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THE ENABLING ENVIRONMENT FOR AGRICULTURAL TECHNOLOGY IN SUB-SAHARAN AFRICA AND THE POTENTIAL ROLE OF DONORS

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To improve agricultural technology development in Africa requires strengthening of the enabling environment, including policies, public institutions and regulations. Various types of market failure imply that markets, by themselves, will not elicit the optimum amount of technology for Africa's farmers. Priorities include more responsive regulations for input supply, support for emerging enterprises, strengthening input marketing, establishing adequate intellectual property protection, and addressing the challenges of biotechnology. Donors can play an important role, but short-term project interventions must give way to longer-term strategies for support to institutions including formal policies and regulations and informal rules and procedures that encourage indigenous organisational innovation.

Policy conclusions

- Agricultural development in Africa requires more attention to the optimum mix of public research and private agricultural enterprise.
- Balanced and integrated attention is required in relation to three elements: regulatory frameworks, public agricultural research, and enterprise development.
- Input regulation needs to allow more flexibility; pursue regional harmonisation; emphasise enterprise reputation and consumer education; and offer adequate protection against negative environmental externalities.
- Public agricultural research needs to establish intellectual property management policies and to work more closely with private enterprises that are able to deliver their technologies to farmers.
- More support is required to local seed companies, nurseries and other entrepreneurs to strengthen their marketing and technical capacities.
- Donor interventions in support of the enabling environment must feature a longer time frame, greater co-ordination, and broader attention to institutional development than conventional project strategies allow.

Introduction

Although there is widespread acknowledgement that policies and regulations are important determinants of economic growth, donor strategies for strengthening these aspects of the enabling environment remain poorly identified. This paper is concerned with the role of the enabling environment for agricultural technology development for sub-Saharan Africa. The availability of adequate technology for Africa's farmers is crucial for the region's development.

Although the enabling environment may be thought of as a broad set of political, social and legal institutions, this paper focuses on government roles (and how donors may contribute to strengthening these). On the one hand, innovation is often hampered by government interference, but on the other hand the free market left to its own devices will rarely promote the optimum level of technology development. Market failures call for public investments and regulation (Box 1).

This paper is concerned with three interrelated elements of agricultural technology in sub-Saharan Africa: regulation, public agricultural research and enterprise development. It is based on a longer study (Tripp, 2003).

Regulation can be seen as a response to inadequate information, and can be implemented through both public and private agencies. In addition, private enterprise reputation and consumer organisation can foster self-regulation. This paper examines the performance of national regulatory agencies and considers the potential of regulatory reform, regional regulatory harmonisation, and the responsibilities of technology producers and consumers. It also examines the related areas of intellectual property protection and biosafety.

Public agricultural research is often presented as an example of a public good. Although private agricultural technology development is of growing importance, public research remains essential. The challenge for African agricultural research is particularly acute. National agricultural research institutes (NARIs) not only face a decline in government and donor support, they also must coordinate with other organisations involved in research and learn how to interact with the private sector (Byerlee, 1998).

The third focal area of this review is *agricultural enterprise*. A principal goal there is to develop mechanisms that elicit increased private sector participation in the development and diffusion of pro-poor agricultural technology. There is a growing realisation that the delivery of both private and public agricultural technology depends to a large extent on the capacities of the local private sector. This includes private seed companies; entrepreneurs who may work with the outputs of public research (such as biopesticides or tissue

Box 1 Market failure and the enabling environment

Markets stimulate and take advantage of new technology, but by themselves are widely inadequate to support processes of technology development. There are several ways in which markets fail that justify public investment or regulatory frameworks. Some of the most important examples related to agricultural technology are:

- Private companies will not invest in research which generates information or techniques that cannot be privately marketed. Hence investment in public agricultural research is necessary.
- Technologies may have externalities that require regulatory frameworks. Examples include phytosanitary control for plant varieties, the control of dangerous pesticides, and biosafety protocols for transgenic crops.
- Innovation benefits from patents and intellectual property protection. Biological innovations such as new crop varieties that can be freely reproduced may not be produced at an optimum level unless some type of plant variety protection is in place.
- Weaknesses of poorly developed markets also limit the development and spread of technology. Many of these may be characterised as transaction costs. Examples related to agricultural technology include the costs of acquiring information about new technology, the inadequacies of retail input networks, and poor quality control by inexperienced or fraudulent enterprises.

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culture); and the various types of importers, input dealers, nurseries and other intermediaries who deliver technology to farmers.

This review encourages donor investment in selected actions at the national level in strengthening regulatory frameworks, agricultural enterprise and national research capacities. It also encourages investment in regional processes, such as regulatory harmonisation, commercial associations and research networks. The emphasis is on the importance of institution building to develop local capacities for structuring regulatory frameworks, fostering trustworthy and competent agricultural enterprises and linking public research to commercial agricultural development.

