Agricultural Sector Investment and the Role of Public-Private Partnerships

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African Development and Poverty Reduction: The Macro-Micro Linkage

Forum Paper 2004

13 - 15 October 2004
Lord Charles Hotel, Somerset West, South Africa

Development Policy Research Unit
Trade and Industrial Policy Strategies
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Abstract

Agricultural research and development (R&D) is critical to the improvement of incomes and livelihoods in sub-Saharan Africa. However, several studies on agricultural R&D suggest that many countries in the region are unable to bring public and private sector assets and resources together as a means of advancing agricultural R&D. This is true not only in the realm of advanced agricultural biotechnologies, but for more conventional forms of R&D as well. Evidence suggests that the constraints to greater cross-sectoral collaboration result from mutually negative perceptions between the sectors, unresolved issues of risk and liability, and high transactions and opportunity costs. A broad range of economic policies could change this, thereby putting the proper incentives in place to meet sub-Saharan Africa's technological needs and to stimulate growth.

Introduction

There is strong empirical evidence to suggest that agricultural research and development (R&D) contributes critically to the improvement of incomes and livelihoods in developing countries. Agricultural R&D contributes to the enhancement of agricultural productivity, output, and quality; to improvements in the sustainable use of natural resources; to lower food prices for consumers; and to the accumulation of physical and human capital among poor or vulnerable agrarian agents and households. These improvements potentially lead to higher incomes, greater food consumption, better nutrition, and favorable changes in the allocation of individual and household assets (Meinzen-Dick et al. 2003; Hazell and Haddad 2001). Such changes play an important role in improving the livelihoods of small-scale, resource-poor farmers and households. Such changes also play an important role in stimulating agricultural development and wider economic growth.

This is particularly relevant in a region such as sub-Saharan Africa, where approximately 67 percent of the population depends directly or indirectly on agriculture for its livelihoods, and where over half of the rural population lives in extreme poverty. Yet while agricultural R&D is advancing as a result of public sector investment, evidence suggests that current economic policies are not bringing private sector assets and competencies to bear on the challenge, either in collaboration with public sector R&D or independently. Data from several surveys of public and private sector R&D investment in developing country agricultural suggest that realization of synergies and scale economies in R&D depends significantly on how economic policies enable private firms and public agencies to collaborate in the development and delivery of new scientific knowledge and technology.

This paper attempts to identify the challenges to greater collaboration between public institutions and private firms in the research, development and delivery of scientific knowledge and technologies that enhance agricultural productivity and value-added processing in a manner that is beneficial to smallholder farmers and households in sub-Saharan Africa. The paper hypothesizes that the willingness and ability of public institutions and private firms to enter into partnerships are constrained by fundamentally different incentive structures; by insufficient minimization of the costs and risks of collaboration; by an inability to overcome mutually negative perceptions; by limited use of

creative organizational mechanisms that reduce competition over key assets and resources; and by insufficient access to information on successful partnership models. Following a test of this hypothesis, the paper extends its analysis to consider the micro-macro linkages, or the relationship between agricultural R&D and overall economic growth in the predominantly agriculture-based countries of sub-Saharan Africa.

Background

The challenges of food security and agricultural development in sub-Saharan Africa are not problems that can simply be solved by strategic initiatives wherein public and private researchers put their heads together, identify a production constraint, and generating the best science to remove the constraint. A wide range of sectoral and macroeconomic policies must accompany the production and consumption of scientific knowledge and technology to stimulate sustainable and equitable technological change and growth. Thus, the "right" economic policies—for agricultural commodity pricing, private sector investment, privatization and market infrastructure development, science and intellectual property rights, corporate taxation and tax incentives, and public expenditure—determine the magnitude and scope of private sector investment in agricultural R&D, the extent to which firms collaborate on public sector R&D priorities, and the degree to which these collaborations are explicitly designed to address smallholder agriculture and other vulnerable agrarian agents in the region.

At present, private sector investment in agricultural R&D is but a small fraction of total R&D investment in sub-Saharan Africa (Table 1). Approximately 98 percent of all investment is attributable to the private sector (Beintema and Stads, 2004). There is little evidence to suggest that the rapid growth of private sector investment in agricultural R&D on a global basis has benefited sub-Saharan Africa: Although private sector investment increased to approximately 35 percent—approximately $11.5 billion per annum—of all (public and private) investment in agricultural R&D by the mid-1990s, the private sector in sub-Saharan Africa accounts for less than 1 percent of this figure. Several countries such as Kenya and South Africa enjoy higher levels of private sector investment, but even these investments do not exceed more than 5 percent of each country's total investment in agricultural R&D. Furthermore, trend data reveal that many countries in sub-Saharan

Africa have experienced real decreases in public sector R&D investment since the mid-1990s (Pardey and Beintema, 2001; Byerlee and Fischer, 2001).

