversible changes set in (Stoop, 1990). This implies that also degradation features are an integral part of agricultural development as it evolves from shifting to permanent types of farming (Stoop et al., 2000).

Concerns about the sustainability of “modern agriculture” have led to the development of a range of alternative, more “environment-friendly” systems. These tend to be based mainly on a more knowledge-intensive farm management, involving

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### Table 1: The major levels of intervention according to geographic/administrative, ecological and socio-economic perspectives and the related major types of interventions involved in agricultural development.

<table>
<thead>
<tr>
<th>Levels</th>
<th>Geographic</th>
<th>Agro-ecologic</th>
<th>Socio-economic</th>
<th>Type of intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Macro level</td>
<td>- Continent (trans-national)</td>
<td>- Eco-region</td>
<td>- Population</td>
<td>- Policies (econ./envirm.)</td>
</tr>
<tr>
<td></td>
<td>- Region (trans-national)</td>
<td></td>
<td>- Government (nat.)</td>
<td>- International laws and regulations</td>
</tr>
<tr>
<td></td>
<td>- Countries</td>
<td></td>
<td>- International agencies</td>
<td></td>
</tr>
<tr>
<td>Macro/meso</td>
<td>- Countries</td>
<td>- Eco-region</td>
<td>- Population</td>
<td>- National policies, laws</td>
</tr>
<tr>
<td></td>
<td>- Provinces (national regions)</td>
<td></td>
<td>- Government (national and local)</td>
<td>National policies, laws and regulations</td>
</tr>
<tr>
<td></td>
<td>- Towns</td>
<td></td>
<td>- Institutions (national / regional / local)</td>
<td>Technologies</td>
</tr>
<tr>
<td>Meso/micro</td>
<td>- Districts</td>
<td>- Agro-ecology</td>
<td>- Government (local)</td>
<td>- Local rules/regulations</td>
</tr>
<tr>
<td></td>
<td>- Villages</td>
<td>- Watershed</td>
<td>- Rural communities</td>
<td>- NR-Management</td>
</tr>
<tr>
<td></td>
<td>- Village territory</td>
<td>- Toposequence</td>
<td>- Farmer organ.’s</td>
<td>- Technologies</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Develop. Agencies</td>
<td>- Farm support facilities</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Private traders</td>
<td>(credit/market inputs)</td>
</tr>
<tr>
<td>Micro</td>
<td>- Village</td>
<td>- Agro-ecology</td>
<td>- Village community</td>
<td>- Local rules/regulations</td>
</tr>
<tr>
<td></td>
<td>- Farm</td>
<td>- Watershed</td>
<td>- Family/household</td>
<td>- Social organisation</td>
</tr>
<tr>
<td></td>
<td>- Field plots</td>
<td>- Toposequence</td>
<td>- Individual</td>
<td>- Technologies/practices</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>*crop-livestock manag.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>*crop husbandry</td>
</tr>
</tbody>
</table>
a more precise timing of operations (in relation to weather conditions) and increased labor inputs, leading to smaller optimum farm sizes:

- **Integrated agriculture**, medium to large scale, increased input use efficiency thus reducing production costs, and improving sustainability
- **Ecological agriculture** (organic, bio-dynamic, low external input, etc.): small to medium-scale, high labour requirements, sustainable, and with an increased emphasis on “high quality” agricultural products that sell at a premium.

Much of the debate among donors, policymakers, researchers, development workers (extension and NGO's) and the general public is dominated by sustainability aspects as related to the above “stereo-types”. These debates, however, tend to bypass the huge variability and diversity in agro-ecological and socio-economic conditions, and the inherent complexities of the adoption / change process at farm levels.

### 3.3 Agricultural research and development paradigms; implications for technology transfer and adoption

Generally, rural communities tend to be more preoccupied by issues, such as health, transport, markets, prices, education, water and electricity, etc, than by agricultural technologies (Sherwood and Larrea, 2001). This is not to say that new “agricultural technologies” are not important, rather that their successful introduction will depend on a wide array of local conditions. Key conditions would be (Boyd and Slaymaker, 2000):

- **importance of agriculture in rural livelihoods**, as affected by the opportunities for diversification and/or for out migration (alternative non-agricultural sources of income),
- **shortage of agricultural land**, as related to population pressures, and
- **type and security of land tenure systems**.

Change and adoption patterns (and thus impact from research) will vary considerably in response to these conditions apart from the local policy, institutional and marketing environments. So changes will generally be slow, continuous and progressive (Vierich and Stoop, 1991; Meertens, et al, 1994), but can also be rapid and substantial in areas with high population pressure as in peri-urban areas, and in the Machakos district in Kenya (Tiffen, et al., 1994). Moreover, farmers tend to introduce changes “spot-wise” and in direct response to localized problems (see Mazzucato and Niemeijer, 2000 for on-farm studies in Eastern Burkina Faso and Kante, 2001 for fertility management in Southern Mali). By contrast externally funded development projects tend to apply blanket improvements that bypass the local micro variability in terms of agro-ecologies and of different social strata in the target population. For the resource-poor farmer the latter is obviously inefficient, hence his non-responsiveness.

The technology transfer process, as an element of agricultural development, has often been considered as “linear”, and has been dominated by “top-down” thinking. As far as public and private sectors are concerned, it has been based largely on standardised technological packages and “blanket” recommendations that were developed by research and passed on to extension for dissemination. Together with concerns about organisational efficiency, this has led to highly structured
mechanically functioning organisations, that culminated with the Training and Visit (T+V) system. Such a system again bypasses many field realities as related to problems of local diversity / variability and complexity that are dealt with more effectively through informal “farmer-to-farmer” communication.

While there have been fundamental changes in the organisation of extension services in recent years, most of these changes have resulted rather from the non-sustainability of the organisational structures than from changed views on the process of “technology transfer”. Top-down attitudes are strongly entrenched in both national and international institutions when it comes to field implementation. The attitudes are linked to two common paradigms that dominate the modern agricultural development perspective:
- the intensification paradigm
- the efficiency paradigm

Under the influence of the “Green revolution” successes in Asia and the example that this has provided to the IARCs in general, a particular intensification paradigm has evolved, which has widely influenced the global agricultural research establishment. This paradigm presupposes that agricultural improvements must come to a major extent from improved cultivars (through conventional and/or bio-technological breeding approaches) in combination with the (increased) use of agricultural chemicals, and increased levels of mechanization. The resulting standardized technologies are presumed to be widely known and only need to be taken from the shelf to have major impacts. Such a view tends to reduce the development issue to a technology transfer problem that can be solved through “organizational efficiency”; hence the efficiency paradigm that has widely affected both the research and development sectors.

The efficiency paradigm also tends to bypass some critical roles of agricultural research that in addition to “technology generation” provides essential “information” to policymakers and donors as a basis for policy decisions, but also to researchers in identifying constraints and research opportunities. In addition, research institutions develop “concepts” and “methodologies” that guide the national development process. This overall capacity is, however, highly dependent on continuity in the form of “maintenance research” and the active, continued presence of interdisciplinary teams of scientists.

Another popular notion in donor circles and among research administrators is to distinguish between different types of research. Fundamental and strategic research are generally considered to be complex, long-term, requiring costly equipment, to be conducted by highly qualified, competent (and prestigious) researchers. This form of research is better to be left to the rich, industrialized countries and/or international centers. Incorrectly, this might suggest, that therefore applied and adaptive research are easier and require fewer resources, and thus can be conducted more appropriately by the “poor” national institutions and their less highly educated scientists.
A central hypothesis of this study is that poor adoption rates of research results can be attributed largely to some of the common research paradigms and to various rigid and simplified conceptions about the agricultural development and technology transfer processes. These paradigms have worked relatively successful in the uniform, high potential agricultural environments as in parts of Asia; it is postulated that for the heterogeneous and marginal (therefore more complex) situations as prevail in West and Central Africa we may need to substantially modify / adjust our paradigms.
4. Results and Discussion

This chapter presents the results of the field studies conducted first and foremost in Mali, to be complemented by a short visit to Guinée, and discussions in Senegal with ISRA, CORAF and FRAO. In both Mali and Guinée the field studies have looked at the factors ranging from international and national policy to institutional as well as methodological, social and technological that may have affected agricultural development and the adoption of research results in recent years.

4.1 The MALI case

The study in Mali has focused on meeting the major national actors (CNRA, IER, DNAMR, SG 2000 and ICRISAT/ICRAF) in Bamako; subsequently their regionalized units and the Producer Organizations were visited during the field tour. The field tour covered the Sikasso, Segou and Bamako Regions.

The Southern Mali – Sikasso region, served by the Sikasso Regional Research Center, represents the cotton-based systems. The Segou region covers two very different systems: the rainfed millet/sorghum - based systems as served by the Cinzana Research Station, and the irrigated rice-based systems of the Office de Niger served by the Niono Regional Research Center. Finally, the Sotuba Regional Research Center that serves the Central (Bamako) region was visited. A more detailed account of the Mali case study is presented in Appendix E.

4.1.1 Historical background

For the country as-a-whole it is informative to place the agricultural developments in an historic perspective. Some of the events that have had major impacts, since the colonial occupation by the French are:

1890 – 1960: Colonial government

1960: Independence: First Republic with centralised government structure following the socialist model; para-statals responsible for regional development (CMDT for Southern Mali; Office de Niger); creation of national agricultural research institute: Institut d’Economie Rurale (IER)

1970 – 1974: Sahelian drought followed by large in flux of donor support, leading to:

1972: “Operations de développement” to achieve regional food self-sufficiency
1985: Start of large scale World Bank “structural adjustment programs”
1990: Start of World Bank-guided national extension project (PNVA),
1991: Reorganisation of IER: creation of a national, regionalized research structure based on six Regional Centers
1992: First democratic elections for Presidency, parliament and local government; start of “decentralisation” policies and increased emphasis on democracy
1994: 50% devaluation of the Franc CFA
1995: General liberalisation of land use (important impact in Office de Niger); start of World Bank sponsored “National Agricultural Research Project” (PNRA) and introduction of the “Comité National de Recherches Agronomiques” (CNRA) and the “Regional User Committees” (CRU) (including CMDT and Office de Niger); increased responsibilisation of private sector
1998: End of World Bank sponsored PNVA project
2001: End of PNRA
2002: Start of new comprehensive World Bank coordinated agricultural support project (PASAOP): increased privatization of research and extension services.

Generally, Malian society has always functioned under centralised and directive forms of government, starting with the colonial period and through the First and Second Republics. With the reductions in the public sector and increased decentralisation during the Third Republic came, however, other centralised, large-scale and “donor-imposed” policies towards agricultural development associated with large multilateral projects such as PNVA, PNRA, and currently PASAOP.

4.1.2 National Policy environment

Most important to recent agricultural development in Mali, have been the democratisation and decentralisation processes that started in 1992 with the Third Republic. This has created a favourable national policy environment that has attracted donors, NGOs and private investors. Likewise, the liberalisation of land use in 1995 has had important effects on stimulating the development of the non-traditional crops (vegetables) sector.

To what extent the multilateral donor assistance, in particular the creations of a national extension service (PNVA) following the “Training and Visit” (T+V) system, of the “Comité National de la Recherche Agronomique” (CNRA) and of the “Comités Régionales des Utilisateurs” (CRU), has been beneficial to agricultural development, is difficult to ascertain. However, some major efforts, like the T+V system for extension were discontinued after several years; likewise funding gaps of one or more years between consecutive project phases have caused serious disruptions and reduced credibility of the actors involved.
4.1.3 Institutional context

Starting in 1995 and through the PNRA a central national coordinating and funding institution for agricultural research (CNRA) was created within the “Ministry of Rural Development”. The CNRA evaluates and funds research project proposals that are subsequently implemented mostly by IER. Simultaneously, a bottom-up and “demand” structure -the CNU/CRU- was created to strengthen the influence of users on the national and regional research agendas.

The development context of the Mali case is complicated by considerable differences between the countries’ major regions with respect to agro-ecological conditions and farming systems, and as a result the group of development actors in each region. The situation is further complicated by the present transition period between two major multi-lateral donor projects (coordinated by the World Bank) along with the on-going institutional reorganizations for the development and extension sector.

The Southern Mali region of Sikasso constitutes the cotton belt of the country and therefore is one of the major pillars of the national economy. Since independence in 1960, the comprehensive development of the region – including all aspects ranging from health, education facilities to agricultural services and infrastructure construction- has been dominated by one single institution: the “Compagnie Malienne de Développement Textiles” (CMDT). While initially this has accelerated the development process and cotton production in particular, it has also had some distinct drawbacks that over time are becoming increasingly clear:
- the monopolisation in terms of institutional development has delayed a balanced evolution towards the wider array of support institutions and an active private sector that are all essential for a diversified, market-driven agricultural sector as compared with the former subsistence and subsequently cotton dominated systems,
- some important sectors of considerable economic potential, such as fruits (mango’s and citrus) and vegetables (in particular potatoes) in peri-urban agricultural systems have been neglected in spite of their considerable economic potentials,
- the presence of a well-functioning CMDT has provided attractive opportunities for additional donor investments, which has further strengthened its dominant role.

The ongoing, large scale restructuring of the CMDT (since 1999) and its reorientation and narrowing of mandate to cotton-based systems leaves presently a confused situation. The resulting institutional gaps need to be filled by a host of new players such as DRAMR as extension service for all non-cotton commodities, the “Chambre d’Agriculture”, the private commercial sector and the relatively young CRUs. Their roles are complemented by NGOs and foreign projects like the Swiss-supported organisation “Gestion et Développement des Resources Naturelles” (GDRN). The latter plays an important facilitating role in the complex communication between CRU and Producer organisations on the one hand and the research – development / extension organisations on the other, to clarify, translate and eventually fund demands raised through the CRUs.

As the development scene in the South was dominated by the CMDT, the “Office de Niger” (OdN) played that role in the vast irrigated area North of Segou. In the agro-
ecologically more marginal, rainfed areas of the Segou region, the actors have been more diverse including combinations of public sector extension (PNVA), NGOs and various development projects (including from FIDA and GTZ).

The PNVA was initially structured around the T+V approach to extension. In 2002 a new comprehensive project “Programme d'Appui aux Services Agricoles et Organisations Paysannes” (PASAOP) will get underway. Among other things it will be aiming at decentralised and privatised extension services (DRAMR) that will collaborate closely with other development actors (Projects, NGOs, CRUs and Producer Organisations) on contract bases. During its initial phase PASAOP will focus on five Regions (Mopti, Segou, Sikasso, Koulikoro and Bamako).

The NGO group is an increasingly important actor on the development scene. A distinction is made between “international” NGOs such as SG 2000, Winrock International, Voisins Mondiaux etc, that tend to work in support of and/or in close collaboration with the public sector development services, and a large number (1300) of “national” NGOs of varying strength and competence. This latter group often operates in relative isolation and feels rather left out of the development activities. In that respect it is important that 17 of the larger national NGOs are currently creating a Federation (CREDO) to facilitate their implication and collaboration with the other development actors, notably DNAMR/DRAMR and IER. In view of their important contributions in terms of education/alphabetisation, health services, support to social organisation, and women empowerment, this group of actors has an increasingly important role to play certainly in the context of the new Project PASAOP.

For Southern Mali farmer organisations have been introduced at an early stage through the CMDT as “Associations villageoises” to facilitate the cotton production. For other commodities and in the rest of the country, farmers are less, or not organised at all. As a result the rather recently created CRUs tend to operate in a vacuum.

4.1.4 Research impact

Partly as a result of the different institutional contexts, the impacts of research vary greatly between the major regions, the predominant cropping systems and between types of technological improvements proposed.

Impacts have been considerable for cash-crop-based systems (cotton, maize and irrigated rice). Table 2 presents a typical example for adoption trends (even though it is for rice in Burkina Faso: INERA, 1999). This shows relatively easy adoption of new varieties (certainly by commercially oriented systems), while the adoption of various cultural practices lags behind, as was also confirmed by Brader (2002) for maize. A similar pattern occurs for the “traditional” staple crops (sorghum, millet) and in general rainfed cereal-based production systems (Yapi, et al., 2000). Adoption rates decrease for all components of a technological package as the farming conditions become more marginal (in terms of soil fertility and rainfall). For further details see Appendix E.
Figure 2: Opportunities (O) and constraints (Δ) for research impact: Mali case

<table>
<thead>
<tr>
<th>Development constraint</th>
<th>MACRO-International</th>
<th>MACRO-National</th>
<th>MESO-REGIONAL</th>
<th>MICRO-Local</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actors</td>
<td>Donors CGIAR, CORAF + Network, Intern. R+D Centers</td>
<td>Nation. governm., IER, DNMAR SG2000, CRRA</td>
<td>CRAMR CMDEO Dn</td>
<td>DNDN + projects, Prod.'s, Indiv.'s</td>
</tr>
<tr>
<td>International policy</td>
<td>Δ</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>National policy</td>
<td>O</td>
<td>?</td>
<td>?</td>
<td>O</td>
</tr>
<tr>
<td>Development/research strategy</td>
<td>Δ</td>
<td>Δ</td>
<td>Δ</td>
<td>?</td>
</tr>
<tr>
<td>Institutional</td>
<td>Δ</td>
<td>Δ</td>
<td>Δ</td>
<td>Δ</td>
</tr>
<tr>
<td>Organisation/management</td>
<td>Δ</td>
<td>?</td>
<td>?</td>
<td>Δ</td>
</tr>
<tr>
<td>Communication - information</td>
<td>Δ</td>
<td>Δ</td>
<td>Δ</td>
<td>Δ</td>
</tr>
<tr>
<td>Methodology/approach</td>
<td>Δ</td>
<td>Δ</td>
<td>Δ</td>
<td>Δ</td>
</tr>
<tr>
<td>Socio-econ. + cultural environm.</td>
<td>Δ</td>
<td>Δ</td>
<td>Δ</td>
<td>Δ</td>
</tr>
<tr>
<td>Techn. devel. + transfer</td>
<td>Δ</td>
<td>Δ</td>
<td>Δ</td>
<td>Δ</td>
</tr>
</tbody>
</table>
Table 2: Adoption rates for rice technologies (INERA, 2000)

<table>
<thead>
<tr>
<th>Rice system</th>
<th>Varieties</th>
<th>Mineral fertilisers</th>
<th>Plant protection</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>NPK</td>
<td>Urea</td>
</tr>
<tr>
<td>Rainfed upland</td>
<td>50</td>
<td>10</td>
<td>3</td>
</tr>
<tr>
<td>Rainfed bas-fond</td>
<td>25</td>
<td>8</td>
<td>5</td>
</tr>
<tr>
<td>Bas-fond managed</td>
<td>75</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Irrigated</td>
<td>92</td>
<td>80</td>
<td>80</td>
</tr>
</tbody>
</table>

Yet, over the last 20 to 30 years many changes in agriculture have occurred spontaneously and through informal contacts among farmers. This applies to the non-traditional vegetable crops that have greatly increased in importance. But also in the traditional agro-sylvopastoral systems some distinct and important changes have occurred, such as: increased use of organic manure and the substitution of mineral fertilisers by organic manure (Stoop and Kebe, 1998). The increased storage of crop residues as animal feed during the dry season, and the widespread adoption of animal-drawn charts, are two additional, highly visible features (see photographs).