The paper provides a number of examples of opportunities for intervention and suggests strategies for donor support.

Opportunities

Plant variety regulation

In much of sub-Saharan Africa, until recently, seed regulatory frameworks have been structured in support of national public plant breeding institutes and public seed companies. Under these frameworks, the introduction of foreign or private sector varieties was difficult. However, many countries have seen significant changes in their seed regulatory frameworks in recent years, in response to pressures of liberalisation that encouraged a diversification of the seed sector and made further cuts in chronically inadequate regulatory budgets.

The process of variety release will be much more efficient if there is regional harmonisation of regulations. This will allow varieties approved in one country easy access to neighbouring countries and will stimulate seed trade.

The most significant progress has been made in Eastern and Central Africa (ECA), in a project initiated through ASARECA (Association for Strengthening Agricultural Research in Eastern and Central Africa) and funded by USAID. The first phase concentrated on Kenya, Tanzania and Uganda. A regional workshop in April 2000 approved a number of changes:

- Public and private breeders may test their varieties anywhere in the region and then enter them in national variety performance trials.
- The mandatory variety performance trial sequence was reduced from three seasons to one season.
- Various institutions, including seed companies, can be accredited to carry out performance trials.
- A common variety catalogue will be produced for the region.

Similar efforts toward seed regulatory harmonisation in southern Africa have been promoted as part of the Sub-Saharan Africa Seed Initiative (SSASI), co-ordinated by the World Bank. A sub-regional workshop including representatives from Malawi, Mozambique, Zambia and Zimbabwe endorsed a number of recommendations for standardising variety release procedures and considering the possibility of regional variety releases, but with no binding follow-up. Activities on regional variety regulation are planned for West Africa, but are still at a preliminary stage.

Seed certification

In most sub-Saharan African countries, seed certification is mandatory for major food crops. There is widespread realisation that public resources are wholly inadequate for this task. This imbalance is not always obvious because of the low level of commercial seed production in most countries, but there are a number of moves towards licensing seed companies to do their own certification. The regional harmonisation initiatives (described above) also consider changes in seed certification, but in general have made less progress than with variety registration. In the case of ECA, the workshop identified common definitions, classes, and standards for the certification of major crops; agreed that seed companies could be accredited to carry out certification; and promoted the idea of an interagency certification scheme to facilitate cross-border seed trade. Although these changes will help rationalise seed certification, most of them require further work and none move in the direction of voluntary certification.

A particularly important challenge which has yet to be tackled on the regional or national level is the fact that the majority of seed quality problems have their origin closer to the point of sale, rather than with the seed producer. This is related to improper storage, handling or transportation; or fraudulent practices by distributors or dealers. National regulatory management and enforcement are rarely adequate to deal with this, so that farmers are not adequately protected by the current regulatory framework. There is a need to shift regulatory inspection resources from upstream activities to point-of-sale presence.

The interactions of NARIs with local seed companies

As systems of plant variety protection become established, NARIs have the opportunity to protect their germplasm, to earn royalties, and to use the private sector to promote publicly-developed varieties. NARIs need advice on how to take advantage of IPR legislation; how to negotiate royalties and licences for their germplasm; how to recognise when protection is *not* a good idea; and perhaps most important, how to take better advantage of the emergence of the private seed industry in order to ensure a broader diffusion and uptake of public varieties.

There is much to be learned on both sides. NARIs need to learn how to negotiate, whether to award exclusive access, what the limits of demand are, and how to preserve a pro-poor stance for technology diffusion. On the other side, many of the private firms are not necessarily as skilled as some would believe when it comes to identifying potential markets or understanding farmers' needs.

Other commercial enterprises

There are other technological innovations that also deserve attention in relation to agricultural entrepreneurship. Tissue culture is a good example. Although these techniques may be developed by public research, their application is best done by commercial firms, as is happening in Kenya for the production of tissue culture banana plantlets (Wambugu and Kiome, 2001).

Although tissue culture technology may be produced by a commercial, centralised laboratory, other kinds of intermediary are necessary to deliver these products to farmers at the local level. It is possible to imagine the development of small local commercial nurseries that develop reputations among farmers and serve a critical role in ensuring quality control.

A similar argument can be made for promoting innovations in agroforestry, where seed production is often difficult. The issue of identifying the most appropriate type of nursery arrangement for seed and seedling access is a key to promoting agroforestry.

The fine balance between public and private domains characteristic of plant breeding is also evident in crop management technology. There is a necessity to take advantage of public research skills and motivations in technology development, on the one hand, while continuously searching for ways to transfer delivery, and ultimately research, to the private sector. Relevant examples include opportunities for small-scale commercial

development in biopesticides, agricultural machinery, and micro-irrigation technology.