Table 1: Public and Private Agricultural Research Investments, 2000 (million US$ 1993 PPP)

	Total Spending			Shares	
Region/Country	**Public**	**Private**	**Total**	**Public**	**Private**
East Africa (7)	341.4	5.4	346.8	98.4	1.6
Southern Africa (6)	428.0	18.4	446.4	95.9	4.1
West Africa (14)	315.3	1.8	317.1	99.4	0.6
Total	**1084.7**	**25.6**	**1110.3**	**97.7**	**2.3**

Source: Beintema and Stads, 2004

In other words, agricultural R&D investment is sub-Saharan Africa is far below the levels needed to sustain a process of technological change and growth. Funding for national R&D agencies—for scientists, training, facilities and equipment—has fallen victim to fiscal belt-tightening, structural adjustment, and changing national priorities. Furthermore, R&D priorities have shifted away from an emphasis on staple crop improvement, an area of research that stands to contribute the most to poverty reduction in the region (World Bank, 2003).

The little private sector investment generated in the region hardly makes up for these stagnant or dwindling public resources. Private sector firms in sub-Saharan Africa typically invest in agricultural R&D for those crops, traits, and technologies that benefit farming systems that are organized along lines similar to those in advanced, industrialized countries. This concentrates R&D investment in those countries with commercialized agricultural sectors—again Kenya, South Africa and several other countries. Thus, the impact of such R&D on small-scale, resource-poor farmers in sub-Saharan Africa is ambiguous, at best.

One way of ensuring that pro-poor R&D programs are strengthened in the face of these realities is through research collaboration, partnership, or other forms of interaction between the public and private sectors. *Cross-sectoral collaborations,* as they are referred to throughout this study, are broadly defined as any joint effort between public and private sectors entities in which each contributes to planning, commits resources, shares risks and benefits, and conducts activities to accomplish a mutual objective. Studies by Spielman and Von Grebmer (2004), Hall et al., (2002), Vieira and Hartwich (2002), and Ozgediz and Nambi (1999), among others, argue that cross-sectoral collaborations represent an innovative and potentially beneficial approach to agricultural research in developing countries, an approach that stimulates the production of goods, services and technologies that would not otherwise be produced by either sector acting alone.

When structured appropriately, cross-sectoral collaborations can generate significant benefits for private firms and public agencies while also serving the interests of resource-poor or vulnerable households in developing countries. Collaborations can offer private firms greater access to farmers and consumers in emerging markets; the chance to wield constructive influence in the development of legal and regulatory regimes; opportunities to participate in important local, regional, and global forums on pro-poor R&D; and prospects to improve corporate profiles and reputations. Collaborations can provide public agencies access to new, cutting-edge scientific expertise and technologies held by the private sector; mechanisms for developing, marketing and distributing final products; and financial resources that are otherwise increasingly difficult to obtain. Collectively, cross-sectoral collaborations can improve the capacity of researchers to address problems in agriculture that cannot be solved by a single actor, cannot be achieved in a manner similar to the relatively rapid, easy gains of the "Green Revolution," or require navigation through uncharted, country-specific research systems and regulatory environments.

By exploiting the potential for research synergies, complementarities, scale economies and knowledge-sharing between participants, collaborations are expected to generate R&D outcomes in greater quantity, with a greater chance of success, or at lower per-unit cost, than public or private actors could expect when acting independently. Collaborative arrangements may be particularly beneficial to larger or more advanced systems that

require access to cutting-edge research tools or other forms of intellectual property (IP). But they may also be useful to smaller national R&D systems that share research priorities with neighboring countries but do not possess sufficient levels of research financing, scientific expertise, laboratory equipment, or other critical inputs (Byerlee and Fischer 2001; Cohen et al. 2002; Shear 2000).