4.1.5 Constraints

An analysis of the wide range of constraints, but also opportunities, that affect the impact of research results in Mali is presented in Figure 2. The types of constraints / opportunities have been presented for the various major actors, while focusing on the main issues. An interesting first conclusion is that major barriers seem to be associated with the two extremes of the agricultural development continuum: the macro-international actors and the micro-local level actors. These results are elaborated below.

a) Policies

A distinction needs to be made between policies originating at the international and at the national level. The former involves events like globalisation and international trade agreements as well as donor policies and visions on “development” that are hardly influenced by individual African countries. Yet the impacts, on for instance the Malian agricultural sector, are profound. Likewise, the consequences for national institutions and for the continuity in their activities and services can be serious, because of the “project-mode” through which much assistance is made available. Obviously, the international policies have not been tailored to Malian needs, or for that matter to the agriculture-based economies of African countries. To some extent Mali has managed to compensate for this through its national liberalisation and decentralisation policies that have created a favourable environment for the private sector and that have attracted donors.
b) Institutional

The institutional landscape for the Malian agricultural sector presents a number of particular issues.

**IER mandate:** IER is by-and-large the only major national institution with a research mandate in support of the national agricultural sector. The present donor pressure for a greater privatisation of research efforts may have undesirable effects in skewing the institutes' research agenda towards short term issues through research contracts with the users. However, much research should be aimed at “preparing for the future”, which will involve medium to long term research activities including essential maintenance research, that require funding stability and a continuity in implementation.

For the future of IER, its programs and activities must be balanced between:
- **short-term, demand-driven research** projects funded through contracts with the users, and
- **long-term, strategic research** projects of a wider national interest that are funded from public resources.

**Overlaps between IER and ICRISAT:** such overlaps should be of serious concern, because based on the comparative advantages of each institution, very complementary research agendas can be defined easily. In that context there is little justification for an international Center to conduct an extensive on-farm testing program. The on-farm testing of “best-bet technological” packages for instance should rather be a domain for collaboration between the national research and extension services (see also section 5.3.1.). Since international Centers will generally have more abundant resources, and also a narrower research agenda (focused on just one or two commodities) than the average national program, there is an understandable temptation for them to intervene in areas that are the obvious prerogative of the national program. This report will argue (see Chapters 5 and 6) that Centers should resist this temptation and use their resources on issues where they do have the comparative scientific advantage. Only in exceptional cases and upon an explicit request by the host Government for support to the national institute, should IARCs take on such types of location-specific research.

**Overlaps between research (international and national) and the development / extension sector:** this overlap is common and originates from the desire by all parties to show “impact” at farmers’ level. The result is, however, that research gets over-expanded in the on-farm environment, conducting studies and trials in numerous villages (being unable to adequately monitor and guarantee data quality), or that extension starts to conduct on-farm experiments and tests without having the professional qualifications. Through “special projects” and/or “contract research”, that provide additional funding to the respective institutions, this trend has been reinforced in recent years by the donors. It has been noticed both at the levels of national and international institutions.

The CRUs were created in 1995 as part of the World Bank supported PNRA. The CRUs are aimed at strengthening the “farmer-demand” structure vis-à-vis the
research and development services. The fact that the CRUs were created through an “external” intervention has had considerable consequences for the effectiveness of their operations, the representativeness of its members, its financial sustainability, as well as for the anchorage at its basis: the farming community. A large proportion of Malian farmers is apparently still unaware about the CRUs existence and certainly about its role.

In both the CRU and the T+V cases, that were major elements of World Bank projects, disproportionate amounts of funding went into the built up and functioning of multi-layered (national, regional, district, community) administrative structures, while the anchorage at the local community level was weak. It might be concluded that such outside interventions, though perhaps desirable from a theoretic point of view, in the end prove to be non-sustainable for lack of both adequate local financial resources and local motivation.

One domain where the liberalisation process has had a most pronounced impact has been in the “non-traditional” vegetable production sector, mainly concentrated in peri-urban areas. This sector is highly profitable and probably could become even more lucrative if the producers were organised, instead of each operating on an individual basis. In this respect the Guinea case offers a sharp contrast in clearly demonstrating the impact producer organisations can have on the efficiency of linkages for demand-led research as well as on efficient private sector involvement in securing input supplies and marketing. Yet, in Guinea the “Federation of Fouta Djallon Farmers” evolved more naturally, because of a widely felt local need to get organised in facing jointly the external commercial and political environments (see the Guinea case: section 4.2.).

c) Approach / Methodological

In spite of considerable efforts to introduce demand-led and participatory approaches to all IER staff at one stage, one can question the effectiveness at present when the ESPGRN researchers do not spend a considerable part of their time on-farm. The very same reservation applies to scientists from international centers when they work with numerous villages.

In spite of the “participatory” logic in terms of diagnosing constraints and developing technologies, neither national or international technical and biological scientists or the average extension agent, have had adequate training to master the (interviewing) skills required. This probably explains why the average diagnosis is of very limited value, not going beyond simple observations of the type: “the variety is not good”, “the soil is poor” or “weeds are a problem”.

On the other hand there were reports of farmers getting seriously annoyed by the frequency of research and extension meetings, tests and surveys. This may be indicative of the many organisations involved (extension, projects, different NGOs) that compete and contradict each other, while following different, uncoordinated approaches that have been mostly “technology-focused” without due attention for human and social aspects.
d) Social Environment / Farmer organisations

In the more risky and marginal (often physically more isolated) environments of the savanna and sahelian zones, farmers are more conservative and superstitious about foreigners and about innovations in general. Here the traditional communal household structures are still strong, while in the more progressive, more commercially oriented (cotton) farms, many of the extended farms have broken up into smaller units as the result of conflicts between the older and younger generations. As a result a diverse social environment has evolved. In the CMDT zone different categories of farmers (A = large, mechanised, B, C and D = small, non-mechanised) have long been recognised, as well as the implications for their respective capacities to adopt new technologies. In other parts of the country this will not be any different, but it has generally not been an element of the extension approach.

There are also important differences in terms of local organisation between regions and as influenced by the major commodities produced. While the cotton producers are understandably well organised through the CMDT; the traditional household organisation prevails among the cereal / livestock farmers; surprisingly enough the commercially attractive non-traditional (vegetable) crop sector has no organisational structure.

Apart from this, there can be remarkable differences between neighbouring villages in their respective interest and motivation to participate in research and extension activities. This is a phenomenon, linked to social dynamics that should be exploited by development institutions.

e) Technological

Most of the formal research and extension interventions are highly technology-biased. Researchers and extension agents are hardly concerned about how a proposed technology will fit into the calendar of farm activities in terms of labour requirements and what are the (financial) risks involved. Often the additional labor requirements and the local availability of the required external inputs at affordable prices are overlooked (see fig. 2: technological constraints at producer level). Very complex is the situation for livestock and certainly for impacts on the sylvo-pastoral / traditional staple crop systems that involve complicated socio-cultural issues in particular as it concerns land tenure issues.

The CRU representatives pointed out that their major need is in the post-harvest domain, dealing with local transformation, improved conservation and storage of fruits and vegetables but also of the traditional cereal crops.

4.2 The GUINEA case

The study in Guinea has been very short; its main objective was to identify some distinct differences with the Mali case. In terms of factors and conditions that have had major effects on agricultural development and on the impact of agricultural
research results, the Guinea case is indeed very different. At the same time it could be considered as fairly representative for a substantial group of countries in the West and Central African Region.

The study started with discussions in Conakry at the headquarters of the major actors: IRAG, SNPRV, DNE and SG 2000. Next it continued with field visits to two major regions: Moyenne Guinée (including the Fouta Djallon mountains) and Basse Guinée. In both regions discussions were held with the local actors: researchers of the IRAG Regional Centers of Bareng and Foulaya, SNPRV and SG 2000 extension staff, NGOs, Producer Organizations and farmers in the two study villages Senghen and Touguikhoure. Details for the Guinea case are presented in Appendix F.

Already during the colonial period Guinée was recognized for its very diverse and rich natural resource base. These cover tropical rainforests in the south-east, savanna zones in the north-east, as well as medium elevation (up to 1500 m) mountain areas of the Fouta Djallon, and the humid coastal zone in the west, which includes extensive areas with mangrove tidal swamps.

4.2.1 Historical background

The historical events that have most profoundly affected Guineas’ agricultural development can be summarized as follows:

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before 1958</td>
<td>Colonial period under French rule; in 1920s creation of first agricultural research stations in Sérédup (forest zone: coffee), Bordo (savanna zone: cotton and rice), Foulaya (coastal zone: tropical fruits) and Koba (mangrove rice).</td>
</tr>
<tr>
<td>Sept. 1958</td>
<td>Referendum: population votes against the “union” with France.</td>
</tr>
<tr>
<td>Oct. 1958</td>
<td>Independence, Sékou Touré as first president; all relations with France broken off and total withdrawal of all French assistance and technical aid.</td>
</tr>
<tr>
<td>1958 – 1984</td>
<td>First Republic: socialist government and creation of a one-party national political system;</td>
</tr>
<tr>
<td>Apr. 1984</td>
<td>Death of Sékou Touré</td>
</tr>
<tr>
<td>1984 – 1986</td>
<td>Transitional governments: introduction of multi-party political system with independent legislature (Parliament) and judiciary (High Court) bodies; opening to the West and introduction of a market economy; privatisation.</td>
</tr>
<tr>
<td>1986</td>
<td>“Direction Nationale de la Recherche Agronomique” (DNRA) moved from Ministry of Agriculture to the Ministry of Higher Education and Scientific Research</td>
</tr>
<tr>
<td>1987</td>
<td>CRA Bareng established as research center for the Fouta Djallon;</td>
</tr>
<tr>
<td></td>
<td>Start of movement to create local, farmer organizations.</td>
</tr>
<tr>
<td>1989</td>
<td>DNRA is transformed into “Institut de Recherche Agronomique de Guinée” (IRAG), which is placed under the Ministry of Agriculture.</td>
</tr>
</tbody>
</table>
1990 – 1994: “Projet Service Agricole” (PSA-1) including IRAG, funded through the World Bank
1992: Creation of the “Fédération des Producteurs de Fouta Djallon” (FPFD)
1996 – 2000: “Projet National de Services Agricoles” (PNSA), including IRAG and the “Service National de Promotion Rurale et de Vulgarisation” (SNPRV) funded by World Bank.
1996 – 2002: Border tensions with Liberia and Sierra Leone; large influxes of refugees.
2002: Negotiations with World Bank towards “Projet National des Services Ruraux” (PNSR)

As for Mali, Guinée has also operated mostly under directive forms of government through the colonial period and the First Republic. Important changes in the system of government were introduced in the years following the death of Sékou Touré. As a result the country has opened up to the West and multilateral donor support started to arrive leading to great improvements in the road infrastructure and a modest increase in private sector activities.

4.2.2 Agricultural development

The abrupt de-colonization and the subsequent policies by the First Republic have seriously delayed the development of the agricultural sector. In spite of some “pockets” of commercial crops (cotton, coffee) and non-traditional vegetable (potatoes, onions) production, the predominant form of agriculture remains subsistence farming. Evidence for this is the fact that the countries’ major traditional food crop -rice- hardly enters the commercial circuit being almost totally consumed at the household and local village levels.

Eventually, the agricultural sector will have to evolve towards more permanent and more capital intensive systems. As population pressures continue to increase and “land” becomes a limiting factor farmers will need to make additional investments in terms of labour, mechanization and/or external input use. However, agricultural intensification and specialization involve considerable risks (biological and economic), which farmers will only accept, when being assured of reasonable financial returns, the presence of capable research and extension services, and of an efficient and reliable agricultural services sector (input supplies, credit facilities, marketing and transformation channels). Experiences elsewhere show that these conditions can be enhanced by an enabling policy environment that promotes the development of a divers and competitive private sector.

4.2.3 National Policy Environment

For some time Guinea has been under pressure by the international community, which has reservations about the Governments’ democratisation policies and lack of transparency. The country has also been affected by the political troubles in neighbouring Liberia and Sierra Leone and the resulting large influx of refugees. The
desperate financial situation of the Government doesn’t aid the overall policy environment either.

4.2.4 Institutional context

Agricultural research and development institutions have come a long way since the first evaluation in 1988 by ISNAR (Stoop and Bosso, 1989). Both research and extension services are young institutions having been created only 10 to 15 years ago.

For IRAG the successful introduction of a regionalised research structure has been most important. It consists of 4 Centers and 2 Specialized Stations according to the major agro-ecological regions of the country; each unit operating fairly autonomously.

As part of the PNSA, the SNPRV built up an extensive national structure and network of extension agents all over the country, following the T+V model of operation. Some of the major developments in both the research and extension structures and activities are described in an evaluation report prepared for the World Bank (Stoop, et al., 1998). This report has led to some major changes, notably the introduction of “study-villages” by IRAG to create a concrete interface between research, producers, extension and NGOs. A description of this approach to an integrated, multi-stakeholder, on-farm research program has been presented by Béavogui, et al. (2000).

Collaborative arrangements such as research and development networks for the sub-region (e.g. WARDA/ROCARIZ Task Forces for rice; and the WARDA based Inland Valley Consortium -IVC), play important roles in providing some vital additional funding, as well as information and technical support. The same applies for the support provided by SG 2000 to the SNPRV. These arrangements become “life lines” for IRAG and for SNPRV during transition periods between projects permitting a minimum number of field activities to continue, as is presently the case.

Most important during the last decade has been the creation of numerous local farmer organizations and their combination at regional levels into “unions” and “federations”. Most prominent today is the “Fédération de Producteurs de Fouta Djallon” (FPFD), that covers 380 formalized farmer groups with a total of 13,000 individual members of which 70% are women. The “Federation” has sub-sections for potato, tomato and onion producers.

The presence of strong farmer organizations will greatly facilitate the operation of the “Comités Régionaux de Recherche/Développement” (CRRD), that are comparable to the CRUs in Mali and that serve a similar objective of introducing a “demand-led” perspective in the research and extension interventions.

4.2.5 Research impact

So far the adoption of new technologies by farmers has been limited mostly to improved varieties for rice (lowland and upland), maize, cassava and various vegetable and fruit crops. Improved cultural practices requiring additional investments in labour and external inputs have not been adopted widely.
Figure 3: Opportunities (O) and constraints (Δ) for research impact: Guinea case

<table>
<thead>
<tr>
<th>Intervention levels</th>
<th>MACRO-International</th>
<th>MACRO-National</th>
<th>MESO-REGIONAL</th>
<th>MICRO-Local</th>
</tr>
</thead>
<tbody>
<tr>
<td>Development constraint</td>
<td>Donors</td>
<td>CORAF + Network</td>
<td>Intern. R+D Centers</td>
<td>Nation. governm.</td>
</tr>
<tr>
<td>International policy</td>
<td>Δ</td>
<td>Δ</td>
<td>Δ</td>
<td>Δ</td>
</tr>
<tr>
<td>National policy</td>
<td>Δ</td>
<td>Δ</td>
<td>Δ</td>
<td>Δ</td>
</tr>
<tr>
<td>Development/ research strategy</td>
<td>Δ</td>
<td>Δ</td>
<td>Δ</td>
<td>Δ</td>
</tr>
<tr>
<td>Institutional</td>
<td>Δ</td>
<td>Δ</td>
<td>Δ</td>
<td>Δ</td>
</tr>
<tr>
<td>Organisation/ management</td>
<td>Δ</td>
<td>Δ</td>
<td>Δ</td>
<td>Δ</td>
</tr>
<tr>
<td>Communication - information</td>
<td>Δ</td>
<td>Δ</td>
<td>Δ</td>
<td>Δ</td>
</tr>
<tr>
<td>Methodology/ approach</td>
<td>Δ</td>
<td>Δ</td>
<td>Δ</td>
<td>Δ</td>
</tr>
<tr>
<td>Socio-econ. + cultural environm.</td>
<td>Δ</td>
<td>Δ</td>
<td>Δ</td>
<td>Δ</td>
</tr>
<tr>
<td>Techn. devel. + transfer</td>
<td>Δ</td>
<td>Δ</td>
<td>Δ</td>
<td>Δ</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
4.2.6 Constraints

The constraints and opportunities for the Guinea case are presented in Figure 3. In comparison with the Mali case, an interesting difference is the problematic situation at the Macro International, Macro National and Meso Regional levels as it concerns the policy environment under which major actors (institutions and the private sector) have to operate. On the other hand the conditions are distinctly more favourable at the meso-micro level in terms of NGOs and farmer organisations. The constraint at the individual producer level (right bottom corner of figure 3), reflects the “supply” nature of most of the technologies offered to farmers and which ignores the very limited resources available to most farmers.

\[ a \quad Policy \]

The national policy environment in Guinea, as created jointly by government and donors, presents the major constraint to agricultural development. Two issues stand out:

- **Barriers to the development of an effective and competitive private sector**
  (presently constrained by many obstacles to local and international trade and to easy transport), and
- **Inadequate support to the development of competent research and extension services**:

It needs emphasizing that in the absence of any changes in the present policies, also the on-going initiatives by NGOs, such as SG 2000, will only have very limited and temporary impacts, and will not have tangible long term effects on the SNPRV and its institutional sustainability.

\[ b \quad Institutional \]

IRAG and SNPRV have lacked continuity because of their “project” status, and the absence of a fixed annual financial contribution to operating costs by the government. This situation has prevented a sound personnel management (e.g. the timely recruitment of young scientists to replace the aging IRAG staff), as well as an appropriate financial management that would ensure institutional sustainability and thus continuity in field activities.