Careful management is required to develop productive public-private links. The incentives for doing the public research need to be sufficient to outweigh the fact that the commercial gain for the innovations will go mostly to the private sector. Relations need to be structured that elicit pro-poor research and good commercial follow-through and distribution.

Fertiliser regulation

Liberalisation and structural adjustment have caused most African governments to relinquish the major role in fertiliser provision, with mixed results. In most cases, the prices that farmers pay for fertiliser have risen, often leading to a decline in fertiliser use. On the other hand, private fertiliser distribution capacity has begun to develop, although a number of problems are evident.

Fertiliser is a bulky input with seasonal demand, requiring considerable storage and transportation capacity, and with high working capital requirements. In many countries there was an initial blossoming of private sector activity and then a fairly drastic retrenchment and concentration, with some risk of oligopolistic behaviour (Debrah, 2000).

These problems point to the need for several types of assistance:

- Better organisation of fertiliser dealers/importers and provision of information on availability of products (for more efficient bulking, importing) and on marketing (possibilities for small packs etc.).
- Better connections between research and dealers to identify the most appropriate products for farmers.
- Better consumer education and protection.

Pesticide and biopesticide regulation

There is widespread use of chemical pesticides in Africa. In many countries there has always been at least some private participation in pesticide provision, and this role is increasing with liberalisation. The regulatory issues here are more important than for fertilisers, particularly because of the negative externalities associated with pesticide use.

Many African countries give relatively little attention to pesticide regulation. The vast majority of the products are imported, and although a government may decide to ban particularly dangerous products it will rarely have the resources to enforce such a decision. National regulatory agencies are under-funded and some countries do not even have a pesticide registry. There are relatively few efforts at regulatory harmonisation. One important exception is the development of a common pesticide registration protocol for the nine CILSS (Interstate Committee for Drought Control in the Sahel) countries.

With increasing liberalisation there is a wider range of private sector participation in pesticide markets. This is not necessarily a good thing, as many of those selling pesticides, particularly in the informal market, have no capacity to provide information about safe usage. There is increasing evidence of 'leakage' of pesticides from government programmes and unregulated cross-border movement of pesticides (Williamson, 2003). Studies in developing countries have shown a high incidence of fraudulent, outdated and misrepresented products.

The significant environmental and public health problems entailed by excessive use of chemical pesticides have led to a search for alternative products. Many biopesticides offer opportunities for more environmentally-sound technology, often linked to local enterprise development. Many of these products are produced through biological processes (insect rearing, microbial production, etc.) that are best managed close to the environment where they are to be used. Relatively short shelf life is an added incentive for local production. As yet, there are only a few examples of commercially viable biopesticide production in developing countries.

It is not clear how many regulatory hurdles such products will have to clear in sub-Saharan Africa. But there have been instances in other countries where regulatory approval has been severely delayed because the biopesticide has had to pass tests designed for conventional pesticides.

The manufacture of many of these products requires exceptional care in order to prevent potentially serious contamination. These requirements, plus the need for special formulations to improve shelf life and efficacy, indicate that local production of many biopesticides will be handled at a scale and level of sophistication beyond a cottage industry. In addition, there are instances of fraudulent biopesticide products reaching the market in developing countries, and point-of-sale regulation will require new tests and procedures.

Intellectual property protection for new plant varieties

One of the elements of the agreement on Trade-Related Intellectual Property Rights (TRIPs), instituted in 1994, requires all members of the World Trade Organisation (WTO) to provide some type of intellectual property protection for new plant varieties. In general, progress on enacting legislation is slower than expected, although least developed nations have been given until 2006 to implement the TRIPs agreement.

Although it seems likely that various details of national legislation will be debated and challenged in the coming years, it is important to examine the potential benefits of interim legislation or operating procedures for both public and private research. Regional harmonisation will help stimulate trade, and it will be helpful if national policy makers are well informed about progress and options in neighbouring countries. Countries may also need assistance in seeing that legislation is implemented and enforced in such a way that it stimulates seed system development.

Biotechnology: IP and biosafety

The use of biotechnology, and particularly the introduction of transgenic crop varieties, implies access to a range of genes, techniques and processes. Most of this technology is owned by firms or institutions in the North. Many biotechnology innovations will have complex ownership, and national IPR systems must be able to accommodate this. The most important issues for developing countries concern approval for access to the relevant technology and the fate of protected genes in released varieties. National IP management capacities need to be strengthened, so that the local private sector can develop and so that NARIs can take better advantage of their own resources in biotechnology and enter into productive agreements with commercial firms.