There is ample evidence to suggest that cross-sectoral collaborations are increasingly popular in development policy and practice as a means of addressing global issues as diverse as health, environment, finance, and governance. The international health sector, for example, hosts a wide variety of global-, regional- and national-level public-private partnerships addressing a range of diseases and conditions (IPPPH, 2003). These partnerships bring together resources and expertise from a wide variety of actors, including international organizations, government agencies from developing and industrialized countries, multilateral and bilateral donors, philanthropic foundations and non-governmental organizations, and some of the largest pharmaceutical and medical research companies in the sector.

But cross-sectoral collaborations in the agricultural R&D sector are few and far between. Their rarity does not necessarily reflect a lack of interest or commitment on the part of either the international agricultural R&D community or the private sector. Policymakers, donors and researchers across sub-Saharan Africa and in industrialized countries have all called for greater partnership with the private sector (GFAR, 2003; UN/WEF, 2003; Michelsen, 2001; CGIAR, 1998; James, 1996). Similarly, experts from leading agricultural research firms have joined with academics and policy researchers to express their support for greater inter-sectoral collaboration (Leisinger 1995; Barry and Horsch 2000; Shear 2000; Richer and Simon 2000). Yet despite the growing popularity of the concept, there are few systematic assessments of why real successes have been so limited.

Thus, there is a need for a more critical and analytical study of why sustained and successful collaborations are so few in number, and why, as a result, opportunities for pro-poor research are being missed. Empirical studies of cross-sectoral collaborations would be a useful start in this direction, to determine whether such arrangements meet basic

economic criteria, for example, whether they increase the total quantity of R&D output, and do so without increasing the per-unit cost of the R&D output. More detailed policy studies would also be constructive, to determine how private firms and public agencies respond to different types of incentives, for example, tax exemptions and deductions, market access guarantees, preferable lending rates, competitive grant schemes, and so on. This paper attempts to contribute to the development of an analytical, rather than promotional, literature on the topic.

Methodology

This primary source of data for this paper is derived from a study on the role of research centers/programs of the Consultative Group on International Agricultural Research (CGIAR) and multinational, research-based corporations in agricultural R&D, conducted by the International Food Policy Research Institute (IFPRI) in early 2004. The study surveyed a purposeful sampling of key stakeholders engaged in or closely associated with cross-sectoral collaborations in agricultural R&D. A total of 42 stakeholders were sampled, including representatives of multinational/national research-based agribusiness firms; international agricultural research centers and programs; multilateral and bilateral donors and foundations; national agricultural research systems; academia; and non-governmental organizations. Data were compiled from semi-structured interviews, and open-ended discussions, further updated with information from a research seminar on the topic held in February 2004. Topics covered included respondents' experiences in planning, management and execution of a collaboration, their incentives and motivations for engaging in the process, and their perceptions of the process and their partners (Spielman and Von Grebmer 2004).

Additional information for this paper is drawn from a study initiated in 2002 by IFPRI and the erstwhile International Service for National Agricultural Research (ISNAR).[1] The study was based on a survey distributed to a purposeful sampling of 76 experts-primarily researchers and regulators—from public research organizations in 16 developing

[1] I SNAR, formerly based in the Netherlands, became a division of IFPRI in April 2004. The ISNAR Division joins IFPRI with a mandate to strengthen innovation in agricultural R&D systems and increase the contribution of research to pro-poor agricultural development, supporting IFPRI's wider mission to identify and analyze policies for sustainably meeting the food needs of the developing world.

countries, and provided data on 209 agricultural biotechnology "events" (successful genetic modifications) through 2003. The sample was designed to capture the extensive variation in the type and state of research in different countries and organizations, and to ensure that relevant knowledge, experiences, and insight were provided to participants. In sub-Saharan Africa, surveyed countries were limited to South Africa, Kenya and Zimbabwe, where agricultural biotechnology research is most advanced.

Findings

The second survey described above provides a good baseline for understanding the role of cross-sectoral collaborations in sub-Saharan Africa, albeit in the area of agricultural biotechnology R&D only. According to the survey respondents, only seven of the 54 transformation events that occurred in the surveyed sub-Saharan African countries were the result of public-private partnerships. Relatedly, only a small fraction of the genetic material used in these events was derived from private sector material. In short, the private sector was neither a significant player in advanced agricultural R&D in sub-Saharan Africa, either independently or in collaboration with the public sector.

With this in mind, consider the findings of the first survey mentioned above. Respondents to this survey indicated that cross-sectoral collaborations are constrained by the following factors, given in order of importance: competition and risk associated with proprietary assets and liability; mutually negative perceptions across the sectors; conflicting incentives; and high transactions and opportunity costs.