Presently both IRAG and SNPRV activities have almost come to a halt in the transition period (2 years) between two consecutive World Bank projects. SNPRV continues a minimum of activities through SG 2000, while IRAG has only some funds from contract research (e.g. with the Federation) and from some commodity-related networks

\[ c \quad Approach / methodological \]

In the past IRAG has made several attempts to introduce “farming systems” and “participatory” approaches into its programs. A handicap here has proved to be the absence of the social science discipline, but also the conflicting recommendations by
Presently privatization of the research and extension services are fashionable approaches. Yet for most countries of the region it would seem inappropriate: in Guinea the two services are professionally weak; the producers are mostly poor small-holders who are operating mostly non-monetarised production systems. Therefore, there are few alternatives in the short and medium term, but continued and increased support by the public sector. The aim should be to first strengthen the professional capabilities of these services that constitute the backbones of intensified commercial farming.

d Social environment / Farmer organisations

The transition from subsistence into commercial, permanent agriculture is technically complex, but also involves many fundamental social and organisational aspects. This must have implications for the approaches to research and development that will be used. The IRAG study villages reveal important information about the importance of local social dynamics and farmer organization, as well as alternative, mostly informal, communication channels (see Appendix F).

e Technological

As in Mali, the research and extension services have been greatly biased towards technological interventions. Unfortunately, most of the required external inputs are either not available locally, do not meet the required quality specifications and/or are excessively expensive.

4.3 Meetings in Senegal

The stop-over in Dakar proved very useful, since the meetings with CORAF/WECARD, ISRA and FRAO covered a number of issues on research coordination, policies and methodologies that were highly relevant for the outcome of the overall study. In the following sections brief backgrounds to the three organizations are provided, as well as on the main issues discussed.

4.3.1 CORAF

CORAF was created in 1987 as a coordinating institution between the agricultural research institutes of the francophone African countries and the research and development institutions based in France. Over the years CORAF has evolved considerably by becoming the collaboration and coordination body of the West and Central African region representing also the Anglophone and Portuguese countries of the region. At present CORAF / WECARD operates a small Executive Secretariat (a total of 13 personnel including secretaries and drivers) based in Dakar, and a total of
20 regional (commodity) networks, thematic research poles (e.g. for irrigated agriculture) and base centers (CORAF, 2001). Each of these collaborative efforts is guided by a coordinator who is based either at a national or international center. For instance the rice network coordinator is based at WARDA, the one for root and tuber crops at the Crops Research Institute in Kumasi (Ghana), the one for sorghum at ICRISAT-Bamako, and the one for cotton at ITRA in Togo. Each coordinator is assisted by a steering committee and oversees the activities conducted by his network in the member countries concerned. The coordinator reports to the steering committee and the general assembly of the network that meets once every two or three years, and annually to the CORAF / WECARD Executive Secretariat.

CORAF / WECARD's aim is to establish itself as an efficient and sustainable institution for coordination and collaboration on agricultural research and development efforts conducted in the sub-region. This involves the NARES, IARCs and ARIs, but also the other development actors including the producers and their organizations as well as the NGOs and private sector. It has lined out its vision in a comprehensive strategy document that distinguishes between vertical priority commodity themes, horizontal systems-based, and transversal programs (genetic resources, biometrics, technology transfer aspects). This strategy is largely based on the national strategies formulated by the respective member countries (CORAF, 2000).

While the strategy is a useful background document, it is very broad and general, and doesn't provide concrete priorities. Actually the strategy deals with the entire range of topics that presently are covered by the CORAF-coordinated networks (10 commodity, 6 thematic and 2 systems networks, in addition to the two base centers). In view of CORAF's small size Executive Secretary and limited human and financial resources, one could question how realistic the proposed strategy is, but also the actual portfolio of regional networks. What is CORAF's "added value" with respect to the implementation of these networks?

The proposed CORAF strategy is very "technology-biased" without a clear vision about how to cope with the "human" element that is crucial in the technology generation and transfer, as well as in the development processes. Neither does it indicate how to cope with the issues of diversity/variability (= location specificity) and the complexity of production systems which on top of that are stretched out over vast areas. For further suggestions see sections 5.3 and 6.

4.3.2 ISRA

The meeting at ISRA focused mostly on political and economic aspects of the global trade liberalization and how this affects the adoption process of improved technologies by small farmers, but also the sustainability of their farming operations. Obviously, the low world market prices for major commodities like rice, groundnuts and cotton is likely to lead to lower investments in external inputs and in soil conservation measures by farmers. In the longer term this may seriously affect the sustainability of local production systems, and thus the national food security situation. The smallest and poorest farmers and notably women and children, would
be the first victims of such situation. Moreover, the other countries in the region are likely to face very similar problems in this respect. Further implications of this issue are discussed in section 5.1.1.

4.3.3 FRAO

The “Fondation Rurale de l’Afrique de l’Ouest” (FRAO) was created in 1993 and works in partnership with rural communities to improve their living conditions and the sustainability of the natural resource base on which their livelihoods depend. FRAO seeks to strengthen the local organization and knowledge of farmer communities and the effectiveness of their communication with the public sector research and development services, but also with NGOs and the private sector, through participatory methods (FRAO, 1997, 1998). It is particularly in the communication domain that biological and technical researchers (international as well as national!) and extension personnel show serious weaknesses that largely blocks the potential effectiveness from jointly conducted, on-farm technology development and transfer activities. In this capacity FRAO has been developing new participatory tools for on-farm work, has conducted training programs and has played a mediating and facilitating role between producers and development agents.

Among other activities FRAO has been mobilized by the World Bank to initiate training programs in Mali for IER staff and CRU members, and more recently by FAO to work with the WARDA-Saint-Louis team in the introduction of “integrated crop management” practices to farmers in the Senegal river irrigated rice schemes.

The meeting with FRAO staff underscored that in spite of the widespread “participatory rhetoric” among researchers and development personnel, there exist fundamental shortcomings with respect to field implementation. The common attitude of scientists’ “superiority” towards extension and NGO personnel as well as towards farmers, remains a serious constraint to the development and transfer of adapted technologies. Moreover, this attitude often prevents scientists from capitalizing on valuable farmer knowledge as a basis for the subsequent development of demand-generated, adapted technologies and their effective on-farm testing. It was also agreed that inadequate communication and interview skills of most researchers and extension agents are largely to blame for the shallow results that are generated through most on-farm, diagnostic exercises (for further discussion see section 5.4.1.).
5. Analysis and Discussion

The discussion is organized broadly according to the major intervention levels and the major issues linked to each level. So at the macro level the emphasis will be on policy aspects and on the principal actors / institutions involved. At the meso and micro levels, the emphasis will be on methodological aspects, and the technological and social aspects as linked with field level interventions. Obviously, the discussion is complicated by the many factors (associated with the different levels) that in one way or another affect the impact of research results on farming.

5.1 Macro level: international policy issues and development strategies

At the macro international level the issues are mostly related to the domains of international policy (trade; development aid) and general development strategies, as applied by the international community. Both Mali and Guinea, and for that matter the other African countries face similar constraints.

5.1.1 Impact of world trade - globalization policies on the African agricultural sector

Obviously, the globalization issue that was raised during the discussions with ISRA in Senegal (section 4.3.2.) is equally relevant for other African countries where the agricultural sector dominates the national economy and where efforts are ongoing to raise production through intensification. The lowering of world market prices for major (food) commodities that results from free-trade, will provide serious disincentives to small, resource-poor, African farmers to intensify and thus invest in their agricultural operations by adopting the proposed new technologies. With agriculture becoming more permanent, due to increased population pressures, this will have potentially serious effects on the natural resource base and its sustainability. But the ramifications still go further: deteriorating rural livelihoods will stimulate the migration to urban centers and to the more prosperous countries of the Northern hemisphere, leading to increasingly complex and serious social problems.

Conclusion-1: lowered world food prices will further undermine the sustainability of African farming systems and consequently will impact negatively on the goals of poverty alleviation among resource-poor farmers and of natural resources sustainability with eventually serious implications for social stability.

The notion that free trade policies facilitate the development of an efficient, large scale, mechanized farming operation, as occurred in the Western world, is unrealistic.
for most African countries. Mainly so, because the vast majority (more than 60%) of the population is currently involved in farming, real incomes are very low and alternative employment options are very limited for the time being. As emphasized also by Roling (2002), agricultural development implies much more than “technology” and “market”, and includes ecological as well as socio-cultural issues that profoundly affect the efficiency and sustainability of production systems. For instance, studies in South Mali and also elsewhere, show that the small family farm with secure land ownership tends to operate much more efficiently than the large industrial farm (Quan, 2000). To place this issue in a West African context, one only has to look at the success and high yields obtained from small plots in the peri-urban settings (see Mali and Guinea case studies: the non-traditional crop systems).

**Recommendation 1**: The international community should support African governments in taking corrective and selective agricultural trade policy measures to protect their national agricultural sectors and ensure their long term viability in an effort to deal with food security, poverty and sustainability issues.

### 5.1.2 Fundamental contradictions in the agricultural development strategies for Africa

The impacts of research on agricultural development in Africa, apart from some successes, have been rather mixed. (Or perhaps expectations had been raised to unrealistic levels?) This applies in particular to the traditional sectors of staple food crops, livestock, pastures and natural forest vegetation management. In response the research and development propositions to rectify this situation are becoming more comprehensive (and costly), while the supporting coordination and administrative structures increase in number, size and complexity. Is this an appropriate response, or is there something fundamentally wrong with our strategies and approaches?

It is also common knowledge that spatial variability and social diversity are huge, that the climatic conditions are risky (droughts and floods), and that as a result the traditional African farming systems are complex (Eicher, 1999). Why then are researchers developing standardized recommendations and decision models for vast and heterogeneous areas? Why have major development and extension efforts been following standardized model approaches to technology transfer? For many years the costly T+V model has been imposed on African countries. Currently, contract research and farmer field schools are becoming the latest fashions, seemingly without questioning whether these are suitable in view of the local development conditions.

The present case studies on just Mali and Guinea highlight fundamental differences between these two countries in terms of their respective national policy environments. But also within each country and between their respective major agricultural sectors (traditional agro-sylvo-pastoral, cash crop-based and non-traditional systems) there are distinctly different development patterns, which need to be taken into account when designing an appropriate strategy for a country and/or a sector.

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1 Arguments will differ for the urban poor, who will profit from lower food prices, and in the case of more widespread opportunities for off-farm employment.
Conclusion-2: While “diversity” and “complexity” have been recognized as key features of African farming systems, neither international or national research have come to terms how to cope with it strategically. Research and development need to be far more imaginative and creative in their strategies and approaches. This is not necessarily a matter of using “modern” science and/or strengthening the social sciences as expressed by the CGIAR (2000) in its new vision and strategy.

Recommendation-2: research, development and extension services require flexible approaches towards technology generation and transfer to cope with variability, to adapt to unforeseen local conditions, and to capitalize on local social dynamics and informal communication. This aspect will be elaborated in the subsequent sections.

Permitting and promoting “flexible” approaches requires, however, substantial changes in the enabling policy environments and management perspectives from the ones that actually prevail in both international and national institutions.

5.1.3 Discrepancies between formal research policies and practical (farming) realities

There is “hunger” in the world and there are large areas with serious “poverty”. Yes! However, there is NO shortage of food in the world (Lappe, et.al., 1998), as demonstrated also by falling food prices over the last 30 years (CGIAR/TAC, 2000). So it should be questioned, to what extent technological improvements leading to increased yields perse would contribute to alleviating hunger and poverty. What contributions could international and national research make that would indeed alleviate poverty, improve food security and the sustainability of agricultural production systems?

In that respect the research goals and objectives as set forward by international research administrators are becoming increasingly utopian, leading to alarming gaps between “theory” and “farming realities”. In spite of the “bottom-up” and “participatory” rhetoric of many policy and strategy documents, the resulting field operations remain basically “top-down”, because of inappropriate, top-heavy administrative structures (like T+V), or for reasons of inadequate tools and skills of the field staff (see section 5.4.1.).

Likewise donors are getting increasingly concerned about “impact” and the “efficient” use of funds. As a result “impact” assessments have become a common feature. Also in this respect a widening gap between the “theory” of donors and administrators, and the “practical realities in the field” is occurring. To measure impact in the field one is confronted by diverse and complex situations and issues of “how to measure” impact, at “what geographic scale” and with “what degree of precision”. As a consequence the reliability of “impact” information is often questionable, because institutions tend to use it for publicity purposes, and yet the (opportunity) costs of obtaining it, are exceedingly high. While the author agrees with the need to monitor impact and to critically review and evaluate research progress regularly (annual), one also needs to be realistic about the limitations and the speculative nature of many impact assessments.
So it is not surprising that the Mali and Guinea case studies are not very positive about the contributions made by international research and development so far.

**Conclusion 3**: the major international trade policies and the proposed yield increasing technologies have had mostly adverse effects on alleviating rural poverty; the richer segments will always be better positioned to profit, and therefore the gap between rich and resource-poor farmers (officially the main target group) is likely to widen.

**Conclusion 4**: instead of exploiting the asset of environmental and social diversity/variability, both research and development are “fighting” it through standardized “magic-bullet” type solutions and large-scale blueprint approaches.

Then what policies, technological concepts and strategies by research and development would indeed help the poorest while protecting the environment? Probably this would require a kind of paradigm reversal by policymakers and scientists. This study suggests that the conventional conceptions for yield increasing technologies, need to be complemented by conceptions for maximizing efficiency in the use of available production factors (time, space/location, water, plant nutrients, labour, knowledge and capital as a last resort), leading to a widened choice of technological options. As concerns the dissemination / transfer process, “learning” and social organization concepts should complement the conventional teaching and instruction approaches. In sections 5.4.2 and 5.4.3 these issues will be elaborated further.

**5.2 Macro level: national policy issues**

At the macro level, there are distinct differences between African countries in terms of their respective national policy environments. Overall government stability and good governance are crucial in creating the economic policy coherence and the enabling policy environment that are required for agricultural development. From it will flow the incentives for donors, the private sector and the general public to make (long term) investments. Obviously the present study can only touch these policy issues superficially. Yet, policies are a determining factor for the impact that research results can have on agricultural development. The national policy environments also constitute one of the major differences between the Mali and Guinea cases.

**5.2.1 Government national policies: implications for creating an enabling environment in support of a modern, sustainable, commercial agriculture**

A first major element of the national policy needs to be the recognition that agriculture constitutes the predominant sector of the national economy, thus impacting directly on the well being of major parts of the population. Since alternative employment options are still scarce in most of the countries, the agricultural sector deserves stable government support. For most African countries this is obviously not the case, as demonstrated most clearly in the present study by the Guinea case.

Currently there is an international trend to leave the development of the agricultural and food sectors predominantly to the private sector and/or (international) market.
forces. However, it is mainly the public sector that has the general responsibility and the means to safeguard the vital, long-term interests related to equity, environmental protection, long-term food security and public health of its population. Therefore, national governments –for the sake of internal social stability- should seek to counter-balance through their national policies some of the undesirable effects that may result from the international policies, as linked with globalization, international trade and structural adjustment.

An element of such national policy should be to raise the support for public sector research and development, thereby ensuring an essential balance between:
- short-term research activities demanded and funded by the users / private sector,
and
- long-term strategic research activities dealing with issues of food security, equity and sustainability of the natural resource base (including essential maintenance research) that are funded through the public sector.

This balance between short and long term, and between public and private sector funding serves a dual purpose: the development of a balanced and comprehensive research agenda as well as an improved funding stability to achieve research program continuity. Currently, neither balance, nor continuity in research and development operations is found in Guinea, while for Mali considerable improvements are still possible.

Apart from the balance at national level, there is another balance to be achieved between national and international / regional coordinated research interventions that will be discussed in section 5.3.

Both international and national policymakers have so far greatly underestimated the complexity, and far-reaching policy implications that are involved in progressively changing the traditional production systems (often shifting agriculture) towards modern, permanent, sustainable and commercially viable farming systems. So far international donors, research and technical assistance have tried to bring this change about or at least try to accelerate this process, mostly through technological means, and sometimes limited policy support in the form of subsidized inputs like fertilizers. National programs for research and development have –partly under the influence of donor pressures- followed the same strategy.

However, this technological approach has bypassed a host of other problems. In particular, the need to involve a whole range of other partners composed of a viable and competitive private commercial sector providing agricultural supplies at reasonable prices and an effective marketing structure that handles the surplus production at reasonably attractive profit levels for the producers. Simultaneously, a professional agricultural research service is required that can cope with the unexpected technical and biological problems that are a common feature of an intensified agriculture. Finally, a reliable extension service needs to evolve progressively to signal problems timely through its regular contacts with the farmer communities, and to expose these communities to the new concepts and technologies of a modern agriculture.
Conclusion 5: to fulfill these conditions eventually requires policy interventions by national governments:
- to remove as far as possible the barriers to easy and rapid transport and national trade operations, thereby enhancing the development of a diverse and competitive private sector, and
- to ensure that the national research and extension services can rely on a stable and annual contribution from the national government’s budget.

A permanent and commercial agriculture requires from the farmers, additional technical and administrative skills. Therefore, general educational aspects and national educational policies need to be an integral element of a strategy for accelerating agricultural development.

However, rather than through directive policies, this agricultural transition requires mostly enabling policies that create favorable conditions for development, so that locally available resources, skills and knowledge can be exploited to a maximum (Pretty, 1998), before resorting to foreign aid and external models of development.

5.3 Macro – Meso level: Major actors and institutional issues

The national research and development/extension system (NARES) and its national partners are a central issue in the present study. In the second place the question is how the NARES can benefit most from collaboration with the international / regional actors.

At this level institutional aspects as related to mandates of national research and extension / development organizations in relation to their international counterparts are of major concern. Likewise management aspects will directly affect the impact of research results.

5.3.1 National agricultural research and development institutions and programs: the evolution in their mandates and scope

National agricultural research and extension systems (NARES) obviously do not operate in isolation; their functionality and effectiveness will be greatly affected by a countries' overall government stability, good governance and the extent of policy support to the agricultural sector.

For agricultural development, the national agricultural research and development capacity, should be considered as a vital element in two ways:
- it constitutes the “first line of defense” for a sector of crucial national importance, and
- it serves as the national linkage to the “world agricultural knowledge system”.

The NARES of the West and Central African region have to operate most of the time with very limited resources (in terms of funds and qualified personnel). However, the scope of their responsibilities (an entire national agricultural sector, including livestock and the natural resource base) is very wide and complex.
The national programs have generally evolved enormously during the last twenty years in terms of their organization, planning and management and the quality of their respective outputs. This has been achieved through a combination of national commitments to building an agricultural research infrastructure along with large funding contributions and technical support from the donor community. Also a large group of African nationals have had opportunities to travel overseas for advanced training (MSc and PhD levels).