The introduction of transgenic crops (locally developed or imported) requires the creation of a biosafety capacity. These procedures involve, for the most part, skills and resources not currently found in most African countries and hence imply significant investment in training (and, to some extent, infrastructure). Beyond these technical requirements, the establishment of biosafety protocols also requires the existence of adequate polices and the capacity to implement and maintain the regulatory framework (McLean et al, 2002).

Responses

There are a number of opportunities for donor support to strengthen the enabling environment for agricultural technology development in sub-Saharan Africa. However,

such support requires changes in donor strategies (Box 2). The level of resources for strengthening the enabling environment is not necessarily very high, but such support requires organisational qualities rarely found in current donor practice, including: long-term commitment; a greater willingness to survey and interact with other initiatives; and a significant level of technical expertise.

The emphasis is on the evolution of local institutions for the development of a robust commercial agricultural sector. These institutions will promote the flow of information among researchers, entrepreneurs, and farmers; build the competence of all participants; and engender the growth of trust and confidence in agricultural enterprise.

The following are examples of the types of activities that might be considered:

Co-ordination activities

- The establishment of a permanent forum to monitor and assess the status and opportunities of the enabling environment for agricultural technology development in selected sub-Saharan African countries. The forum could be initiated on a very modest basis by designating one contact person from each interested donor agency, and one senior policy maker from each participating country.

Regional activities

- Support to convening authorities to manage meetings, workshops, and studies that promote regulatory harmonisation.
- Providing opportunities for exchange of experience between regions on regulatory reform or implementation.
- In a limited number of cases, initial support for the establishment of a regional regulatory authority, particularly in areas where individual countries have little experience, e.g. biopesticide registration.
- Developing links between regional public agricultural research networks, on the one hand, and regulatory and enterprise development activities, on the other.

Country-level activities

- Providing advice and support to carry through on the implementation of regulatory harmonisation, or instituting national regulatory reform.
- Support and development of best practice for re-orienting national regulatory activities for inputs toward point-of-sale enforcement and consumer education.
- Providing advice on relations between NARIs and seed companies.
- Providing advice for the development of new intermediary commercial services, such as nurseries for tissue culture or agroforestry products.

Box 2 The limitations of donor strategies for strengthening the enabling environment

Donors have relatively little experience in providing behind-the-scenes support to strengthening the enabling environment for agricultural technology, and short-term, project-based interventions are rarely adequate. Particular problems with conventional donor strategies include:

- Project-based interventions rarely include a time frame that allows for significant institutional strengthening.
- Project-based interventions tend to 'front-load' institutional change (e.g. by forming producer associations) rather than support indigenous institutional evolution.
- Donor projects may duplicate or compete with each other, and there are few effective mechanisms for co-ordination.
- Country projects, even from the same donor, may not be consistent and send mixed signals about the direction of institutional change.
- There are few examples of an integrated approach that acknowledges the complementary roles of regulation, enterprise development, and public research.
- Regulatory reform projects rarely give adequate attention to both regional and national reform processes.
- Experience gained by a donor in one region is rarely applied to another.

Conclusions

This paper has made a case for institution building related to the enabling environment for agricultural enterprise in sub-Saharan Africa. 'Institution building' is a term with an ill-defined trajectory in development assistance. It is sometimes associated with 'bricks and mortar' projects, and more frequently with various types of training. However, the kinds of donor activities suggested by the present analysis do not involve investment in infrastructure and only partially concern specific training opportunities. The focus is more on a long-term, co-ordinated effort to promote the evolution of local institutions. These include formal regulations and laws, but at least as important are the informal rules, operating procedures and mechanisms of trust that allow the development of agricultural enterprise. This is a particular challenge for conventional donor assistance. It requires a commitment to long-term monitoring and support, the co-ordination of donor activities with national policy formation, and the ability to offer modest, targeted input at the appropriate time and place.

References

Byerlee, D. (1998) 'The Search for a New Paradigm for the Development of National Agricultural Research Systems', *World Development* 26: 1049–56.

Debrah, S.K. (2000) *From State Monopoly to Private Sector Oligopoly: African Agricultural Input Markets in Crisis*. Lome: IFDC.

McLean, M., Frederick, R., Traynor, P., Cohen, J. and Komen, J. (2002) 'A Conceptual Framework for Implementing Biosafety: Linking Policy, Capacity and Regulation', *ISNAR Briefing Paper* 47. The Hague: ISNAR.

Tripp, R. (2003) 'Strengthening the Enabling Environment for Agricultural Technology Development in Sub-Saharan Africa', ODI *Working Paper 212*. London: ODI.

Wambugu, F. and Kiome, R. (2001) 'The Benefits of Biotechnology for Small-Scale Banana Producers in Kenya', *ISAAA Briefs* 22. Ithaca, NY: ISAAA.

Williamson, S. (2003) 'Pesticide Provision in Liberalised Africa: Out of Control?' A*gREN Network Paper* 126. London: ODI.

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