The majority of respondents argued that the most significant constraint to cross-sectoral collaboration arises from the competition and risk associated with the use of valuable assets and resources. A given actor's willingness or ability to engage in a collaboration is often determined by its capacity to maintain a competitive advantage while minimizing the risks associated with a research collaboration. This is a critical aspect of agricultural biotechnology R&D, with its overt reliance on plant genetic resources and the tools and methods of genetic engineering. If collaboration depends on the use of proprietary knowledge, private partners face a risk—real or perceived—that their public counterparts

may leak this knowledge to a competitor, either inadvertently or through detailed, public disclosure of research activities. At the same time, if collaboration requires the use of knowledge held in trust for the public good, public partners face a risk—similarly real or perceived—that their private counterparts may capitalize on or appropriate this knowledge for private gain.

Additionally, private firms face risks that stem from the financial and reputational liability associated with the use of proprietary technologies for unintended or improper purposes. Respondents suggested that while contractual limitations on the use of such knowledge resources can help reduce concerns over competition, full enforcement of contracts is often difficult in many developing countries, and sometimes undesirable where long-term relationships are of greater value than the losses to competitors or of public trust. Public organizations, on the other hand, face risks to their reputation if the public or public interest groups deem a close association with, say, a multinational agbiotech firm as undesirable or controversial. Thus, the constraints posed by competition and risks are not easily mitigated. The solutions to this problem are often complex, requiring investment in public relations and corporate social responsibility campaigns, or other means of protecting reputational integrity.

Next, respondents suggest the willingness of public agencies and private firms to partner is significantly constrained by persistently negative perceptions. Typical misperceptions—researchers in multinational firms should be treated with suspicion, while researchers in the public service are slow and inefficient—are prevalent. Additionally, misperceptions are sometimes created by the use of confidentiality and nondisclosure agreements that accompany many R&D collaborations, insofar as these agreements prevent public researchers from sharing knowledge with colleagues and generate suspicion among fellow researchers and third-party actors who observe or involve themselves in the public research agenda. Respondents also suggested that misperception may result from the relative distribution of bargaining power: public institutions or private firms may be unwilling to partner where one party can potentially dominate the collaboration by virtue of its organizational size, the value of its intellectual property, the size of its research budget, or its ability to influence political and economic decision-makers.

Respondents also identified the obvious differences in incentive structure as a barrier to greater cross-sectoral collaboration: private firms exist to maximize profits, while public agencies exist to fulfill wider social mandates. Where common interests do not exist or are difficult to identify, the potential for collaboration and cooperation are necessarily lower. But many respondents were also quick to point out that public and private interests do, under certain circumstances, coincide. Public agencies may pursue collaborations with the private sector to access their cutting-edge research tools and technologies, or to use their marketing and distribution channels to farmers and other end- or intermediate-users. Similarly, private firms may pursue collaborations to access emerging markets in developing countries, gain knowledge about local regulatory processes, obtain genetic resources held in the public trust, or enhance their reputations and goodwill with the public or with public interest groups. Cross-sectoral collaboration may also be a prerequisite to research funding, for instance, in some competitive grant programs, thereby creating an incentive for coincidental interests.

Yet even where coinciding interest are identified or created, cross-sectoral collaborations may face additional challenges. Respondents cited high transactions costs as a major constraint to successful collaboration and collaboration outcomes. The direct and indirect costs of contracting, coordinating, and enforcing a relationship between collaborators may result in slow and inefficient interactions and negotiations. For example, collaborators incur costs associated with managing regulatory and contractual aspects of collaborations that rely on proprietary knowledge. Collaborators also incur costs associated with searching for information in asymmetrical relationships, for example, the cost of finding information about the other party's stock of proprietary knowledge, or its way of doing business. Respondents also cited high opportunity costs as a barrier to collaboration, particularly where conventional research investments are foregone in favor of an investment undertaken through an untested, non-traditional or uncertain modality such as a collaboration.

In short, there are several strong economic reasons that explain why cross-sectoral collaborations are so few and far between in sub-Saharan Africa. Incentive structures are deficient, risk management mechanisms inadequate, and costs prohibitive. What remains now is to identify ways to address these constraints through constructive economic policy.