During the last decades, the national agricultural research institutes in most countries have increasingly been structured to cover the major national agro-ecological regions through a network of sub-centers and/or stations and experimental farms. These regionalised structures are uniquely placed for close contacts to the rural community (either directly or through linkages to national extension / development services, including NGOs) to cope with location specific agricultural problems and issues. It should be emphasized that international / regional agricultural research institutions can in no way substitute for this capacity to deal with local diversity and variability in agriculture.

National regionalisation is a precondition to achieve a “bottom-up” input. On-farm and participatory activities therefore need to be integral components of an agricultural research program. Without it research would become readily isolated from its major client group and thus from the farming reality. Of course this applies in the first place to the national programs; but it is no less relevant for international research. The emphasis of the latter should be different, however, by focussing on methodological aspects (e.g. of participatory research and extension).

On-farm research activities are confronted by a common dilemma: what should be the appropriate scope of field interventions? Because of the vastness and diversity of the on-farm environment, as well as pressures by the development sector (and by donors) there exist a dangerous tendency for research to over-expand and thereby to take on “development” responsibilities. Over-expansion by research readily leads to program fragmentation, a loss of focus and excessively expensive operations. Apart from that, over-extended on-farm programs are easily marginalized by unreliable data because the technical personnel are no longer supervised adequately by the responsible, center-based scientists (see also section 5.4.1. on participatory research). These concerns are substantiated by the observations in the Mali case (for both national and international research institutions). By comparison Guinea has succeeded to create both a functional, decentralized and autonomous network of centers, as well as operational, limited-scale, on-farm interventions and studies (see Beavogui, et al., 2000).

In many countries, decentralization has encountered problems with the out-posting of scientists and technicians to often rather remote locations (Mali; Burkina Faso), as well as with a fragmentation of on-farm research over numerous locations. These are fundamental management issues that should be handled pro-actively by the research leadership, because of the serious “cost” and “efficiency / research quality” implications involved.
Counter to research, the public extension services have been linked mostly to the administrative structure of a country. In the early 90s Mali and Guinea created large and costly, multi-level extension structures that spanned the entire country, or at least major parts of it. Both followed the T+V model, which in both cases collapsed when the World Bank funding came to an end in the late 90s.

In the context of the present decentralization and privatization policies, both countries are in the process of negotiating / starting new projects with the World Bank in support of rural development. Thus in Mali the PASAOP and in Guinea the PAMR projects are getting underway. Both are based on the principle of “research and development contracts” in an effort to make the respective services more client-oriented, while operating through “producer organizations”. However, also in this case it remains questionable to what extent this mechanism can continue to function after the projects come to an end, since a major part of the clientele is composed of resource-poor, subsistence farmers. Again it appears that too much attention will be directed towards building and operating formal administrative structures and mechanisms that in the end remain remote from the farmer community, while being non-sustainable in the absence of donor funding.

Even so, the present perspective on extension/development has become more realistic in recognizing that to reach rural communities widely one must:
- build partner coalitions (between: development projects, NGOs, extension, producer organizations and research), and
- mobilize the farmer community as an active participant in the process.

In coping with the problem of local rural diversity and to create the required enabling environments (with respect to communication and education) decentralized national institutions tend to be best positioned. Moreover and in view of the limited national resources (human and financial) it would have been realistic to follow a “process approach” by gradually building up a modest capacity, and by starting in those parts of the country where impact would have been most likely.

This also implies the need to increasingly stimulate and mobilize rural communities to deal with local constraints through their own initiatives through “self-help” groups, rather than being “passive recipients in a technology transfer” process. Two elements of greatest significance in this process are: informal communication channels and local social dynamics.

Donors, in their desire to demonstrate rapid, tangible “impact” on agricultural development, are often to blame for over-extended on-farm activities. On the other hand there is the inability from research management to stick to research (rather than development) priorities, while being tempted by additional short-term funding. However, the negative effects as encountered in Mali and Guinea are substantial:
- the creation of costly, over-extended / over-ambitious infrastructures and programs, that go beyond the medium term availability of adequately trained local personnel both for the research and extension sectors,
- the creation of heavy administrative structures to plan, monitor and evaluate the impact of research funding, along with an unrealistic emphasis on “impact for development” through over-extended, formal “technology transfer” efforts,
- the non-sustainability of programs once donor support is halted, reduced and/or shifted to other sectors for donor-related political purposes (NGOs; debt-relief, emergency aid, etc),
- the reliance on donor funding and an over-emphasis on “client orientation” have led to a “project-based” type of research programs that tend to lack the flexibility and continuity in field operations that are essential for research endeavors.

Conclusion 6: Donor pressures to demonstrate development impacts by national (but also international) research and extension institutions have frequently led to over-expanded programs (geographically and in content) in relation to the available national human and financial resources.

This has negatively affected the efficiency of research output, but has also undermined the sustainability and credibility of national institutions and their research activities. A pressing question for all of the NARES currently is: “what is possible given the currently available, national resources?” The answer to this question has been greatly distorted by the relative abundant availability of external, short-term project funds.

Recommendation 3: National research and development institutions should take the lead to review rigorously what are the essential national needs and where are major development impacts most likely. These should be ranked in order of priority and be compared with the nationally available resources (funds and qualified personnel) to arrive at more modest programs that will bring continuity in the support for vital, national interests. Such reviews would also contribute to the identification of major research domains of a more fundamental nature, where regional efforts will be justified (see section 5.3.5.).

5.3.2 NGOs (international and national)

From the Mali and Guinea case studies the NGOs appear as important actors in the local development process and in meeting local needs. A distinction needs to be made between international NGOs (such as SG 2000, Winrock International, Voisins Mondiaux, etc.) and the national NGOs. The former tend to be well funded and be part of extensive and influential international networks that can also mobilize important professional resources. The latter are extremely diverse in all respects: personnel, professional qualifications, interests and funding; they often have fragmented and overlapping activities (see Mali case). In spite of their variable capabilities NGOs play potentially important roles in particular at local levels, and in terms of education (alphabetization), social organization, women empowerment, alternative employment options and creating a local dynamics as discussed under 5.3.3.

The role of the NGOs is very complementary to that of research and extension institutions and therefore merits much closer integration into the general agricultural development efforts and the scaling-up process. With respect to the national NGOs a
major obstacle in mobilizing them is their fragmented nature. It should be considered
a priority by the NGO group to get better organized among themselves to become an
effective and reliable partner in development.

5.3.3 Local social organizations and producer organizations as elements of rural development

In “development” the components of general education and social organization of
rural communities are as important as technologies. Recently, Honkounou (2001) in
West Africa and Berdegue (2001) for Chile have drawn attention to both the diverse
forms of local farmer organizations, their different origins, their internal dynamics
(the type of leadership) and the overall relevance and motives behind their creation in
explaining their success or lack of it. Their results link well with the findings in the
Mali and Guinea case studies. First of all there are considerable differences in
“farmer organizations” between the major agricultural sectors distinguished in this
study. The strength and considerable political influence of these organizations for the
non-traditional sector in Guinea is understandable. However, for a more diffuse
sector like the traditional staple crops, it would be difficult to repeat.

The creation and development of regional producer committees (the CRUs in Mali;
the CRRDs in Guinea) through external project interventions is proving rather
complex. Identifying / selecting representative committee members and ensuring
anchorage at the grass-root levels are much more problematic, than when the local
organization evolves naturally because the producers feel a common need to combine
forces.

Apart from the differences between the agricultural sectors, there are also profound
differences in social organization and local dynamics between villages, and within
villages between households and individuals. In Southern Mali the CMDT has been
distinguishing for a long time between A (large and fully mechanized), B, C and D
(small non-mechanized) types of households. Further studies (Stoop and Kebe, 1998;
Kante, 2001) revealed that the impact of household diversity upon technology
adoption / change can be substantial. Both research and development have normally
bypassed the implications of this feature for their interventions. While a complicating
factor when trying to disseminate routinely a standard technological package, it can
also be exploited to accelerate a local development process through key individuals,
thereby enhancing the local informal communication. The Guinean study village
“Senghen” provides an interesting example of such a situation (see Appendix F: The
Guinea case).

5.3.4 CORAF as a coordinating institution

For the West and Central African region, spanning some 20 countries, each of which
has “agriculture” as the major economic sector, there is obviously scope for
coordination and collaboration on research and development issues of a common
interest. Presently, both these functions are handled by CORAF. In addition it serves
as the “regional forum” for the agricultural development debate. Section 4.3.1.
described the present CORAF program and its (draft) strategic plan. The question is
whether CORAF with its extremely limited human and financial resources, should
aim for these very wide-ranging responsibilities, or that it would be more effective
when focused on a more limited agenda?

The author believes in the latter, provided that agreement can be reached between
member countries on a concrete set of tasks and an appropriate size. As mentioned
also by Janssen and Kassam (2001), the presence of a strong sub-regional organization
is a prerequisite for the development of a balanced regional research agenda. Rather
than claiming responsibility for an extensive program of research networks, research
poles and base centers covering the entire range of agricultural sectors and systems,
CORAF could play a strategically much more important role by limiting itself to the
coordination aspect. Even if that were the case, CORAF would require additional
professional staff to cover the major agricultural sectors: crops, livestock,
forestry/NRM, agricultural development (socio-economic aspects) and policies.
Moreover an ICT capacity would be essential for a regional organization.

The following indicative suggestions are made for a future CORAF:
- It needs to be a small, functional and efficient organization, with a limited, highly
  qualified, professional staff (about 5 to 6 senior officers),
- It should become the reference base with respect to “agriculture” (potentials and
  constraints) in the region, and the research and development capabilities available
  in each of the member countries,
- It should serve as a broker between NARES, and between NARES and IARCs in the
  identification of common research needs of broad regional interest and/or of
  common interest to a group of countries,
- It should have a financial autonomy, permitting it to sub-contract specific research
  projects to a relevant IARC and/or other qualified institutions in or outside the
  region.

To meet these conditions CORAF will have to build up its legitimacy and credibility
with the member countries, with the donor community and with the other major
development actors. Simultaneously, it should progressively strengthen its role as a
broker and a source of funding for research projects of significance to the sub-region.
This would instill a sense of “ownership” and responsibility for regional research
programs also in the member countries. Moreover, it would lead to a greater
empowerment of CORAF by having a degree of financial autonomy over resources
that -at least partly- consist of contributions from member countries.

A coordinated regional research agenda should be constructed around a limited
number of relevant, concrete themes, that can muster broad support from member
countries and that are also attractive for donors to “buy into”. The major themes will
follow logically from the considerations of:
- objectives, priorities and direct practical needs of national agricultural sectors,
- “appropriate intervention levels” as related to major themes,
- considerations of complementarity between decentralized national research
  structures and a coordinated regional / international research structure,
- comparative advantages in terms of available expertise and physical facilities,
- minimal transaction costs
As such CORAF should evolve over the coming years, as a crucial, coordinating institution in the development of a regional program that is implemented partly through an integrated IARC program and partly through collaboration among NARES. The aim should be to avoid creating an additional research bureaucracy and/or to embark on over-elaborate priority-setting and planning exercises (for which it would be difficult to find the required donor funding).

Some possible research themes of regional significance that came up during the case study discussions are:
- creation of central databases on the natural resource base, current agricultural systems, major production and development constraints; national research programs and their available expertise/human resources,
- (economic) policy research: a domain in which most NARS lack adequate capacity (e.g. impact of globalization and of WTO rules and regulations on the African agricultural sector and its sustainability),
- regional breeding programs (e.g. rice, maize, cassava etc); RYMV resistance breeding for rice,
- role of soil organic matter and micro organisms in sustaining long term soil fertility; contributions by different sources of organic manure; complementarity between organic and mineral fertilizers,
- water management,
- integrated control of striga,
- methodology development: participatory approaches, actor coalitions for development.

Conclusion 7: In realizing a bottom-up, coordinated regional research effort for West and Central Africa, as aimed for by the CGIAR (2000) in its “New vision and strategy”, the presence of a strong regional coordinating institution is essential. CORAF still requires considerable strengthening of its human and financial resources to be able to fulfill this role successfully.

Recommendation 4: in the short term the present CORAF team should focus on developing a “medium-term plan of operations / business plan” that specifies to member countries, donors and other development partners, how it intends to evolve as an institution, how it will function and what resources it would therefore require.

5.3.5 (CORAF) Regional Networks as a collaborative mechanism

Since the 80s a wide range of regional commodity networks have been created. Most operate currently under the aegis of CORAF, while being hosted and operated from a basis in either a national or international institute. These various networks have made important contributions in:
- information and material (germplasm) exchanges,
training, breaking the scientific isolation of national scientists, providing support (scientific and financial) to the implementation of national research studies.

While these contributions of the networks are important, the transaction costs are exceedingly high with the annual meetings taking up a major share of the budget. In that respect the restructuring and redefinition of the WARDA / WECARD rice network / Task Forces in 1999 has set a useful example:
- reduction of the number of Task Forces,
- one shortened (4 days) regional meeting/conference once every two years,
- complementary funding on a competitive basis for an increased number of national rice research proposals of regional significance, that are implemented under the Task Forces program, and
- funding of regional monitoring tours by combined teams of national and WARDA scientists.

The present study has been unable to look in detail into the functioning of the various networks. However, questions can be raised about their effectiveness and about what purpose it serves to have all of them attached to CORAF? After all, CORAF completely lacks the human resources to oversee this wide range of networks.

The networks regularly span more than ten countries, while being handled by a single coordinator. There is no way that this person can provide more than limited, mostly administrative support. Consequently, the potential spill-over effects in terms of the creation of a data/knowledge base about the participating countries, focused support to specific national needs and capitalization on the results achieved by individual members for a wider regional purpose, do not materialize.

Presently the contributions by regional networks tend to be overvalued as far as data quality and scientific relevance are concerned. In several cases the supplementary financial support provided to the NARS for the implementation of network trials has become crucial in maintaining a minimum level of operations in the absence of adequate national funding. As a result the value of the scientific output is marginalised, and the justification for such networks might eventually be jeopardized.

Successful networks require initiatives and dedicated scientific inputs from the “bottom” i.e. from motivated scientists in the individual member countries. One or two experienced senior scientists could then ensure overall coherence and guidance as well as the regular exchange of results from the “top”. The reality in the region is, however, that most networks are driven predominantly from the “top”, mainly because of funding/donor arrangements.

5.3.6 Donors, CGIAR and IARCs policies and research strategies

Certain shortcomings in the policies and development strategies originating at the international level when judged against the specific needs and conditions of
individual countries, have been signaled already (sections under 5.1.). This implies that the international level is not always positioned appropriately to resolve issues of more local concerns and importance.

CG Centers, being positioned at the macro-international level, have to focus on “broad and major technological and policy issues”. As a consequence the Centers need to accept that they are rather distant from field level realities, in particular the problems associated with the variability and diversity in the natural resource base and with local social / cultural environments. Irrespective of the considerable competence and financial resources available at international levels, these constraints must be faced by donors as well as by the international scientific and development communities. In spite of the ambitious goals for poverty, malnutrition and hunger alleviation, while protecting the natural environment that the CGIAR has set (CGIAR/TAC, 2000), these issues fall largely in the “national policy research” domain.

Moreover, research at the Centers is dominated by technical and economic disciplines that lead to a focus on technological improvements and economic impacts. These biases may lead to technological options that in the context of resource-poor national programs and as related to hands-on “agricultural development” for resource-poor farmers, are inappropriate. Moreover, the disciplinary research focus (as associated with “Centers of excellence”) leads readily to a degree of compartmentalization and reductionism, because the “human/people” component in the research and adoption processes tends to be bypassed. This is compounded by increasing donor pressures for rapid “impacts” and the resulting emphasis on short to medium term, (spectacular) quick-fix technological outputs. However, there is a need to view and to address agricultural development problems and constraints from more than just one angle by employing multi-dimensional approaches (Gubbels and Ghimire, 2002). This applies as much for policies and organizational issues, as it does for technologies.

Increased food production can be achieved technologically in different ways; some will be quicker, less costly and with fewer unknown risks (health and environment) to producers than others (compare solutions derived from genetic improvement, from genetic engineering or just simply from agronomic research). Different research strategies and approaches (at various levels of sophistication) tend to be associated with large differences in research costs and efficiencies, but may also have ramifications for the subsequent dissemination and adoption process. Agricultural production systems based on liberal use of external inputs will always be more costly to farmers than a more knowledge-intensive, integrated crop management approach. The latter firstly seeks to adapt the choice of the crop (and its varieties) to best exploit the G x E interactions and the naturally existing potential of the resource base, and secondly to optimize the crop growth environment through limited external inputs (for details see section 5.4.3.). If indeed our target group is the resource-poor farmer and our objective poverty alleviation than the latter system would be the most appropriate.

As analyzed in the past for the “Green revolution” in Asia, food production in uniform, high potential areas can be successfully increased. It has been well
documented, however, that this bypasses the specific needs of the poorer sections of the rural populations. For the marginal and risky environments that prevail in most of Sub Saharan Africa, this same social phenomenon will be even more pronounced. **Conclusion 8:** In view of the marginal and risky agro-ecological environments of SSA, the Centers have to a large extent followed inappropriate research strategies that were overly inspired by “Green revolution” concepts.

As mentioned already under 5.1.3, it would require a mere paradigm shift for scientists to be able to correct this (see section 5.4.). And yet, IARCs should be expected to achieve this and thereby capitalize more effectively on their considerable intellectual resources by conducting imaginative research (NOT necessarily the same as “modern science”) on issues of practical relevance, that are beyond the capacities of the NARES. This applies equally to biological, technical as well as social and economic disciplines.

While the author is fully aware that the current donor environment with its short-term emphasis on development and impact, is rather unfavorable, the IARCs do have sufficient independence (through unrestricted core funds) to ensure balanced research agendas. Such agenda should cover both the “short-term donor wishes” through special projects / contract research, and the longer term needs for the development of creative, non-conventional research for which the NARES often lack the human and financial resources.

Another concern should be that the heavy governance structure of the CGIAR system (presumably covered increasingly by the unrestricted core funds) and the administrative demands that follow from it for individual scientists, has started to interfere with “creativity”. Principal scientists tend to be overloaded increasingly with non-research tasks, which cannot remain without impacts on their scientific performance.

The CGIAR and IARCs have over the years increasingly created an “excellency” and “success” culture around their various operations. In many cases this has resulted in paternalistic attitudes that have negatively affected relationships with national programs. A serious drawback of this CGIAR culture is that it interferes with realistic assessments of the comparative advantages that flow from its international and sub-regional position in the agricultural development continuum and therefore its complementary status and role in relation to their national partner institutions. But even more serious this culture prevents the Group from facing its limitations and failures.

**5.4 Meso – Micro level: field interventions**

At this level organizational and management issues prevail as related to interactions between regionalised research services and the scaling-up activities by development and extension services.

Here the agricultural development continuum is confronted by the problem of technology generation for different agro-ecological environments. And next how to
adapt technologies to specific local conditions to ensure adoption and impact on agricultural production. Also at this level the participatory approaches and the local social dynamics become key elements in the dissemination/scaling-up process.

5.4.1 Methodologies and participatory approaches in development-oriented research

In spite of the widespread and common “participatory” and “demand-driven” rhetoric in research proposals and reports, the author considers this still a major weakness in both international and national programs. There are a lot of on-farm activities going on in terms of tests, demonstrations and surveys, but many do not deserve the classification “participatory”, and are implemented in the usual top-down and supply-driven fashions.

The shortcomings show up in several ways:
- the outcomes of diagnostic surveys or constraint identifications of the type “the soil is poor”; “the variety is no good” or “weeds are a problem” - - - . Such information is too general to be useful, and does not permit a focused and effective response by thematic specialists, nor does it provide any insight in the dynamics of farm operations,
- the same holds for formal surveys conducted routinely through standardized questionnaires, where masses of data are collected by technicians,
- the format in which the results of on-farm experiments are analyzed and presented tend to be the same as for on-station experiments (i.e. treatment means). Yet, the main reason for working on-farm is to involve and expose the farmers (individuals or groups) and to get information on the socio-economic acceptability / constraints associated with the proposed technologies. By presenting the results as “means” much of the information is effectively eliminated,
- inappropriate use of “farmer trials”: there is a common belief that “farmer trials” (designed by research and/or extension) ought to be simple (i.e. only 3 or 4 treatments) and need to be implemented in large numbers (preferably covering tens of farmers). Field implementation including field lay-out, data collection and analysis are therefore left almost entirely to poorly supervised technicians, the responsible scientist being too occupied to spend adequate time in the field.

What kind of viable conclusions could possibly be drawn from such efforts? To what extent are these efforts indeed “demand-driven”? Will the considerable costs (vehicles, gas, per diems, inputs, labour, etc.) weigh up against the meager results and shallow conclusions of such efforts?
In many cases the major objective of going on-farm -that is to obtain socio-economic feedback from the farmer community- is not realised.

These shortcomings cannot be rectified very easily. A classroom-training course of one or two weeks for technical scientists and/or technicians will not solve the problem, nor does the introduction of additional interventions that have not been thought through adequately from a pluri-annual development perspective.

As commented earlier the research and development interventions have been largely technology-biased. This is not surprising, since both international and national
research institutions are dominated by biological and technical scientists, who have never received any formal training in the social sciences and who do not have any experience with interviewing techniques. This is a widespread problem throughout the region that was underscored also by FRAO during the discussions in Dakar. Another handicap is that most agricultural scientists nowadays do no longer have a farming background and thus lack an appreciation of the risks and labour bottlenecks that are integral parts of any farming operation. This problem is compounded by the present popularity among scientists of computer modeling techniques, at the expense of time spend in the field and the ability to make professional field observations.

**Conclusion 9**: increasingly scientists (national and international) attempt to improve production systems of which they hardly know, let alone understand, the intricacies of the mechanisms and processes (biological, ecological, technical and socio-economic) involved.

In recent years “participatory variety selection” (PVS) and “community-based seed systems” (CBSS) have been interesting approaches to involve farmers in identifying promising varieties and their desirable traits, and to multiply seeds locally in the absence of a private seed industry. But considerably more thought needs to be given to raise these interventions beyond a “one-off” variety / seed multiplication intervention and to link it to the existing local knowledge, the livelihood systems and to the informal communication systems in a multi-stakeholder context.

In Mali there are reports about reduced farmer cooperation, because farmers were getting tired of questionnaires and tests. Rather than reflecting lack of collaboration by farmers this may well indicate a non-professional approach by research and extension personnel. **Conclusion 10**: communication between producers and research/extension is still inadequate, because of a lack in “interviewing skills”, “time constraints” by senior personnel, and a lack of logistics permitting scientists to stay in the field for adequate periods of time.

5.4.2 Social organization: Field implementation and organization of participatory approaches

The farming environment in Africa is so stretched out and variable with small communities in remote places, that any formal national organization faces an impossible physical task, apart from the lack of professional staff and financial resources. The recent failures in Mali and Guinea to establish such extension services underscore this problem.

Continuation of the formal, conventional project format aimed at building administrative (top down) bureaucratic structures complemented by artificial handouts in the form of inputs and credits to the poor, or the temporary funding from project resources of local farmer organizations (CRU or CRRD) will not prove sustainable either. So what alternatives remain?

Maybe a complete rethinking of how to cope with extension and development under these conditions is required. This report has emphasized repeatedly the importance of indigenous knowledge and technologies, of the local social structures, of local dynamics, and of informal processes (communication and experimentation). It is
suggested, that research and development (involving biological, technical as well as socio-economic aspects) need to capitalize on these processes and reinforce these through “lean” projects that follow a “process approach” while using local social dynamics as a criterion for initiating interventions (see also: Sherwood and Larrea, 2001). The mechanical, blue print and blanket approaches of the past, have largely ignored the crucial factors of local motivation of individuals and communities, and of informal processes. As demonstrated by the Senghen village study in Guinea this approach is not necessarily very complex, but requires the “human” component. Motivated research and extension personnel, open communication, awareness of informal processes and of local (social) dynamics are probably more effective in technology transfer and in accelerating agricultural development, than creating multi-layered bureaucracies following formalized approaches.

Key elements are a client and problem orientation (see Beavogui et al., 2000) that exploit local indigenous knowledge, both in terms of technologies, social organization, local rules and regulations; it is mainly through an emphasis on local communication structures that the development process is enhanced through:
- creation of local farmer groups / organizations,
- farmer-to-farmer communication,
- the mobilization of prominent farmers in the community as local advisors, and
- the recognition of different social strata in the target population.

Conclusion 11: In coping with the agro-ecological and socio-economic variability and diversity typical for African agriculture, the mobilization and strengthening of local capabilities and knowledge needs to be emphasized increasingly. In other words one should seek to strengthen the local capacity to deal with its own problems through informal experimentation and/or through farmer groups / farmer field schools. In general, the local educational level will be reinforced by facilitating communication and learning, rather than through standardized prescriptions.

5.4.3 Technology generation, testing and dissemination

An issue of considerable concern to resource-poor farmers is the unavailability of inputs, their high costs and/or inappropriate or even unreliable quality (see Mali and Guinea study villages). As recorded also in the case studies technology development and the subsequent scaling-up tend to bypass key elements of agricultural livelihood systems, notably the “variability” and “diversity” aspects, as well as the “peoples” factor (Kwesiga et al. 2001; Sherwood and Larrea, 2001). Consequently, the bulk of the technologies proposed by research and extension are basically supply-driven and rely heavily on external inputs (see on-farm experiments and demonstrations as conducted by SG 2000).

In spite of the “poor farmer” target group and the official research goal of “poverty alleviation” little innovative research (international and national) is being conducted that is aimed specifically at these issues and towards forms of agriculture that are specifically adapted to these conditions. Such forms would have to be based on agro-ecological adaptation in combination with cultural practices that permit minimal use of external inputs. Indigenous knowledge, as expressed through traditional
production systems, tend to provide important leads for this type of research. Its concepts involve an effective exploitation of “G x E interactions” by using different land types within farms for different crops and crop varieties through intricate cropping systems (Vierich and Stoop, 1992). Other local concepts (photosensitive varieties; early seeding; crop adaptation to major different soil types; and intercropping) that permit a more even distribution of labour and risks over the season (van Staveren and Stoop, 1984; Stoop, 1987) are also particularly relevant to the target group. The relevance of these concepts increases further for the marginal and risky environments that make up major parts of SSA. The point is that imaginative research could exploit these concepts to arrive at a better understanding about the biological / technological processes and mechanisms involved in agricultural production, and how these can be influenced to the benefit of the producers (and ultimately the consumers). In a recent paper by Stoop, et al. (2002), similar possibilities have been explored for rice with quite amazing results in terms of the “knowledge gaps” that even to-day exist for this “well-researched” crop.

In a rather similar way, the relevance of informal “farmer-to-farmer” communication and trade, as well as the role of informal, on-farm experimentation are widely underestimated and hardly exploited by formal research and development approaches. There are at community levels nearly always a number of individuals that are particularly knowledgeable about the properties of various locally available varieties (Richards, 1985). Moreover these people tend to be involved in local seed selection, multiplication and distribution and/or trade (Jusu, 1999). Though these local seed systems should not be over-idealized, this local knowledge and the resulting informal local trade / exchange in seeds are valuable elements of a traditional agriculture (Tripp, 2000). Only rather recently has WARDA been capitalizing on this local knowledge in multiplying and disseminating the new NERICA rice varieties in Guinea through the “Community-based Seed Selection (CBSS) system (Beye, 2000).

As emphasized by Tripp (2001) each new technology is associated with various types of “quality information” according to the ease with which it can be transmitted. He thus distinguishes between “search quality” which includes readily visible features; “experience quality” which becomes clear during field observation, and “credence quality” which involves non-readily verifiable characteristics like improved nutritional quality (increased protein or vitamin A contents). The types of quality information have serious implications for information management, but also have ramifications for farmer education, and the abilities of public and private sectors to deliver essential information and to build up a reputation for reliability and credibility. This raises the issue of farmer confidence in public sector research and extension institutions, which for good reasons (unreliability and incompetence) is very low in most countries of SSA. In this respect actor coalitions / platforms might be in a better position to accelerate “agricultural development” and to cope with the diversity of issues that will all affect the impact from research results.
6. Summary and Concluding remarks

This study concludes that the causes for low adoption rates of research results find their origin at different intervention levels and are of different (interdependent) types. Most far-reaching are the constraints identified at the highest international and national (policy) levels, because these have ramifications up to the local grass roots. Creating the right (enabling) policy environment will most likely resolve many of the lower level constraints.

In general African countries were poorly prepared for independence. As a consequence many countries have had to rely excessively on foreign expertise, leading to an "expert / consultant culture". In many cases this has led to very costly, often over-ambitious projects (not in line with the national/local resources, needs and cultures). This indeed should be considered as one of the major causes for the current foreign debt crisis of many African countries.

The "expert" culture tends to rely on "success stories" from elsewhere often copied uncritically. In that way approaches, like the T + V system and currently the FFS model, are being promoted as blueprint solutions. Frequently these approaches can be proved inappropriate and/or requiring substantial revision when viewed and analyzed more comprehensively against the local conditions (agro-ecological as well as socio-economic and cultural) and the national policy environment. Unfortunately the expert culture has instilled a form of over-dependency on foreign advice and foreign tools in many African countries.

Generally, the “experts” have been pre-occupied with technology development and economics; the influence of human / social sciences has been weak or even absent. As the development emphasis has been shifting increasingly to issues like poverty alleviation and technology transfer, the weakness in social sciences becomes a serious handicap (at international and national levels). Moreover, the “expert culture” has also been responsible –for efficiency reasons- for the introduction of management principles that were largely copied from the western industrial sector. Many of these principles are particularly suitable for mechanical, routine processes, but not for a research process. The latter needs to be creative and imaginative, requiring flexibility to cope effectively with diverse and complex problems typical for African agriculture. In this context also many forms of transnational regional research are vastly over-rated; it certainly tends to be far removed from the principal client: the poor producer.

“Agricultural development” involves widely different aspects ranging from research and extension to general education. Education applies to all actors involved in the
development continuum, though in different forms and ranging from primary schooling to university levels. From the analysis about the constraints to technology transfer, it follows that some of the problems find their origin in the University curricula through which national research and extension personnel are trained. Closer collaboration and integration between NARES and the agricultural faculties of the national Universities therefore is highly desirable.

Training and education have always had major attention from donors and the international centers. It has been, however, of a rather “static, top-down, mechanical” nature of passing on information and skills often through short courses of one or two weeks using rather standardized training packages. By contrast an emphasis on “learning” provides a more open and dynamic environment, that permits to learn from errors committed in the past. To cope effectively with the African development problems will require a greater reliance on non-conventional processes and approaches like farmer participation, informal communication and learning-by-doing types of interventions (Roling and Wagemakers, 1998). This will involve quite fundamental adjustments in the way institutions are organized and managed, and in the approaches and methodologies used. This applies also for the education facilities, ranging from primary to university levels.

According to this study the primary causes of low adoption rates of research results— in particular for the marginal environments of West and Central Africa— can be summarized as follows:

At the international level:
- Conceptual gaps between “scientific theory” and “management theory” versus the “practical, grass root realities of African farming” (in theory: “bottom-up and demand-led” approaches; in reality: “top-down and supply-led” approaches). This gap finds its origin in the “expert/superiority culture” associated with international technical assistance organizations, leading to the constraint of “over-ambitious / over-stretched projects” (see below).

At the national level:
- Absence of adequate national policies in support of the agricultural sector. Leading to:
  - Lack of incentives for the private trade and transport sectors, resulting in non-availability of agricultural supplies and services, and inadequate marketing facilities,
  - Ineffective national services for research and extension largely because of poor continuity in their interventions resulting from their “project” (temporary) status.

The above primary causes lead to a wide range of secondary causes:
- Over-ambitious and therefore non-sustainable (project-based) institutional developments, operating on basis of blueprint approaches; the resulting services have poor continuity because of the limited, longer term, availability of national human and financial resources,
- Inappropriate research and development approaches:
- Research strategies (international and national), leading to technology-biased results of limited relevance to a majority of (resource-poor) farmers; research
strategies biased towards yield increases, instead of yield stability and production factor efficiency (time, space, water, plant nutrients, labour, etc) under marginal environments;
- Technology transfer approaches pre-occupied by technological impact, bypassing the “human” factor concerning local organization, (informal) communication, actor-coalitions and learning/educational aspects,
- Inefficient / irrelevant technologies with respect to local input, labour and knowledge constraints as result of an inappropriate research strategy (see above),
- Absence or weakness (lack of empowerment) of local producer organizations, leading to absence of a grass-root policy influence, and ineffective producer feedback to research and extension agencies,
- Poor integration between national development and national education (from primary school to university).

In response to these constraints a number of general recommendations are made:

a in view of the unsatisfactory record of donor projects and their often limited impacts, the African institutions and African experts should accept increased responsibility for planning and project formulation,

b national governments have to face up to the crucial importance of the agricultural sector to their populations by making annual budget allocations to their national agricultural services institutions, that would permit a minimal level of continuity in their operations,

c instead of following some kind of costly blueprint model or procedure, proposed projects should aim at a maximum degree of flexibility in terms of implementation,

d a “process approach” of progressively building institutions and by gradually increasing geographic coverage is required; first on basis of available national resources (human and financial) and secondly through complementary support by external donors and technical assistance,

e research strategies should aim for improved knowledge and understanding about mechanisms and processes (biological, ecological, technical, socio-cultural and economics), that operate in agricultural production and development processes. Such knowledge would permit a more efficient use of resources/inputs, instead of trying to solve “symptoms” through “magic bullets”,

f strengthening and empowerment of producer organizations,

g reinforcement of University curricula with items from the social sciences involving interviewing / communication skills and participatory techniques for technical students with the objective to introduce a holistic multi-dimensional perspective to agricultural development at an early stage in the education.

With reference to a) and b) above and in view of the very limited financial resources available for research at national as well as international levels, a coordinated regional effort is highly desirable. Such effort should be based on:

- firstly, autonomous, modestly sized and decentralized, national research institutions that operate in close collaboration with the other national development actors to reach effectively a maximum of rural communities (see the Guinea model as described by Beavogui et al., 2000),

- secondly a modest regional coordinating institution (CORAF), that is financially at least partly supported by contributions from each of the 21 member countries. The
national contributions to CORAF would raise its legitimacy and credibility as regional research coordinator between NARES, between NARES and IARCs and in its negotiations with the donor community. Even to fulfill a regional mandate—limited to coordination—, CORAF would require a doubling of its professional staff from the actual 3 to at least 6.

- thirdly the IARCs would work increasingly on more fundamental issues that are beyond the capabilities and means of national programs. In addition they would work (on a special project basis) on problems/constraints of a common regional significance that are defined in collaboration with the NARS/CORAF, and eventually funded through CORAF.

The poorer and more marginal the agro-ecological environment, the more diverse and variable the constraints, so that the possibility of identifying “sweeping” solutions should be considered very unlikely. Solutions will be varied and highly location-specific, and will require the mobilization of the population at grass root levels. Local institutions and flexible approaches should guide such process. This implies that international agencies (including the CGIAR, and except for the policy and conceptual domains) are not adequately positioned to resolve it. Their contribution should be in providing flexible guidelines and general methodologies. There is a parallel here at the human level of “poverty”, which also is a very diverse problem for which local people are going to exploit a wide range of alternative solutions, not one blueprint.

Research institutes—certainly the IARCs—should increasingly take the lead in focussing their research on biological, ecological, technological and socio-economic mechanisms and processes that operate in agricultural production systems (crops, livestock, fish, forestry, —). The aim is to improve the “efficiency” of these production systems, permitting a greatly reduced external input use and reduced environmental pollution and health hazards, as well as raising the “quality” of the agricultural outputs. Ultimately research needs to prepare for more “knowledge-intensive” agricultural production systems that will be based on a more informed use of external inputs in combination with local production factors.

The mechanisms and processes involved will be similar under a wide range of conditions; however their relative importance and intensity will be determined by local factors, requiring the development of location-specific adaptations for which decentralized national institutions are ideally positioned.

In this perspective and from an institutional viewpoint IARCs should therefore seek to capitalize on their considerable scientific human capital and physical facilities to conduct innovative research (which is not necessarily of the “modern” or “cutting edge” type) that goes beyond what national institutes can handle. To better link national interests and to have indeed a bottom-up regional input, the strengthening of CORAF as a representative and effective interlocutor for the member countries will be a very first requirement in realizing a coordinated regional research approach. In this process all the institutions involved need to recognize their respective strengths but also their limitations and weaknesses thus permitting a most efficient exploitation of their mutual complementarities.
Literature


Boyd, C. and Slaymaker, T., 2000. Re-examining the “more people less erosion” hypothesis; special case or wider trend? ODI Natural Resource perspectives No 63.