The Micro-Macro Linkage

Given the issues raised above, we extend this analysis to consider the micro-macro linkages, or the relationship between agricultural R&D and overall economic growth in the predominantly agriculture-based economies of sub-Saharan Africa. The fundamental issue characterizing these economies is the often short-lived and unsustainable response to the technological change resulting from agricultural R&D. While new scientific knowledge and technology may increase agricultural productivity, relatively inelastic demand, slow supply responses, poor market infrastructure and high transactions costs in the marketplace often result in a falling prices for agricultural output. Where agricultural output prices fall faster than the smallholder's per-unit costs of production, the negative income effects reduce the incentives for technology adoption and stifle the forward movement of technological change. And as farming in the region shifts from subsistence to market orientation, the price impacts on smallholder incomes are amplified as the smallholder's own consumption of output decreases as a proportion of total farm output. Acting as the key linkage between microeconomic behavior and the macroeconomy, the price effect associated with agricultural output is an important force in the process of technological change, determining the extent to which returns on investment in agricultural R&D will attract private agents, and indicating whether agricultural R&D can, in fact, effect poverty reduction, agricultural development, and economic growth. (For a survey of the work detailing the relationship between technological change, price effects, and economic growth in the context of sub-Saharan Africa, see, *inter alia,* Gabre-Madhin et al., 2003.)

Thus, the question is what types of macroeconomic and sectoral policy options can minimize the deleterious effects of technological change on agrarian producers. In an efficient market scenario—where many small producers and consumers have complete access to markets, where transactions costs between agents are not prohibitively high, where information is not held asymmetrically, and so on—agents necessarily adjust their

behavior to take full advantage of technological changes. But where markets are nascent, seasonal, inefficient and incomplete, or subject to unequal distributions of market power and high transactions costs, the question is more complex. In short, policies are needed to strengthen market operations. This includes development of physical and information infrastructure; contract enforcement and settlement mechanisms; and human capacity strengthening at all levels; innovation in credit and finance to smallholders; and new approaches to social capital formation among smallholders. Broader policies are also needed to strengthen growth in the agricultural processing, non-farm and export sectors as a means of adding value to agricultural commodities, pushing out demand for agricultural output, and counteracting the negative price effects of technological change.

To complement these solutions, and to sustain the process of technological change, additional policies are needed to strengthen agricultural R&D investment and the cross-sectoral collaborations designed to support such investment. This includes mechanisms designed to reduce the cost of pro-poor R&D ("push" factors) such as greater public investment in government research agencies and universities; wider tax credits, deductions and exemptions for private research firms; business grants or preferential lending terms; and other financial transfers to the private sector. In the area of agricultural biotechnology, mechanisms include stronger research exemptions for the use of intellectual property; working requirements for intellectual property ownership; compulsory licensing; or exercising of eminent domain by patenting authorities in industrialized countries. Alternatively, this includes mechanisms designed to create or secure markets for pro-poor R&D and increase returns on investment to private firms ("pull" factors) such as stronger legislation and enforcement of intellectual property rights; tax credits on sales; or pre-committed purchases by government, private foundations, or other actors. (See, *inter alia,* Correa (2000); Taylor and Cayford (2003); and Webber and Kremer (2001).) Additional approaches include investment in institutional and organizational mechanisms designed to facilitate the collaboration process and remove some of the constraints noted above. Joint venture arrangements, commercial entities with a public-interest mandate, separation of research priority-setting and financing from execution, or the use of non-profit "honest broker" organizations to manage research and assume risk, are all possible options (Spielman and Von Grebmer, 2004). In sum, innovative approaches to agricultural

R&D that recognize the continued importance and increasingly pluralistic nature of the sector are desperately needed.

Conclusion

Agricultural R&D is essential to agricultural development and economic growth in sub-Saharan Africa. But where public sector R&D is unable to get the job done, there is an opportunity for greater private sector involvement. The preferable route to improving incomes and livelihoods through agricultural R&D requires closer collaboration between the public and private sectors. This can be achieved with policies that support private sector investment and lift the constraints—risk and liability, negative perceptions, non-intersecting incentives, and hidden costs—that impede closer collaboration. This also requires complementary policies to strengthen market infrastructure and operations in the region, so as to minimize the impact of negative price effects on smallholders. With the proper policies and incentives in place, cross-sectoral collaborations in agricultural R&D can be more effectively applied to the challenges of poverty reduction, agricultural development and economic growth in sub-Saharan Africa today.

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