Tripp, R., 2001: Seed provision and agricultural development; The institutions of rural change. Overseas Development Institute, London.

Tripp, R., 2001a: Can biotechnology reach the poor? The adequacy of information and seed delivery. Food Policy 26: 249-264


APPENDIX A: Terms of reference

“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”.

Terms of Reference for Willem Stoop

CGIAR Vision and Strategy

In 2000, the CGIAR adopted a new Vision and Strategy. It defined its vision as “A food secure world for all.” Its overall goal was defined as “to reduce poverty, hunger malnutrition by sustainably increasing the productivity of resources in agriculture, forestry and fisheries.” Its mission was defined as: “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.”

The scientific, institutional and policy outputs associated with this vision-goal-mission framework are, by themselves, insufficient to achieve the CGIAR’s vision and goal. It is their dissemination and uptake by farmers, national research systems, civil society, private sector, policy makers and governments in developing countries that will be required to achieve the vision of a food-secure world. This will require the CGIAR to work more closely with other components of the development spectrum in determining its research priorities and in ensuring the dissemination of its research outputs. These outputs will be essential tools for promoting sustainable agricultural development, and hence in reducing food insecurity and poverty in a broad range of environments.

To implement the new Vision, CGIAR endorsed the idea of developing a two-pronged approach for the future in support of research and research-related activities to contribute both to the reduction of poverty and to improving food security. This would entail support for research 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 poverty in the marginal and hard areas. This strategy entails clearer targeting of the needs of people and how they will benefit from the research supported by the CGIAR. The focus of the CGIAR are the rural and urban poor, including farmers, fishers and on-farm workers and poor urban consumers.
Seven strategic planks have been identified that underlie the strategy outlined above to focus on poverty reduction and prevention, using the best and most relevant science in the most effective and efficient ways possible. These planks are:

1. **People and Poverty Focus**: Focus the CGIAR research agenda on people and the reduction of poverty, hunger and malnutrition in developing countries;
2. **Modern Science**: Mobilise new developments in social, biological and physical sciences to address the priority researchable issues;
3. **Geographic Priorities**: Give highest priority to developing a concerted approach to address the research needs of Sub-Saharan Africa and South Asia;
4. **Regional Approach to Priority Setting and Research Implementation**: Adopt a regional approach to research planning and implementation and integrate this with global priority setting;
5. **New Partners in Science and Development**: Seek new partners for problem identification, research, and dissemination of research outputs;
6. **Task Forces**: Use task forces to address priority problems in new and flexible ways;
7. **Catalytic Role**: Strengthen the role of the CGIAR as a catalyst and integrator of knowledge in support of NARS and the global agricultural research system.

The rationale and implications of the seven planks are discussed in the attached document entitled “Vision and Strategy for the CGIAR”. Planks 1-4 have programmatic and investment implications for the CGIAR and its research agenda. Planks 5-7 relate to the more efficient implementation of the CGIAR’s research agenda. Achieving impacts on poverty with the greatest efficiency and effectiveness possible in a given national and regional context is likely to require introduction by the CGIAR of a number of new institutional mechanisms and reorientation of others that have been used in the past.

In order to address more effectively the regional heterogeneity of the causes of poverty in the regions, the CGIAR, in close collaboration with its partners, will adopt a stronger regional orientation in its research planning and implementation. Also, the CGIAR will diversify and expand its partnerships to ensure that its limited resources are effectively leveraged in addressing the problems of the poor.

**Your Consultancy**

The study will look into the following issues:
- the appropriateness of currently available improved technologies given the agro-ecological and socio-economic conditions in the region,
- the efficiency of the present technology transfer mechanisms in widely reaching the producers,
- the bottlenecks (technical, institutional, organizational and cultural) that restrain the generation, dissemination and adoption of improved technologies, and
- implications of the above issues for the new CGIAR regionalisation strategy, leading into recommendations towards an increased impact of its future research efforts.
Implementation and work plan

The study has two components that will be implemented more or less simultaneously, and yet from slightly different angles to permit greater complementarity:
a Dr. W.A. Stoop operating from the perspective of national research and development institutions in support of local client groups.
b Dr. L. Brader, operating from the perspective of a consolidated CGIAR Center research program in support of a regional research agenda, and

Through these two components the scope of the study will be broadened, while its cost and time requirements will be reduced.

For the component sub a, for which you are responsible, the following phases and itinerary are proposed:
- Preparatory phase (till early January 2002): discussions with resource persons in The Netherlands from DGIS, ISNAR and Wageningen; review of documents; preparation of interview guide for different groups of stakeholders; Field study (January till early February 2002):
  a 3 weeks in Mali with discussions/interviews in Bamako (IER, PNVA, ICRISAT), Sikasso (impact of 20 years FSR and of Inland Valley Consortium collaboration), Cinzana (impact of 20 years support by the Syngenta — formerly Novartis — Foundation) and Niono (impact of WARDA Task Forces collaboration),
  b 7 to 10 days in Guinea to follow-up on the progress made in the interventions by IRAG and SNPRV through the “villages d'étude” approaches, initiated in 1999, and
  c 3 days in Senegal meetings with ISRA and CORAF.
- Report writing (February 2002): partly during the field study and finalization in The Netherlands; consultation with FAO/TAC/GFAR in Rome (3 days in February); submission of a draft report to TAC Secretariat by the 20 February 2002 for comments.
- Presentation of findings and conclusions (first half of March 2002) at a CORAF/WECARD Workshop of 2 to 3 days in Dakar.

The field studies in Mali and Guinea will be conducted together with a counterpart from the respective national program.

You should submit your final report in an electronic form to TAC Secretariat (Dr. Shellemiah Keya, Executive Secretary, shellemiah.keya@fao.org) by 22 March 2002.
APPENDIX B: Itinerary of the mission and people met

<table>
<thead>
<tr>
<th>Date</th>
<th>Location</th>
<th>Meeting Details</th>
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<tbody>
<tr>
<td>October 25</td>
<td>ISNAR</td>
<td>Dr. Paul Perrault</td>
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<td>November 21</td>
<td>ISNAR</td>
<td>Dr. Willem Janssen</td>
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<td>“</td>
<td>Wageningen University</td>
<td>Prof. A Kuyvenhove</td>
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<td>“</td>
<td>DGIS, The Hague</td>
<td>Mr K.L. Tamminga</td>
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<tr>
<td>December 14</td>
<td>Wageningen, IAC</td>
<td>Mr F. Neuman; ICRA, Dr D. Enserink</td>
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<tr>
<td>“</td>
<td>Wageningen University</td>
<td>Prof. N. Roling; Dr. J.J. Hardon</td>
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<tr>
<td>January 7</td>
<td>KIT, Amsterdam</td>
<td>R.M.G. van Poelje, H.J.M. Verkuijl; A. Blokland (techn. assist to IER)</td>
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<tr>
<td>September 9</td>
<td>Departure Amsterdam</td>
<td>Arrival Bamako; Meetings: Dr. Niangado; P. Kleene (conseiller URDOC)</td>
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<td>January 10</td>
<td>Meetings Bamako:</td>
<td>- Sasakawa Global 2000: Dr. M. Galiba (Directeur), M. Camara (coordinateur regional sorgho-mil)</td>
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<td>“</td>
<td>- ONGs nationales:</td>
<td>Mme A. Kanoute; Djibril Kone (ADAF/GALE); Moussa Sogoba; Yacouba Tangara (GRAT); Mamadou Mariko (AMCFE); Seydou Tougola (STOP-SAHEL)</td>
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<td>- Ambassade des Pays Bas: Mme Monique Calon</td>
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<td>- CNRA/CORAF: Dr Adama Traore</td>
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<td>December 11</td>
<td>IER Direction: Dr. B. Teme (DG) and A. Cisse (DGA)</td>
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<td>“</td>
<td>- ICRISAT-Bamoko: Drs. B. Shapiro, O. Youm, E. Weltzien-Rattunde, J. Ndjeunga, R. Tabo, et I. Akintayo</td>
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<td>“</td>
<td>- Direction nationale de vulgarisation (DNAMR): A. Sidibe (Directeur) and A. Sangare (Cellule Liaison Recherche – Developpement)</td>
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<tr>
<td>January 12</td>
<td>- ICRAF/ICRISAT: Dr. A. Niang</td>
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<tr>
<td>January 13</td>
<td>Travel Bamako to Sikasso</td>
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<tr>
<td>January 14</td>
<td>- CRRA de Sikasso: Dr. A. Hamadoun (Directeur)</td>
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<td>“</td>
<td>- Dr. Zana Sanogo (Chef ESPGRN et Animateur de College scientifique)</td>
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<td>“</td>
<td>- Meeting Programme Recherche forestiere: H. Yossi (Chef) and scientists</td>
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<td>January 15</td>
<td>- CRRA de Sikasso:</td>
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<td>- Meeting ESPGRN scientists: MM M'Pie Bengaly and Hamadi Djouara</td>
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<td>- Meeting CRU Region de Sikasso: Mmes Korotoumou Kone, Aissata Coulibaly, Dienebou Sidibe, Alidiata Traore and M. Mohamadou Bengaly</td>
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<td></td>
<td>- Meeting GDRN: Celestin Dembele (coord.), Amady Coulibaly and Almami Traore</td>
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70
16 - Field visit to Noyaradougo (test village of ESPGRN); discussions with farmers.
- Meeting with Program “Riz de basfond”: M. Fousseyni Cisse
17 - Meeting Direction Regional CMDT: M. Oumarou Aya (Directeur regional), Mamadou Diarra (Chef Ediv. Developpement rural)
- Meeting: Chambre d’Agriculture: Sountoura Bakary (Secretaire General) and Salif Diarra (conseiller technique)
- DRAMR: Seydou Keita (Directeur regional), Abdoulaye Sanogo(Promotion des filieres agricoles), Amadou Coulibaly (Statistique Suivi-Evaluation), Natouye Bougoudogo (Documentation –Information), Nanko Mariko (Conseil rural, vulgarisation agricole), Jean Pierre Diabate (Appui du monde rural), Manassaro Togo (Formation).
- CRRA Sikasso Programme Coton: Tereta Idrissa (Entomologiste)
Travel Sikasso to Koutiala
19 Meeting: M. Ferko Bodnar (DDRS, impact evaluation soil conservation)
20 Travel Koutiala to Cinzana
21 - Meeting Equipe SRA Cinzana Station: Samba Traore (Chef et Agronome), Seriba Katile (Phytopath), Sory Diallo (selection niebe), Aly Boubacar (selection sorgho), Moussa Sanogo (selection mil), Mamadou N’Diaye (entom.) and Diakalia Sogodogo (ESPGRN).
22 - DRAMR Region Segou: Idrissa Diawara (Directeur), Makono Tangara (Chef Div. Conseil Rural) and Abdoulaye Traore (Chef Section Liaison Rech./ Dev.)
- Meeting CRU Region Segou: Brema Traore (President),
23 - Meeting ONG Voisins Mondiaux: Bianivo Mounkoro (Directeur) and Siaka Traore
- Meeting ICRAF/IER: Dommo Timbely and Mme Anne Marie Lemay (Univ. Laval).
- Travel Segou to Niono
24 - CRRA Niono: Dore Guindo (Directeur)
- Equipe SPGRN: Daouda Kone (Chef and animateur college scientifique) and scientists
- Equipe Riz irrigue: Mamadou Coulibaly (chef) and scientists; Bangoly Cisse (Delegue Fruits et legumes);
25 Meetings in Niono: URDOC: Yacouba Coulibaly (Chef), Yacouba Sangare, Kongotigui Bengaly, Mamadi Keita (URDOC2 staff); Youssouf Dembele (Repr. POP Zone Niono); Oumar Coulibaly (Chef SLACAER Niono)
Meeting: Amadou Mariko (Chambre d’Agriculture, Niono), Yacouba Diallo and Youssouf Berthe (Producers)
26/27 Report writing; field visit to vegetable production fields around Niono.
38 Travel Niono to Bamako
29 Visit to CRRA de Sotuba: Meetings: Lassine Diarra (Directeur Centre).
- Meeting Equipe LaboSol et Agro-ecologique: Mamadou Doumbia (Chef), Aminata Sidibe, Souleymane Dambe, Siriba Dione, Abdouramane Yorote, Cheick Diakite, Mamoutou Kouressy, Adama Bagayoko, Didier Bazile (CIRAD);
- Meeting: N. Coulibaly (Chef Progr. Mais); A. Toure (Chef Progr. Sorgho)
- Meeting: Equipe SPGRN: Abou Berthe (Chef), Samba Soumare, Mme Cisse Oumon Traore (Labo Techn. Alimen.), Salif Traore, Mme Sow Penda Sissoko, Mme Sissoko Haona Traore, Diby Diakite, Boubacar Traore.
30 - Synthese de mission CORAF / IER: Adama Traore (CNRA/CORAF; President);
Oumar Niangado (Syngenta Found.); Bino Teme (DG IER), Amadou Cisse (DGA IER), Aly Kouriba (DS IER), Bakary Coulibaly, Mme Diarrasso Niamaye, Hugo Verkuilj, Dore Guindo, Siaka Dembele (all IER); Kabirou N'Diaye (PSI/CORAF); Hamadoun Drame (DNAMR), Amidou Sangare (DNAMR); Barry Shapiro, Eva Weltzien – Rattunde, Ousmane Youm, Ramadjita Tabo (all ICRISAT)
- Departure for Dakar

31 - Dakar: Meeting CORAF / WECARD: Ndiaga Mbaye (Executive Secretary); Marcel Nwalosie (Scientific Coordinator)

Febr.
1 - Meeting FRAO: Mme Ndeye Coumba Fall (Program Director), Abdou Fall.
- Meeting ISRA: Mme Aminata Niane Badiane (Directeur Scientifique a.i.), Moustapha Ane (Agro-economist).
2 - Report writing
3 - Travel Dakar to Conakry
4 - Meeting IRAG: Sekou Beavogui and Philippe Morant (Direction scientifique),
- Meeting SG 2000: Tareke Berhe (Res. Rep.),
- Meeting SNPRV: Mody Sidi Diallo, Mamady Kante, Seydou Barry and Andre Lama; and Summary of meeting: Baba Gale Camara (Directeur)
- Meeting Direction National d'Elevage: Seny Mane (Directeur Adjoint)
5 - Meeting IRAG Direction: Sekou Beavogui (DG-A), Philippe Morant (Conseiller), Boye Diallo, Abdoulaye Diallo, Sekou Diaisan, Mamadi Kourouma, Cheick Conde, Thierno Bah, Boubacar Diallo, Senkoun Wague and Abdoulaye Bangoura:
- Travel Conakry to Labe (Fouta Djallon) with Dr. Tareke Berhe (SG 2000)
6 - Meeting: Pierre Antoine (Winrock International);
- Field visit to “study village” Senghen and discussions with village / farm leaders and with field personnel of SNPRV/SG 2000, thematic and systems researchers and technicians of CRA Bareng involved in Seghen village.
7 - Travel from Labe to Timbi Madina; visit to CRA Bareng: Mamadou Aliou Diallo (Director), Ibrahima Tanou Diallo (Coord. Scientifique); Alpha Oumar Balde (Coord. Reg. SNPRV/SG 2000)
- Meeting with IRAG scientists
- Meeting with Federation des Producteurs de Fouta Djallon
- Travel Timbi Madina to Kindia
8 - Visit to CRAF Foulaya: Mahmoud Camara (Directeur), Ousmane Kolea Soumah (Coord. Scientifique), Bakary Camara (coord. Reg. SNPRV/SG 2000).
- Meeting with IRAG scientists from Foulaya and CRA Kilissi, including representatives of SNPRV, and APEK and CLUZA (ONG)
- Field visit SG 2000 to “producteur-semencier”
9 - Field visit to Tougikoure (Village d'étude) with IRAG staff and SG 2000; discussions with farmer groups.
10-13 - Report writing
14 - Travel Kindia to Conakry
- Synthèse de mission at Direction IRAG and representatives from SNPRV, DNE, and SG 2000.
16 - Departure Conakry
17 - Arrival Amsterdam
## APPENDIX C: Matrix for stakeholders

<table>
<thead>
<tr>
<th>Issues</th>
<th>International</th>
<th>National</th>
<th>Local</th>
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</thead>
<tbody>
<tr>
<td>Donors, CGIAR, Intern. Research</td>
<td>CORAF (regional coord.)</td>
<td>Nation. policymaker</td>
<td>NARES (research)</td>
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<tr>
<td>Constraints</td>
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<td>-bio-physical</td>
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<td>-socio-econ.</td>
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<td>-policies</td>
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<td>-organisation</td>
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<td>-technology</td>
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<td>-social organ.</td>
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<td>-methods</td>
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<td>Impact</td>
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<td>-revenu</td>
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<td>-yield</td>
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<td>-efficiency</td>
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<td>-risks</td>
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<td>Improvement</td>
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<td>-technologies</td>
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<tr>
<td>-social organ.</td>
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## APPENDIX D: Matrix for agricultural commodities

<table>
<thead>
<tr>
<th>Issues</th>
<th>Trad. food crops (sorghum, millet, maize, rice)</th>
<th>Cash crops (cotton, coffee, rice?)</th>
<th>Non-trad. Crops (vegetables; potatoes, irrigated rice)</th>
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<tbody>
<tr>
<td>Agricultural changes over last 30 years</td>
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<tr>
<td>Changes in social organisation over last 30 years</td>
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<tr>
<td>Presence, types and roles of farmer organisations</td>
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<tr>
<td>Availability of agric. Services (credit, supplies, marketing; advice/info.)</td>
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<tr>
<td>New technologies</td>
<td>*varieties</td>
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<td></td>
<td>*cultural practices</td>
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<tr>
<td></td>
<td>*agric. chemicals (fert./ pesticides)</td>
<td></td>
<td></td>
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<tr>
<td>Origin of new technology</td>
<td>*neighbour, local market</td>
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<td></td>
<td>*extension service</td>
<td></td>
<td></td>
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<td></td>
<td>*NGO</td>
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<td></td>
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<tr>
<td></td>
<td>*others</td>
<td></td>
<td></td>
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<tr>
<td>Needs for improvements</td>
<td>*technologies</td>
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<td></td>
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<tr>
<td></td>
<td>*Agric. Services</td>
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<td></td>
<td>*farmer organisation</td>
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<td></td>
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<tr>
<td></td>
<td>*others</td>
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</table>
APPENDIX E: The MALI case

The study in Mali has focused on meeting the major actors (CNRA, IER, DNAMR, SG 2000 and ICRISAT/ICRAF in Bamako; subsequently their regionalized units and the Producer Organizations were visited during the field tour. The field tour covered the Sikasso, Segou and Bamako Regions. The Southern Mali – Sikasso region, served by the Sikasso Regional Research Center, represents the cotton-based systems. The Segou region covers two very different systems: the rainfed millet/sorghum-based systems as represented by the Cinzana Research Station, and the irrigated rice-based systems of the Office de Niger served by the Niono Regional Research Center. Finally, the Sotuba Regional Research Center that serves the Central (Bamako) region was visited for discussions with thematic and systems scientists.

1 Historical background

For the country as-a-whole it is informative to place the agricultural developments in an historic perspective. Some of the events that have had major impacts, since the colonial occupation by the French are:

1890 – 1960: colonial government
1960: independence: First Republic with centralized government structure following the socialist model; para-statals responsible for regional development (CMDT for Southern Mali; Office de Niger); creation of national agricultural research institute: Institut d’Economie Rural (IER).
1970 – 1974: Sahelian drought followed by large in flux of donor support, leading to 1972: “Operations de developpement” to achieve regional food self sufficiency,
1985: Start of large scale Worldbank “structural adjustment programs”
1990: Start of Worldbank-guided national extension project (PNVA), following Training and Visit (T+V) model,
1992: First democratic elections for Presidency, parliament and local government; start of “decentralization” policies and increased emphasis on democracy;
1994: 50% devaluation of the Franc CFA
1995: General liberalization of land use (important impact in Office de Niger); start of new Worldbank sponsored Agricultural research project (PNRA) and introduction of “Regional User Committees” (CRU),
1995 – 2001: Further withdrawal and reduction of public sector services (including CMDT and Office de Niger); increased responsibilization of private sector,
1998: End of Worldbank sponsored PNVA project
2001: End of PNRA
2002: Start new comprehensive Worldbank coordinated agricultural development project (PASAOP): increased privatization of research and extension services.

Generally, Malian society has always functioned under centralized and directive forms of government, starting with the colonial period and through to the independent First and Second Republics. With the reductions in the public sector and increased decentralization during the Third Republic came, however, other centralized, large-scale and “donor-imposed” policies towards agricultural development associated with large multilateral projects..

2 Mali field visits

2.1 Sikasso Region – Southern Mali

Agricultural Production Systems

The Southern Mali / Sikasso region is broadly characterized by cotton-based systems with maize, sorghum and millet as major traditional staple cereal crops of which the relative importance of each in the system varies with the agro-ecological sub-zones. Throughout the sylvo-pastoral system is closely integrated/associated with this cropping system. In addition there are localized pockets (mostly the bas-fonds) where rice has been grown traditionally as a women’s crop, and/or where farming has been intensified to cultivate non-traditional crops like potatoes and a range of vegetables mainly as peri-urban systems. In the Klela plain some 1200ha are farmed with improved rice by male commercial farmers, whereas fruits (in particular mango’s and citrus) constitute a major -yet under-exploited – commodity. The entire region is in transition from a largely subsistence, traditional to an increasingly intensified commercial farming system. This process has been described in detail earlier by Stoop, et al. (2000).

Institutional context and development

Within Mali the Southern region of Sikasso has for many years been the cotton belt and therefore is one of the major pillars of the national economy. Since independence in 1960, the comprehensive development of the region – including all aspects ranging from health, education facilities to agricultural services and infrastructure construction- has been dominated by one single institution: the CMDT. While initially this has accelerated the development process and cotton production in particular, it has also had some distinct drawbacks that over time are becoming increasingly clear: - the monopolisation in terms of institutional development has delayed a balanced evolution towards the wider array of support institutions and active private sector
that are all essential for a diversified, market-driven agricultural sector as compared with the former subsistence and subsequently cotton dominated systems.

- some important sectors of considerable economic potential, such as fruits (mango’s and citrus) and vegetables (in particular potatoes) in peri-urban agricultural systems have been neglected,

- the presence of a well-functioning CMDT has provided attractive opportunities for investment by foreign donors and with it the broad introduction of certain “external” development concepts. A major one has been the introduction in 1995 of the local and regional user committees (CRU’s) to provide the users/ producers with a communication and demand mechanism to signal constraints and services requirements from the various support institutions (research and extension services). Another one has been the “Projet Lutte Anti-erosive” (PLAE), supported by the Dutch and aimed at protection and conservation of the natural resource base for the cotton belt.

The ongoing, large scale restructuring of the CMTD (since 1999) and its reorientation and narrowing of mandate to cotton-based systems leaves presently a confused situation. The resulting institutional gaps need to be filled by a host of new players such as DRAMR as extension service for all non-cotton commodities, the “Chambre d’Agriculture”, the private commercial sector and the relatively young CRUs, as well as some NGOs and foreign projects like the Swiss-supported organization “Gestion et Developpement des Resources Naturelles” (GDRN). The latter plays an important facilitating role in the complex communication between CRU and Producer organizations on the one hand and the research – development / extension organizations on the other, to clarify, translate and eventually fund issues and demands raised through the CRUs.

Research Impact and constraints

The recent thesis by Kante (2001) starts of with a listing of currently available technologies (emphasizing water and soil fertility management) that are available for Southern Mali. Kante’s subsequent analysis points to very partial adoption of these various technologies and most interestingly how adoption differed between sub-zones (effects of agro-ecological conditions and of population pressures) and within sub-zones by the different classes of households (types A, B, C and D) in relation to their available resources (land, labour, capital and knowledge).

So the picture for the impact of research results is very different for the major commodities. Moreover, the types of bottlenecks (technical; socio-cultural, organizational or institutional) as linked to different groups of stakeholders are different for each commodity.

The various actors generally agree about the significant impacts of research on cotton, maize and commercial rice production. There is, however a total lack of impact on sorghum and millet farming in spite of years of research efforts. All the improved sorghum and millet varieties proposed so far have proved totally non-adapted in terms of maturity cycles, leading to severe grain disease problems and excessive bird damage (ESPGRN, 2001).
For vegetables—particularly potatoes—there appears much scope for large and quick impacts provided the producers become organized; to a lesser degree this applies also for the fruits producers.

Very complex is the situation for livestock and certainly for impacts on the sylvopastoral systems that involve complex socio-cultural issues in particular land tenure rights.

The CRU representatives pointed out that their major need is in the post-harvest domain, dealing with local transformation, improved conservation and storage of fruits and vegetables but also of the traditional cereal crops.

Constraints at the CRRA of Sikasso

The creation of the CRRA-Sikasso is a relatively recent event (1991); prior to that only the “production systems” team (ESPGRN and earlier DRSPR) was located here. Starting in 1991, thematic/commodity teams for cotton, bas-fond rice, forestry, and fruits and vegetables have complemented the SPGRN team, which however remained a dominant component, because of its liberal funding through support from the Dutch government.

For the SPGRN team the change in donor support (from a project with foreign technical assistance to an IER program with more limited “Dutch program funding”) along with the introduction of the “research project/contract” system have constituted major operational changes. It was satisfying to note that the team has remained in-tact and continues to operate through the program structure and along the approaches that were developed through the collaboration with KIT staff in the past. Two observations were made:

- the new “research project contract” mode seems to lead to an increased compartmentalization within the program with scientists being pre-occupied by “their” project at the expense of inter-project collaboration. The program leader will have to ensure that this trend is effectively counterbalanced.
- the team may not yet have come to terms sufficiently with the changed financial situation, in particular the high charges of 300 FCFA/km for transport. The program may be over-stretched as judged against the allocated funds. For on-farm, participatory research to remain credible, scientists have to spend considerable and regular periods of time in the field to communicate directly with the producers and other actors, and to monitor / supervise implementation by technicians. To ensure this condition the team may have to consider to reduce the number of antennes / locations and/or number of villages. Another option is that when the “clients/users” demand an involvement by the SPGRN program that they will have to share into the transportation costs.

At a more general CRRA level, it needs to be signaled that the various thematic/commodity teams are made up of technical/biological disciplines, with mostly an experiment station orientation. For a Center that has a development-oriented mandate and a “user-demand” strategy this is a fundamental handicap. It will certainly prove a drawback for implementing complex and long term research in the
sustainability, (agro)forestry and communal land conservation issues, that typically require a local awareness and social mobilization / organization for successful interventions and feed-back.

2.2 Segou Region (CRRA of Niono and SRA Cinzana)

Agricultural Production Systems

Being part of the Northern Sudanian and Southern Sahelian zones where rainfall is more marginal and more erratic than towards the South, the prevailing rainfed systems are millet-based with cowpea as important secondary crop, and sorghum in lower areas on the wetter and heavier soils. Throughout this zone livestock (cattle and small ruminants; both settled and nomadic) is an important component of the mostly “traditional” cereal-based systems.

A sharp contrast is provided by the economically important irrigated rice-based systems along the Niger river and on the vast plains of the “Office de Niger”, located North of Segou and around Niono. Under the influence of land use and trade liberalization, as well as diversification policies, rice production has greatly increased (from 1 to 1.5 ton/ha during the 80s and 5 to 6 tons/ha at present), and simultaneously the off-season vegetable production has boomed with eschalots in particular (30,000 tons in 1995 to 70,000 tons in 2001).

Institutional context and development

As the development scene in Southern Mali was dominated by the CMDT, it was by the “Office de Niger” for the vast irrigated planes north of Segou and around Niono. The development activities of this huge irrigation scheme started in the 1930s and 40s and were initially aimed at large scale cotton production. Around 1960 it was concluded that the potential of rainfed cotton production in Southern Mali was greater and so the efforts were moved initially to the Koutiala area and the N’Tarla station.

Subsequently the “Office de Niger” went through a dip, as the land was used for the extensive cultivation of rice. After the Sahelian drought and thanks to considerable donor support that followed it, the irrigation structures were rehabilitated, the land was leveled and intensified rice production was introduced initially through collective, state-run farms. The big production boom came when land use and production were liberalized. Presently, the once comprehensive responsibilities of the “Office de Niger” have been trimmed down to the engineering and maintenance aspects of the irrigation infrastructure and to water management. The input supply, marketing and extension services have been taken over by the DRAMR, the private sector and a host of projects. At the producers’ level a wide and varied range of mostly village-based “Farmer Associations”, “Cooperatives”, “Tons” (a common local savings fund), “Groupements d’Intérêts Economiques” (GIE), as well as different male and female producer groups have been formed, though with little coordination among them.
By contrast the rainfed farming areas show a slower evolution, partly because of the environmental risks of droughts and poor soil conditions. Considerable public sector extension efforts—first through the PNVA (the T + V system) and currently by the DRAMR through the PASAOP project—have been undertaken during the 80s and 90s. The PASAOP multi-lateral project combines elements of the T + V system of extension with an increased user-demand orientation through service contracts with the research and private sectors. It is complemented by large scale rural development projects (FIDA), as well as by more localized interventions from national and international NGOs (Voisins Mondiaux, World Vision, CARE, Safe the Children, Winrock International, SG 2000, etc).

Obviously, the major institutions involved in the development process (public and private sectors; bilateral projects and NGOs) all operate from somewhat different perspectives. While with proper coordination their respective activities could be very complementary, there are also substantial risks of duplication and contradictory approaches and recommendations.

**Research impact and development constraints**

Agricultural development and research impact patterns are vastly different for the rainfed as compared with the irrigated systems. Either system has seen its changes, research impacts and failures, although these are more spectacular for the rice-based systems. For rice, impact has been particularly striking:

- the introduction of high yielding, short straw varieties since the 80s,
- the change in cultivation practices from broadcast seeding (using up to 120 kg seed/ha) to transplanting practices (40 to 50 kg seed/ha),
- the liberal use of mineral fertilizers (ammonium phosphate and urea); recently complemented with potassium

These intensification practices have come, however, with greatly increased pest and disease outbreaks of catastrophic proportions for rice-yellow mottle virus (RYMV) in 1995/6 and increased pyriculariosis. This has required the rapid introduction of new resistant/tolerant varieties and adjusted management practices, that have handsomely paid off, given the extent of the RYMV damage.

Farmers’ response to other proposed technologies have been much less favourable, notably to:

- the introduction of varieties having “improved grain quality” for lack of quality related price incentives,
- the use of pre-germinated seeds in direct seeding techniques,
- the use of chemical herbicides,
- the integration of a legume fodder crops to provide supplementary livestock feeding,
- the use of azolla as supplementary source of nitrogen (50 kg N/ha), and
- the composting of rice straw.
As in the case of Sikasso there exists a large potential for research impact in the irrigated vegetable sector, that has yet to be realised. Potentially large benefits can be expected from the introduction of improved, adapted varieties (eschalots and tomatoes), that are resistant to the major diseases; and from improved post-harvest technologies (in terms of storage, conservation and transformation), once the newly assigned IER vegetable specialist becomes fully functional. The transfer of improved vegetable technologies may eventually be constrained by the absence of any producer organisation and the extreme fragmentation of individual producers up to the level of individual family members, each marketing his/her produce separately to earn a little cash.

For the extensive, rainfed millet-based system the development and technology impact pattern is distinctly different. An adoption study conducted by Berlin (1997) and a recent inventory of technologies originating from the Cinzana station by Slaats and Niangado (2000), emphasize the introduction of new millet and sorghum varieties and some cultural practices with respect to legumes. Here the considerable risks associated with agro-ecologically, marginal environments and the poverty of the average producer are serious obstacles to investments into intensification practices. These risky conditions also make producers more prudent and reluctant to change, apart from the generally stronger cultural and superstition related influences about contacts with foreigners and their admittance to ones fields.

Even so agricultural developments are in motion, albeit at a much slower rate than in the irrigated systems. Improved millets have been adopted at a fair level (an estimated 27% for Toroniou), although the exact pattern is difficult to trace, because the materials become fully integrated into the system under local names. Adoption of Apron Plus and currently to Apron Star is widespread; the investments in improved soil fertility practices (through FYM, compost with or without NP mineral fertilizer micro-dose) move slowly because of the obvious risks of obtaining even negative effects in drought years. Locally, the improved cowpea intercrop grown in alternating rows with millet is adopted as an animal fodder crop, that is stored and sold in the dry season to the peri-urban livestock sector. Other spontaneous changes such as increased storage of crop residus as fodder and wide adoption of animal-drawn charts can be noticed in the more densely populated areas near Segou and Niono.

Constraints at the CRRA Niono

As for Sikasso the SPGRN team is a major actor in the technology transfer chain. The team as a whole (Cinzana external experimentation unit, and the Niono interdisciplinary team) operates rather independently internally (little interaction between Cinzana and Niono based team members) and externally with the thematic research team.

While the team has to operate under similar resource constraints as Sikasso, its overall program has been fragmented further by the various demands of a range of development actors, mostly in the domain of diagnostics activities to be conducted in an excessive number of villages. As a result this activity is becoming a routine/mechanical exercise for the Niono SPGRN team, that in the end adds little in-
depth appreciation and knowledge about the various systems. The outcomes consist of common, very generalized constraints, while subsequently the team is little implicated in follow-up action research activities aimed at resolving the identified constraints.

On the other hand, the efforts by individual team members to document their ideas on various issues related to the technology transfer process and to the factors and issues that impede rapid adoption of new technologies demonstrate a clear progression in research attitudes.

2.3 Bamako and Koulikoro Regions: CRRA of Sotuba

Agricultural development and research impacts

Agriculture in this vast region is dominated by agro-sylvopastoral systems with sorghum as the dominant crop; maize and cotton are the other important crops. Major concerns exist about diminishing soil fertility and the resulting degradation of the natural vegetation cover. This process is compounded by the increased exploitation of the communal forest resources for firewood and charcoal production.

The agricultural development activities in this zone have been guided by the “Operation Hautes Vallées de Niger” (OHVN), which, however, has always had less resources available (human and financial) than its counterparts CMDT and Office de Niger. As a result development activities have reached the rural communities rather unevenly so that large differences exist between villages with respect to the use of improved agricultural techniques. Besides this, the agro-ecological diversity in this vast zone is considerable, which complicates the definition of “adequate” recommendations and technological packages, thus hampering the technology transfer process. Moreover, OHVN charges 5000 FCFA/ha to farmers requiring assistance for the implementation of soil conservation and anti-erosion measures, which for the poorest C and D categories of farms is a serious obstacle. The overall impact of agricultural research results therefore is judged limited and varied at best. Constraints at the CRRA of Sotuba

In the discussions with different groups of scientists (thematic: Maize and Sorghum Programs; the LaboSEP/GIS and Agro-climatic units; and the SPGRN team and Food Technology Lab.) some interesting constraints to the technology transfer process were exposed. Notably the various commodity units all operate separately when implementing their research respective activities. This is particularly evident for the on-farm components, with most of the teams conducting independent efforts in different locations. Not only does this deepen the divide between disciplines and between thematic and systems' units, it also tends to raise implementation costs considerably. Likewise there exist large differences in the “participatory” perspectives and the personal motivations for on-farm activities between scientists that may often explain the varying degrees of cooperativeness encountered in different study villages.

As remarked also in the case of the Sikasso CRRA, the study villages of the SPGRN team are located at an average distance of some 120 km from Sotuba. With the new
rules for transportation charges this constitutes a considerable share of a limited research project budget. Since the transport charges will not be reduced, the CRRA management will have to explore how the constraints of inter-unit cooperation and the efficiency of on-farm research efforts can be reconciled and improved.

3 Over-all analyses of the Mali case

Most important to agricultural development in Mali, probably have been the democratization and decentralization processes that started in 1992 with the Third Republic. This has created a favourable national policy environment that has attracted donors, NGOs and private investors. To what extent the multilateral donor assistance (World Bank) has indeed been successful in supporting the development of the Malian agricultural sector is uncertain, however.

The Mali case is complicated by considerable differences between the countries' regions with respect to the development actors and the present transition period between two major multi-lateral donor projects (coordinated by the World Bank). In the South the CMDT has dominated the development scene, as did the Office de Niger in the area North of Segou. In the other agro-ecologically more marginal regions, the actors have been more divers including combinations of public sector extension, NGOs and various development projects.

The impacts of research have been considerable for cotton-based systems and for irrigated rice, while for most of the “traditional” production systems it has been marginal. One domain where the liberalization process has had a most pronounced impact has been in the non-traditional vegetable production sector, mainly concentrated in peri-urban areas. This sector is highly profitable and probably could become even more lucrative if the producers were organized, instead of each operating individually. The Guinee case clearly demonstrates the impact producer organizations can have on the efficiency of linkages for demand-led research as well as on efficient private sector involvement in securing input supplies and marketing.

While many changes did take place in the rural areas, these generally cannot be linked directly to the large multilateral projects in support of the agricultural sector that were implemented over the last 10 to 15 years. For instance the PNVA was structured around the T+V approach to extension, which was discontinued after the project ended in 1999; the PNRA led to the creation of CRUs in an effort to increase user influence and a demand-led approach to research. In both cases disproportionate amounts of funding went into the built up and functioning of multi-layered (national, regional, district, community) administrative structures, while the anchorage at the local community level remained weak. Up till today a large majority of farmers remains unaware of the existence and functions of the CRU and/or considers its composition non-representative.

In spite of considerable efforts to introduce demand-led and participatory approaches to all IER staff at one stage, one can question its present effectiveness with researchers being unable (because of transport limitations) to spend a considerable part of their time on-farm. On the other hand there were reports of farmers getting
seriously annoyed by the frequency of research and extension meetings, tests and surveys. This may be a reflection of uncoordinated and fragmented interventions by too many actors. It may also indicate an approach that is excessively “technology-focused” without adequate attention for human and social aspects.
APPENDIX F: The GUINEA case

Already during the colonial period Guinee was recognized for its very diverse and rich natural resource base. These cover tropical rainforests in the south-east, savanna zones in the north-east, as well as medium elevation (up to 1500 m) mountain areas of the Fouta Djallon and the humid coastal zone in the west, which includes extensive areas with mangrove tidal swamps.

1 Historical background

The historical events that have most profoundly affected agricultural development in the country can be summarized as follows:

Before 1958: Colonial period under French rule; in 1920s creation of first agricultural research stations in Seredou (forest zone: coffee), Bordo (savanna zone: cotton and rice), Foulaya (coastal zone: tropical fruits) and Koba (mangrove rice).

Sept. 1958: Referendum: population votes against the “union” with France.

Oct. 1958: Independence, installation of Sekou Toure socialist government and creation of a one-party national political system; all relations with France broken off and total withdrawal of all French assistance and technical aid.

1958 – 1984: First Republic

Apr. 1984: Death of Sekou Toure

1984 – 1986: Transitional governments: introduction of multi-party political system with an independent legislature (Parliament) and judiciary (High Court) bodies; opening to the West and introduction of a market economy; privatisation.

1986: “Direction National de la Recherche Agronomique” (DNRA) moved from Ministry of Agriculture to the Ministry of Higher Education and Scientific Research

1987: CRA Bareng established as research center for the Fouta Djallon; start of the move to local farmer organizations

1989: DNRA is transformed into “Institut de Recherche Agronomique de Guinee” (IRAG), which is placed under the Ministry of Agriculture.

1990 – 1994: Projet Service Agricole (PSA-1) including IRAG, funded through the World Bank

1992: Creation of the “Federation des Producteurs de Fouta Djallon” (FPFD)

1996 - 2000: “Projet National de Services Agricoles” (PNSA), including IRAG and the “Service National de Promotion Rurale et de Vulgarisation” (SNPRV) funded by World Bank.
1996 – 2002: Border tensions with Liberia and Sierra Leone; large in-fluxes of refugees.
2002: Negotiations with World Bank towards “Projet National des Services Ruraux” (PNSR)

As for Mali, Guinee has also operated mostly under directive forms of government through the colonial period and the First Republic. Important changes in the system of government were introduced in the years following the death of Sekou Toure. As a result the country has opened up to the West and multilateral donor support started to arrive leading to great improvements in the road infrastructure and increased private sector activities. Most important during the last decade has been the creation of numerous local farmer organizations and their combination at regional levels into “unions” and “federations”. Most prominent today is the “Federation de Producteurs de Fouta Djallon” (FPFD), that covers 380 formalized farmer groups with a total of 13,000 individual members of which 70% are women. The “Federation” has sub-sections for potato, tomato and onion producers.

Agricultural research and development have come a long way since the first evaluation in 1988 by ISNAR (Stoop and Bosso, 1989). Most important has been the successful introduction of a regionalised research structure according to the major agro-ecological regions of the country consisting of 4 Centers and 2 Specialized Stations, each having a fairly autonomous management. Some of the major developments in both the research and extension structures and activities are described in an evaluation report prepared for the World Bank (Stoop, et al., 1998). As a result of this evaluation some major changes have been introduced, notably the introduction of “study-villages” by IRAG to create a concrete interface between research, producers, extension and NGOs. A description of this approach to an integrated, multi-stakeholder, on-farm research program is given by Beavogui, et al., 2000.

2 Reports on the field visits

2.1 Moyenne Guinee (Fouta Djallon) Region – CRA of Bareng

Agricultural Production Systems

The Fouta Djallon region is composed of mountainous areas and gently sloping highland plains; elevations range between 800 and 1500 m above sea level. The region is known for its unique agriculture – livestock (cattle and small ruminants) system, based on the “tappades”. These are fertile household compounds surrounded by life fences of shrubs and multiple use trees, where all major food crops are grown, such as maize, cassava, cowpeas and a range of fruit trees (mostly citrus mangoes and avocados). Outside the tappade are extensive communal grazing and forest areas and large fields cropped to fonio; all these areas have very unfertile and acid soils. In the lower bas-fond areas and along the streams vegetable production of mainly potatoes, tomatoes and onions has long been practiced because of the favorable soil and temperate climatic conditions.
Mainly due to the vegetable production a virtual agricultural revolution has taken place over the last 15 years. Large areas on the plains—formerly used for fonio—are now being regenerated by using liberal quantities of farmyard manure and compost complemented by mineral fertilizer to grow potatoes, subsequently followed by maize or rainfed rice that profit from the residual fertility. Again these areas are protected from the livestock by digging ditches and bunds on which life fences of multiple use trees are established, in the shade of which Café arabica is presently being introduced as an additional cash crop.

Institutional context and development

The above mentioned agricultural development has been greatly accelerated by strong farmer organizations. These range from local village producer groups with an average of about 40 members to the overarching “Federation” (FPFD) that organizes the timely arrival of imported planting materials and seeds, as well as the fertilizers and pesticides for their members. Also they negotiate with the traders an annually fixed price for the produce, that is sold through two collection/storage locations in the region. Due to its considerable political weight, the Federation has been able to obtain import and export tax exonerations from the Government. However, this does not mean that all the usual barriers to transport as well as the clearing at the port of Conakry and/or at the inland borders have been resolved also.

In addition the “Federation” has concluded research contracts with the CRA of Bareng (IRAG), covering the operating costs of some scientists, to conduct specific studies on potato and onion varietal screening for better storage characteristics and for certain cultural practices. For that purpose experiments are conducted both on-station and on-farm with farmer groups. Unfortunately, and as for the other IRAG centers most work has currently come to a halt with the end of the PNSA as of January 2001. Only a limited number of activities continue through contract research with the Federation, and through limited funds from various international crop networks.

Besides the “Federation” that supports the non-traditional crops sector, the SNPRV/SG2000 is responsible for the traditional staple crops and livestock. Since the end of the PNSA in 2000 the extension service has been in a crisis, and the roles of international NGOs like SG 2000 and Winrock have become increasingly important in keeping extension work going. For maize and (rainfed) rice this has involved the multiplication of seeds of improved high protein maize (QPM) and the NERICA rice varieties partly by local seed producers on a contract basis, as well as organizing the availability and sale of essential agricultural chemicals (mineral fertilizers, pesticides and herbicides).

Research impact and constraints

The research group at the CRA of Bareng has made important contributions in the identification of adapted varieties for potatoes, onions, peppers and maize and the associated cultural practices; it has also contributed greatly to the improved management of the fertility problems on the extensive, fonio-cropped plains of the...
Fouta. Through the latter studies, an intensified cropping system based on heavily fertilised potatoes followed by improved maize (QPM) and/or NERICA rice has become possible.

Comments on the Study-village Senghen

The study-village of Senghen constitutes a rather unique case. Started in 1999, it was build around a large, local farm. Its dynamic leader, who headed a group of about 100 farmers (mostly women) could easily afford to take the risks in trying the various suggestions made to him by the Bareng (systems and thematic) research group. These involved a wide range of subjects: potato farming on the poor fonio soils and the required soil fertility measures (based on organic and mineral fertilizers), the subsequent rotation with early rainfed NERICA rice varieties, maize or hot peppers; the establishment of improved pasture management, the planting of a wood lot, the planting of arabica coffee in the shade of the life fences. These activities were complemented by SNPRV/SG 2000 with improved maize storage cribs and local seed multiplication of the NERICA rices following the “community-based seed selection” (CBSS) system as developed and promoted by WARDA (Beye, 2000). The introduction of fruit trees and the establishment of a nursery for Acacia seedlings for communal woodlot plantings were the work by an NGO “ESSOR”.

By early 2002, the single large farmer group (mixed) had split up into several smaller, commodity-based groups for rice seed multiplication, for potato production, for livestock and for coffee. In total these groups have now 380 members. Members of these groups are active in teaching others both inside and outside of the Senghen village; through some radio advertising a whole informal communication flow has been set in motion. Moreover, the dynamic and respected leader holds several additional and influential positions in the community (the Union of farmer groups, and the “Chambre d’Agriculture”). As such this village provides an interesting example of “local dynamics” and how it can be exploited by the development sector in accelerating the dissemination of technologies through mostly informal pathways (Hounkonnou, 2001). Of course this dynamics has been spurred further by the presence of both motivated and able research (systems and commodity specialists including livestock) and extension personnel. Two research technicians are permanently based in the village. In terms of scientific effort, the work in the study-village is not very high-powered; yet its impact, without a significant input by social scientists, is all the more remarkable.

As a next step the researchers may now want to include studies on the cropping calendar to identify labour bottlenecks, that could provide useful entry points in the identification of further research issues. At a later stage, scenarios about future land use, soil fertility evolution and land property rights in response to increasing human and animal population pressures might be elaborated as suggested by Billaz (2001).
2.2. Basse Guinee (Guinee maritieme) Region – CRAF of Foulaya

Agricultural Production Systems

Basse Guinee covers a very diverse region, ranging from the mangrove coastal plains to the footslopes (up to about 800 m above sea level) of the Fouta Djallon mountains. Many different food crops (mangrove, upland and lowland rice; maize, sorghum, groundnut, cassava, cowpea) and vegetables are grown, as well as oilpalm, fruit trees (avocado, citrus, mangos and bananas) and pineapple. Livestock (cattle and small ruminants) are important both as sedentary and transhumance systems. Farming is predominantly of a subsistence nature, which is complemented by small-scale commercial trading.

While there are some interesting exceptions of larger farmers, that produce surpluses for the market and/or are specialized in one commodity like pineapple, most farmers are small and grow a large variety of crops mostly for auto-consumption with the relatively small surpluses marketed locally.

Institutional context and development

Farmer groups are again important as linked to specific commodities (e.g. pineapples), but are less prominent than for the Fouta Djallon region and are definitely less of a political force in the absence of formalized structures. The private sector is small scale and little organized; agricultural supplies and services are marginal. The public sector research and extension (SNPRV) services have mostly come to a halt with the end of the World Bank project (PNSA) at the end of 2000. SG 2000 has contributed in filling some of the gaps notably for maize, rice and cowpea cropping through the multiplication of seeds and by organizing the availability of agricultural chemical inputs.

Agricultural research is concentrated in the CRAF of Foulaya, where the fruit crop, cassava and vegetable research programs, and farming systems team are based, as well as the agro-technology and sols labs. The Center is complemented by the Koba station near the coast where research is conducted on mangrove rice and by the Kilissi station just outside of Kindia with the national programs for rice, maize and groundnut breeding.

Research impact and constraints

Research impact has been mostly in the introduction of improved varieties for irrigated, lowland and upland rice, for improved cultivars of pineapple and banana, and for mosaic virus resistant cultivars of cassava. Through SG 2000 a high-quality protein maize variety is being introduced, as well as improved cowpea varieties from IITA in combination with the regular technological package including mineral fertilizer and pest control measures. Efforts are also undertaken by SG 2000 to increase the legume component in rotations (to reduce the N fertilizer requirements by a subsequent cereal crop) and to introduce zero-tillage practices through a “Round-up” herbicide treatment and mulching.
As general constraints came forward the lack of reliable agricultural services, and the high costs, poor availability and unreliable quality of agricultural inputs, but also the absence of a reliable marketing outlet for surplus production. These constraints come on top of the earlier mentioned human and financial resource problems with which the IRAG centers and researchers have to cope.

Comments on the Study-village Touguihoure

The Touguihoure study-village presents a diverse agro-ecological environment with a large, managed basfond area (the structures were rehabilitated with help of IRAG in 1999) and abundant uplands and lowlands. Consequently, a wide range of traditional food crops is grown. In addition oilpalm and fruit trees are common, and provide some additional income; in the basfonds vegetable crops like aubergines, peppers, tomatoes, watermelons and cucumbers are grown during the off-season.

In 1999 the farming systems team of the CRAF of Foulaya -in collaboration with the respective commodity scientists- started a series farmer trials introducing new pineapple and banana cultivars, improved cassava planting materials, a cashew tree planting, and lowland and upland rice varieties. Replications of the trials were assigned to different farmer groups. The village had about 4 groups at the start of the research intervention, which increased quickly to 10 groups (including women groups for vegetable trials) each with 10 to 15 members. The results of the trial replications, differed greatly in response to the farmer group in charge, which provided useful comparisons in terms of the cropping calendar and labour constraints. After the first year the introduced pineapple and banana planting materials found their way to individual group members and/or to new collective plantings by the group.

The bananas suffered from phyto-sanitary problems, that could be partly resolved by the researchers. The potassium-rich fertilizers required for bananas and pineapples proved unavailable, so mixtures of 17:17:17 and urea were applied; the expensive herbicide brought by one farmer proved to be an inactive white powder. The sale of the additional produce encountered unforeseen problems and had to be organized by the IRAG technician.

Apart from the technical information, the results obtained in the Touguihoure village study are particularly informative in terms of the problems encountered in introducing commercial crops and their subsequent marketing. Moreover, the different local organizational format (small, non-formalized groups) and a less prominent village leader provide valuable insights in the importance of local social dynamics in comparison with the Senghen village.

3 Over-all analyses of the Guinee case

The Guinee case is distinctly different from the Mali one. However, it is likely to be quite representative for a substantial number of countries in the West and Central African region.
In spite of its large and diverse agricultural potential, the abrupt de-colonization and the subsequent policies by the First Republic have seriously delayed the development of the agricultural sector. In spite of some “pockets” of commercial cash crop (cotton, coffee) and non-traditional vegetable (potatoes, onions) production, the predominant form of agriculture remains subsistence farming. Evidence for this is the fact that the countries’ major traditional food crop –rice- hardly enters the commercial circuit being totally consumed at the household and local village levels.

Eventually, the agricultural sector will have to change to more permanent and specialized forms (farms focusing on one or two commodities) as population pressures continue to increase and “land” becomes a limiting factor. To make these changes farmers will need to make additional investments in terms of labour, mechanization and/or external input use. Intensification and specialization of farming involves considerable risks (biological and economic), which farmers will only be willing to take, when assured of reasonable financial returns, the presence of capable research and extension services, and of an efficient and reliable agricultural services sector (input supplies, credit facilities, marketing and transformation channels). Experiences elsewhere show that these conditions are enhanced by a divers and competitive private sector and by an enabling policy environment.

Against this background it must be concluded, that the national policy environment in Guinee, as created jointly by government and donors, constitutes the major constraint to agricultural development. A more favorable environment would have stimulated the creation of:
- an effective and competitive private sector (presently constrained by many barriers to local and international trade and to easy transport),
- competent research and extension services: both services are young institutions having been created only 10 to 15 years ago. So far these have lacked continuity because of their “project” status, and the absence of a fixed annual financial contribution to operating costs by the government. These conditions have prevented both a sound personnel management (e.g. the timely recruitment of young scientists to replace the aging IRAG staff), as well as an appropriate financial management that are essential to achieving institutional sustainability.

Presently both IRAG and SNPRV activities have almost come to a halt in the transition period (2 years) between two consecutive World Bank projects aimed at strengthening the agricultural sector. SNPRV continues a minimum of activities through SG 2000, while IRAG has only some funds from contract research (e.g. with the Federation) and from some commodity related networks (e.g. WARDA/ROCARIZ Task Forces) and the WARDA based Inland Valley Consortium (IVC).

The ROCARIZ and IVC activities have been approved by the IRAG Directorate in Conakry and are part of a pluri-annual collaboration. A special national coordinator has been appointed to follow up that the project proposals for ROCARIZ are integral elements of the national program and that reporting requirements are met, because otherwise funding is halted. In that respect the collaboration between IRAG and WARDA is fully transparent.
In 1998 another consortium effort started when two locations (one in the savanna and one in the forest zone) were selected as sites for the “ecoregional-EPHTA” program coordinated out of IITA. Unfortunately, these two efforts have never come off the ground for lack of transparency in the agreements between IRAG and IITA, and the fact that the implementation was linked primarily to two individuals, instead of being properly anchored in the host national institute.

While the transition to a more dynamic and commercial agricultural sector (that would catalyze overall development in the country) is delayed by an unfavourable policy environment, there are important ongoing movements at local levels in terms of farmer organizations and evidence that farmers are indeed ready to adopt intensified practices. At present the required preconditions are only fulfilled locally through activities by NGOs such as SG 2000. However, in the absence of simultaneous government policy adjustments, the overall impacts will be minor and not sustainable.

With the exception of the vegetable (potatoes, onions) and fruit (pineapple) sectors that have strongly organized producer groups, the Guinean agriculture is predominantly of a subsistence nature. For that reason, a privatization of the research and extension services would be inappropriate: the two services are professionally weak; the producers are mostly poor smallholders who are operating mostly non-monetarised production systems. Therefore, there are few alternatives in the short and medium term. Continued and increased public support will be required in first strengthening these services that constitute the backbones of intensified commercial farming.

So far the adoption of new technologies by farmers has been limited mostly to improved varieties. Improved cultural practices requiring additional investments in labour and external inputs have not been adopted widely for the obvious reasons mentioned above. More substantial impacts from research and extension therefore will also be conditional on an enabling policy environment for the private sector as a whole. The reinforcement of “demand-led” perspectives for research will be facilitated by the presence of strong farmer organizations. The latter will also positively affect the functioning of the CRRD coordinating units (comparable to the CRUs in Mali).